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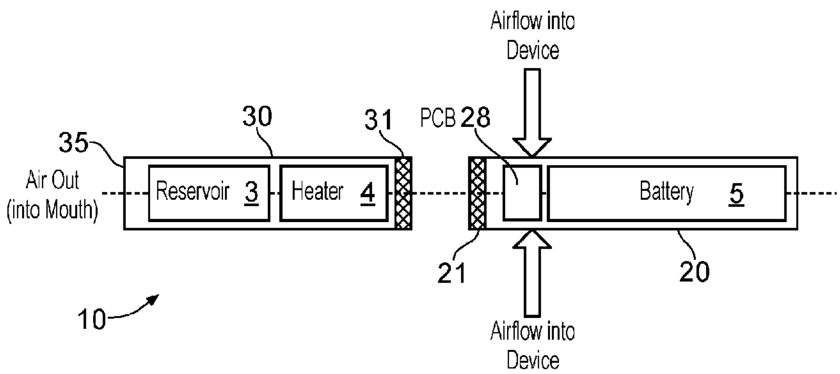

FIG. 1

(57) **Abstract:** The present invention relates to an aerosol generating component comprising a material having a grain, wherein the orientation of the grain of the material is substantially orthogonal to an axis upon which electrical connectors of the aerosol generating component are located.

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Delivery System

Field

The present invention relates to a delivery system, in particular to a non-combustible aerosol delivery system and to components of said aerosol delivery system. The present invention further relates to methods of generating and delivering an aerosol using the non-combustible aerosol delivery system and components disclosed herein.

Background

Non-combustible aerosol delivery systems which generate an aerosol for inhalation by a user are known in the art. Such systems typically comprise an aerosol generator which is capable of converting an aerosolisable material into an aerosol. In some instances, the aerosol generated is a condensation aerosol whereby an aerosolisable material is first vaporized and then allowed to condense into an aerosol. In other instances, the aerosol generated is an aerosol which results from the atomization of the aerosolisable material. Such atomization may be brought about mechanically, e.g. by subjecting the aerosolisable material to vibrations so as to form small particles of material that are entrained in airflow. Alternatively, such atomization may be brought about electrostatically, or in other ways, such as by using pressure etc.

Since such aerosol delivery systems are intended to generate an aerosol which is to be inhaled by a user, consideration should be given to the characteristics of the aerosol produced. These characteristics can include the size of the particles of the aerosol, the total amount of the aerosol produced, etc.

Where the aerosol delivery system is used to simulate a smoking experience, e.g. as an e-cigarette or similar product, control of these various characteristics is especially important since the user may expect a specific sensorial experience to result from the use of the system.

It would be desirable to provide aerosol delivery systems which have improved control of these characteristics.

Summary

According to a first aspect of the present disclosure, there is provided an aerosol generating component comprising a material having a grain, wherein the orientation of the grain of the material is substantially orthogonal to an axis upon which electrical connectors of the aerosol generating component are located. The axis upon which electrical connectors of the aerosol generating component are located may correspond to a first axis.

In some examples, the material has a crystalline structure.

In some examples, the orientation of the grain of the material is substantially orthogonal to an axis around which the aerosol generating component is curved. The axis around which the aerosol generating component is curved may correspond to a second axis.

In some examples, the aerosol generating component comprises a heating section.

In some examples, one or more elongate apertures (e.g. slotted apertures) are provided in the aerosol generating component, e.g. in the heating section.

In some examples, the heating section is provided between the electrical connectors.

In some examples, the aerosol generating component (e.g. the heating section) comprises a plurality of elongate heating portions. The heating portions may be arranged side-by-side. The heating portions may extend between respective terminal portions. In some examples, an elongate aperture (e.g. slotted aperture) is provided between adjacent heating portions.

The aerosol generating component may be formed of an electrically conductive material.

The aerosol generating component may be formed of a single layer.

The aerosol generating component may be substantially planar.

According to an aspect of the present disclosure, there is provided an aerosol generating component comprising a material having a grain, wherein the orientation of the grain of the material is substantially parallel to one or more elongate apertures (e.g. slotted apertures) provided in the aerosol generating component.

In some examples, the orientation of the grain of the material is substantially orthogonal to an axis around which the aerosol generating component is curved.

In some examples, the heating section is provided between electrical connectors of the aerosol generating component.

In some examples, the heating section comprises a plurality of elongate heating portions. The heating portions may be arranged side-by-side. The heating portions may extend between respective terminal portions. In some examples, an elongate aperture (e.g. slotted aperture) is provided between adjacent heating portions. The aerosol generating component may be formed of an electrically conductive material.

The aerosol generating component may be formed of a single layer.

The aerosol generating component may be substantially planar.

According to an aspect of the present disclosure, there is provided an article for use as part of a non-combustible aerosol provision system, the article comprising: an aerosol generating component according to a previous aspect of the present disclosure; and one or more of a reservoir for aerosolisable material, and an aerosol generation chamber.

In some examples, the aerosol generating component is at least partly located in the aerosol generation chamber.

In some examples, the reservoir is configured to provide aerosolisable material to the aerosol generating component.

In some examples, the reservoir is configured to hold a liquid aerosolisable material.

According to an aspect of the present disclosure, there is provided a non-combustible aerosol provision system comprising: an article comprising the aerosol generating component according to a previous aspect of the present disclosure; and a device comprising one or more of a power source and a controller.

In some examples, the power source is configured to provide power to the aerosol generating component via the electrical connectors.

According to an aspect of the present disclosure, there is provided a method of manufacturing an aerosol generating component, the method comprising: providing an aerosol generating component comprising a material having a grain; and processing the material so that the orientation of the grain of the material is substantially orthogonal to an axis upon which electrical connectors of the aerosol generating component are located.

According to an aspect of the present disclosure, there is provided a method of manufacturing an aerosol generating component, the method comprising: providing an aerosol generating component comprising a material having a grain; and processing the material so that the orientation of the grain of the material is substantially parallel to one or more elongate (e.g. slotted) apertures provided in the aerosol generating component.

It will be appreciated that features and aspects of the invention described above in relation to the first and other aspects of the invention are equally applicable to, and may be combined with, embodiments of the invention according to other aspects of the invention as appropriate, and not just in the specific combinations described above.

Brief Description of the Drawings

Various embodiments will now be described in detail by way of example only with reference to the accompanying drawings in which:

Figure 1 is a schematic representation of an aerosol provision system according to the present disclosure.

Figure 2 is a diagram of an article for use as part of an aerosol provision system according to the present disclosure.

Figure 3 is an exploded diagram of the article of Figure 2.

Figure 4 is a rough sketch of an aerosol generating component for use in the article of Figure 2 according to the present disclosure.

Figure 5 is schematic diagram of an aerosol generating component for use in the article of Figure 2 according to the present disclosure.

Figure 6 is schematic diagram of an aerosol generating component for use in the article of Figure 2 according to the present disclosure.

Detailed Description

Aspects and features of certain examples and embodiments are discussed / described herein. Some aspects and features of certain examples and embodiments may be implemented conventionally and these are not discussed / described in detail in the interests of brevity. It will thus be appreciated that aspects and features of apparatus and methods discussed herein which are not described in detail may be implemented in accordance with any conventional techniques for implementing such aspects and features.

As described above, the present disclosure relates to (but is not limited to) non-combustible aerosol provision systems and devices that generate an aerosol from an aerosol-generating material (which also may be referred to herein as aerosolisable material) without combusting the aerosol-generating material. Examples of such systems include electronic cigarettes, tobacco heating systems, and hybrid systems (which generate aerosol using a combination of aerosol-generating materials). In some examples, 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 of the present disclosure. In some examples, 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. In some examples, 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 in such a hybrid system may be, for example, in the form of a solid, liquid or gel and may or may not contain nicotine. In some examples, 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.

Throughout the following description the terms “e-cigarette” and “electronic cigarette” may sometimes be used; however, it will be appreciated these terms may be used interchangeably with non-combustible aerosol (vapour) provision system or device as explained above.

In some examples, the present disclosure relates to consumables for holding aerosol-generating material, and which are configured to be used with non-combustible aerosol provision devices. These consumables are sometimes referred to as articles throughout the present disclosure.

The non-combustible aerosol provision system typically comprises a device part (which also may be referred to herein as a device) and a consumable/article part which also may be referred to herein as an article). The device part typically comprises a power source and a controller. The power source may typically be an electrical power source, e.g. a rechargeable battery.

In some examples, the non-combustible aerosol provision system may comprise an area for receiving or engaging with the consumable/article, an aerosol generator (which may or may not be within the consumable/article), an aerosol generation area (which may be within the consumable/article), a housing, a mouthpiece, a filter and/or an aerosol-modifying agent.

In some examples, the consumable/article for use with the non-combustible aerosol provision device may comprise aerosol-generating material, an aerosol-generating material storage area which also may be referred to herein as a reservoir for aerosolisable material), an aerosol-generating material transfer component (e.g. a wick, such as a pad), an aerosol generator (which also may be referred to herein as an aerosol generating component), an aerosol generation area which also may be referred to herein as an aerosol generation chamber), a housing, a wrapper, a filter, a mouthpiece, and/or an aerosol-modifying agent.

The systems described herein typically generate an inhalable aerosol by vaporisation of an aerosol generating material. The aerosol generating material may comprise one or more active constituents, one or more flavours, one or more aerosol-former materials, and/or one or more other functional materials.

Aerosol-generating material may, for example, be in the form of a solid, liquid or gel which may or may not contain an active substance and/or flavourants. In some examples, the aerosol-generating material may comprise an “amorphous solid”, which may alternatively be referred to as a “monolithic solid” (i.e. non-fibrous). In some examples, the amorphous solid may be a dried gel. The amorphous solid is a solid material that may retain some fluid, such as liquid, within it. In some examples, the aerosol-generating material may for example comprise from about 50wt%, 60wt% or 70wt% of amorphous solid, to about 90wt%, 95wt% or 100wt% of amorphous solid.

The term “active substance” as used herein may relate to a physiologically active material, which is a material intended to achieve or enhance a physiological response. The active substance may for example be selected from nutraceuticals, nootropics, psychoactives. The active substance may be naturally occurring or synthetically obtained. The active substance may comprise for example nicotine, caffeine, taurine, theine, vitamins such as B6 or B12 or C, melatonin, cannabinoids, or constituents, derivatives, or combinations thereof. The active substance may comprise one or more constituents, derivatives or extracts of tobacco, cannabis or another botanical.

The aerosol-former material may comprise one or more constituents capable of forming an aerosol. In some examples, the aerosol-former material may comprise one or more of 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.

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

As used herein, the term “component” is used to refer to a part, section, unit, module, assembly or similar of an electronic cigarette or similar device that incorporates several smaller parts or elements, possibly within an exterior housing or wall. An electronic cigarette may be formed or built from one or more such components, and the components may be removably or separably connectable to one another, or may be permanently joined together during manufacture to define the whole electronic cigarette. The present disclosure is applicable to (but not limited to) systems comprising two components separably connectable to one another and configured, for example, as a consumable/article component capable of holding an aerosol generating material (also referred to herein as a cartridge or cartomiser), and a device/control unit having a battery for providing electrical power to operate an element for generating vapour from the aerosol generating material.

Fig. 1 is a highly schematic diagram (not to scale) of an example aerosol/vapour provision system such as an e-cigarette 10. The e-cigarette 10 may have a generally cylindrical shape, extending along a longitudinal axis indicated by a dashed line, and comprises two main components, namely a control or power component or section 20 (which also may be referred to herein as a device) and a cartridge assembly or section 30 (which also may be referred to herein as an article, consumable, cartomizer, or cartridge) that operates as a vapour generating component.

The cartridge assembly 30 includes a storage compartment (which also may be referred to herein as a reservoir) 3 containing an aerosolisable material comprising (for example) a liquid formulation from which an aerosol is to be generated, for example containing nicotine. As an example, the aerosolisable material may comprise around 1 to 3% nicotine and 50% glycerol, with the remainder comprising roughly propylene glycol, and possibly also comprising other components, such as water or flavourings. The storage compartment 3 has the form of a storage tank, being a container or receptacle in which aerosolisable material can be stored such that the aerosolisable material is free to move and flow (if liquid) within the confines of the tank. Alternatively, the storage compartment 3 may contain a quantity of absorbent material such as cotton wadding or glass fibre which holds the aerosolisable material within a porous structure. The storage compartment 3 may be sealed after filling during manufacture so as to be disposable after the aerosolisable material is consumed, or may have an inlet port or other opening through which new aerosolisable material can be added. The cartridge assembly 30 also comprises an electrical aerosol generating component 4 located externally of the reservoir tank 3 for generating the aerosol by vaporisation of the aerosolisable material. In many devices, the aerosol generating component may be a heating element (heater) which is heated by the passage of electrical current (via resistive or inductive heating) to raise the temperature of the aerosolisable material until it evaporates. A liquid conduit arrangement such as a wick or other porous element (not shown) may be provided to deliver aerosolisable material from the storage compartment 3 to the aerosol generating component 4. The wick may have one or more parts located inside the storage compartment 3 so as to be able to absorb aerosolisable material and transfer it by wicking or capillary action to other parts of the wick that are in contact with the aerosol generating component 4. This aerosolisable material is thereby vaporised, to be replaced by new aerosolisable material transferred to the aerosol generating component 4 by the wick.

A heater and wick combination, or other arrangement of parts that perform the same functions, is sometimes referred to as an atomiser or atomiser assembly. Various designs are possible, in which the parts may be differently arranged compared to the highly schematic representation of Figure 1. For example, the wick may be an entirely separate element from the aerosol generating component, or the aerosol generating component may be configured to be porous and able to perform the wicking function directly (by taking the form of a suitable electrically resistive mesh or capillary body, for example).

In some cases, the conduit for delivering liquid for vapour generation may be formed at least in part from one or more slots, tubes or channels between the storage compartment and the aerosol generating component which are narrow enough to support capillary action to draw source liquid out of the storage compartment and deliver it for vaporisation. In general, an atomiser can be considered to be an aerosol generating component able to generate vapour from aerosolisable material delivered to it, and a liquid conduit (pathway) able to deliver or transport liquid from a storage compartment or similar liquid store to the aerosol generating component by a capillary force.

Typically, the aerosol generating component is at least partly located within an aerosol generation chamber that forms part of an airflow channel through the electronic cigarette/system. Vapour produced by the aerosol generating component is driven off into this chamber, and as air passes through the chamber, flowing over and around the aerosol generating component, it collects the produced vapour whereby it condenses to form the required aerosol.

Returning to Figure 1, the cartridge assembly 30 also includes a mouthpiece 35 having an opening or air outlet through which a user may inhale the aerosol generated by the aerosol generating component 4, and delivered through the airflow channel.

The power component 20 includes a cell or battery 5 (which also may be referred to herein as a battery, and which may be re-chargeable) to provide power for electrical components of the e-cigarette 10, in particular the aerosol generating component 4. Additionally, there is a printed circuit board 28 and/or other electronics or circuitry for generally controlling the e-cigarette. The control electronics/circuitry connect the vapour generating element 4 to the battery 5 when vapour is required, for example in response to a signal from an air pressure sensor or air flow sensor (not shown) that detects an inhalation on the system 10 during which air enters through one or more air inlets 26 in the wall of the power component 20 to flow along the airflow channel. When the aerosol generating component 4 receives power from the battery 5, the aerosol generating component 4 vaporises aerosolisable material delivered from the storage compartment 3 to generate the aerosol, and this is then inhaled by a user through the opening in the mouthpiece 35. The aerosol is carried to the mouthpiece 35 along the airflow channel (not shown) that connects the air inlet 26 to the air outlet when a user inhales on the mouthpiece 35. An airflow path through the electronic cigarette is hence defined, between the air inlet(s) (which may or may not be in the power component) to the atomiser and on to the air outlet at the mouthpiece. In use, the air flow direction along this airflow path is from the air inlet to the air outlet, so that the atomiser can be described as lying downstream of the air inlet and upstream of the air outlet.

In this particular example, the power section 20 and the cartridge assembly 30 are separate parts detachable from one another by separation in a direction parallel to the longitudinal axis, as indicated by the solid arrows in Figure 1. The components 20, 30 are joined together when the device 10 is in use by cooperating engagement elements 21, 31 (for example, a screw, magnetic or bayonet fitting) which provide mechanical and electrical connectivity between the power section 20 and the cartridge assembly 30. This is merely an example arrangement, however, and the various components may be differently distributed between the power section 20 and the cartridge assembly section 30, and other components and elements may be included. The two sections may connect together end-to-end in a longitudinal configuration as in Figure 1, or in a different configuration such as a parallel, side-by-side arrangement. The system may or may not be generally cylindrical and/or have a generally longitudinal shape. Either or both sections may be intended to be disposed of and replaced when exhausted (the reservoir is empty or the battery is flat, for example), or be intended for multiple uses enabled by actions such as refilling the reservoir, recharging the battery, or replacing the atomiser. Alternatively, the e-cigarette 10 may be a unitary device (disposable or refillable/rechargeable) that cannot be separated into two or more parts, in which case all components are comprised within a single body or housing. Embodiments and examples of the present invention are applicable to any of these configurations and other configurations of which the skilled person will be aware.

As mentioned, a type of aerosol generating component, such as a heating element, that may be utilised in an atomising portion of an electronic cigarette (a part configured to generate vapour from a source liquid) combines the functions of heating and liquid delivery, by being both electrically conductive (resistive) and porous. Note here that reference to being electrically conductive (resistive) refers to components which have the capacity to generate heat in response to the flow of electrical current therein. Such flow could be imparted by via so-called resistive heating or induction heating. An example of a suitable material for this is an electrically conductive material such as a metal or metal alloy formed into a sheet-like form, i.e. a planar shape with a thickness many times smaller than its length or breadth. Examples in this regard may be a mesh, web, grill and the like. The mesh may be formed from metal wires or fibres which are woven together, or alternatively aggregated into a non-woven structure. For example, fibres may be aggregated by sintering, in which heat and/or pressure are applied to a collection of metal fibres to compact them into a single porous mass. It is possible for the planar aerosol generating component to define a curved plane and in these instances reference to the planar aerosol generating component forming a plane means an imaginary flat plane forming a plane of best fit through the component.

These structures can give appropriately sized voids and interstices between the metal fibres to provide a capillary force for wicking liquid. Thus, these structures can also be considered to be porous since they provide for the uptake and distribution of liquid. Moreover, due to the presence of voids and interstices between the metal fibres, it is possible for air to permeate through said structures. Also, the metal is electrically conductive and therefore suitable for resistive heating, whereby electrical current flowing through a material with electrical resistance generates heat. Structures of this type are not limited to metals, however; other conductive materials may be formed into fibres and made into mesh, grill or web structures. Examples include ceramic materials, which may or may not be doped with substances intended to tailor the physical properties of the mesh.

A planar sheet-like porous aerosol generating component of this kind can be arranged within an electronic cigarette such that it lies within the aerosol generation chamber forming part of an airflow channel. The aerosol generating component may be oriented within the chamber such that air flow though the chamber may flow in a surface direction, i.e. substantially parallel to the plane of the generally planar sheet-like aerosol generating component. An example of such a configuration can be found in WO2010/045670 and WO2010/045671, the contents of which are incorporated herein in their entirety by reference. Air can thence flow over the heating element, and gather vapour. Aerosol generation is thereby made very effective. In alternative examples, the aerosol generating component may be oriented within the chamber such that air flow though the chamber may flow in a direction which is substantially transverse to the surface direction, i.e. substantially orthogonally to the plane of the generally planar sheet-like aerosol generating component. An example of such a configuration can be found in WO2018/211252, the contents of which are incorporated herein in its entirety by reference.

The aerosol generating component may have any one of the following structures: a woven or weave structure, mesh structure, fabric structure, open-pored fiber structure, open-pored sintered structure, open-pored foam or open-pored deposition structure. Said structures are suitable in particular for providing a aerosol generating component with a high degree of porosity. A high degree of porosity may ensure that the heat produced by the aerosol generating component is predominately used for evaporating the liquid and high efficiency can be obtained. A porosity of greater than 50% may be envisaged with said structures. In one embodiment, the porosity of the aerosol generating component is 50% or greater, 60% or greater, 70% or greater. The open-pored fiber structure can consist, for example, of a non-woven fabric which can be arbitrarily compacted, and can additionally be sintered in order to improve the cohesion. The open-pored sintered structure can consist, for example, of a granular, fibrous or flocculent sintered composite produced by a film casting process. The open-pored deposition structure can be produced, for example, by a CVD process, PVD process or by flame spraying. Open-pored foams are in principle commercially available and are also obtainable in a thin, fine-pored design.

In one embodiment, the aerosol generating component has at least two layers, wherein the layers contain at least one of the following structures: a plate, foil, paper, mesh, woven structure, fabric, open-pored fiber structure, open-pored sintered structure, open-pored foam or open-pored deposition structure. For example, the aerosol generating component can be formed by an electric heating resistor consisting of a metal foil combined with a structure comprising a capillary structure. Where the aerosol generating component is considered to be formed from a single layer, such a layer may be formed from a metal wire fabric, or from a non-woven metal fiber fabric. Individual layers are advantageously but not necessarily connected to one another by a heat treatment, such as sintering or welding. For example, the aerosol generating component can be designed as a sintered composite consisting of a stainless steel foil and one or more layers of a stainless steel wire fabric (material, for example AISI 304 or AISI 316). Alternatively, the aerosol generating component can be designed as a sintered composite consisting of at least two layers of a stainless steel wire fabric. The layers may be connected to one another by spot welding or resistance welding. Individual layers may also be connected to one another mechanically. For instance, a double-layer wire fabric could be produced just by folding a single layer. Instead of stainless steel, use may also be made, by way of example, of heating conductor alloys-in particular NiCr alloys and CrFeAl alloys ("Kanthal") which have an even higher specific electric resistance than stainless steel. The material connection between the layers is obtained by the heat treatment, as a result of which the layers maintain contact with one another-even under adverse conditions, for example during heating by the aerosol generating component and resultantly induced thermal expansions. Alternatively, the aerosol generating component may be formed from sintering a plurality of individual fibers together. Thus, the aerosol generating component can be comprised of sintered fibers, such as sintered metal fibers.

The aerosol generating component may comprise, for example, an electrically conductive thin layer of electrically resistive material, such as platinum, nickel, molybdenum, tungsten or tantalum, said thin layer being applied to a surface of the vaporizer by a PVD or CVD process, or any other suitable process. In this case, the aerosol generating component may comprise an electrically insulating material, for example of ceramic. Examples of suitable electrically resistive material include stainless steels, such as AISI 304 or AISI 316, and heating conductor alloys-in particular NiCr alloys and CrFeAl alloys ("Kanthal"), such as DIN material number 2,4658, 2,4867, 2,4869, 2,4872, 1,4843, 1,4860, 1,4725, 1,4765 and 1,4767.

As described above, the aerosol generating component may be formed from a sintered metal fiber material and may be in the form of a sheet. Material of this sort can be thought of a mesh or irregular grid, and is created by sintering together a randomly aligned arrangement or array of spaced apart metal fibers or strands. A single layer of fibers might be used, or several layers, for example up to five layers. As an example, the metal fibers may have a diameter of 8 to 12 μm, arranged to give a sheet of thickness 0.16 mm, and spaced to produce a material density of from 100 g/m^2 to 1500 g/m^2, such as from 150 g/m^2 to 1000 g/m^2, 200 g/m^2 to 500 g/m^2, or 200 to 250 g/m^2, and a porosity of 84%. The sheet thickness may also range from 0.1mm to 0.2mm, such as 0.1mm to 0.15mm. Specific thicknesses include 0.10 mm, 0.11 mm, 0.12mm, 0.13 mm, 0.14 mm, 0.15 mm or 0.1 mm. Generally, the aerosol generating component has a uniform thickness. However, it will be appreciated from the discussion below that the thickness of the aerosol generating component may also vary. This may be due, for example, to some parts of the aerosol generating component having undergone compression. Different fiber diameters and thicknesses may be selected to vary the porosity of the aerosol generating component. For example, the aerosol generating component may have a porosity of 66% or greater, or 70% or greater, or 75% or greater, or 80% or greater or 85% or greater, or 86% or greater.

The aerosol generating component may form a generally flat structure, comprising first and second surfaces. The generally flat structure may take the form of any two dimensional shape, for example, circular, semi-circular, triangular, square, rectangular and/ or polygonal. Generally, the aerosol generating component has a uniform thickness.

A width and/or length of the aerosol generating component may be from about 1 mm to about 50mm. For example, the width and/or length of the vaporizer may be from 1 mm, 2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 7 mm, 8 mm, 9 mm or 10 mm. The width may generally be smaller than the length of the aerosol generating component.

Where the aerosol generating component is formed from an electrically resistive material, electrical current is permitted to flow through the aerosol generating component so as to generate heat (so called Joule heating). In this regard, the electrical resistance of the aerosol generating component can be selected appropriately. For example, the aerosol generating component may have an electrical resistance of 2 ohms or less, such as 1.8ohms or less, such as 1.7ohms or less, such as 1.6ohms or less, such as 1.5ohms or less, such as 1.4ohms or less, such as 1.3ohms or less, such as 1.2ohms or less, such as 1.1ohms or less, such as 1.0ohm or less, such as 0.9ohms or less, such as 0.8ohms or less, such as 0.7ohms or less, such as 0.6ohms or less, such as 0.5ohms or less. The parameters of the aerosol generating component, such as material, thickness, width, length, porosity etc. can be selected so as to provide the desired resistance. In this regard, a relatively lower resistance will facilitate higher power draw from the power source, which can be advantageous in producing a high rate of aerosolisation. On the other hand, the resistance should not be so low so as to prejudice the integrity of the aerosol generator. For example, the resistance may not be lower than 0.5 ohms.

Planar aerosol generating components, such as heating elements, suitable for use in systems, devices and articles disclosed herein may be formed by stamping or cutting (such as laser cutting) the required shape from a larger sheet of porous material. This may include stamping out, cutting away or otherwise removing material to create openings in the aerosol generating component. These openings can influence both the ability for air to pass through the aerosol generating component and the propensity for electrical current to flow in certain areas.

Figure 2 is a diagram of an exemplary article 100 according to the present disclosure. The article 100 comprises a housing. In this specific example, the housing comprises an outer housing 110 and an inner housing 120. The outer housing 110 is formed by the coming together of first and second outer housing component 110a and 110b. The specific external appearance of the outer housing 110 is not limited, although in this specific example the outer housing 110 has a multi-faceted surface. The housing, for example the outer housing 110, may contain at least one outlet 115. In this specific example, there are two outlets 115. Said outlet(s) 115 is for conveying aerosol generated within the article 100 to the mouth of the user. Thus, in the example shown in Figure 2, outer housing 110 also forms the mouthpiece of the article.

The first outer housing component 110a mates with the second outer housing component 110b so as to form outer housing 110. In this specific example, the components 110a, 110b fit together via a snap fit arrangement. In particular, resilient tabs 111 on the second outer housing component 110b (only one side of which is visible in Figure 2), snap into corresponding receiving apertures 112 on first outer housing component 110a. It will be appreciated that the precise location of the tabs and apertures are not limited, and indeed the tabs may be formed on outer housing component 110a and apertures on outer housing component 110b.

Referring to Fig. 3, the first outer housing component 110a is shown separated from second outer housing component 110b to reveal the inner housing component 120, an aerosol generating component 130 (which in this specific example is an electrically resistive metallic heater), a flow regulator 140, and a pad 150. The inner housing component 120 may be configured so as to define a storage area 121 for aerosolisable material (not shown). The inner housing component 120 may be sleeved at least partially inside first outer housing component 110a. It is possible for the inner housing component 120 to be connected to the first outer housing component 110a (for example they may be attached together or part of the same moulding). The inner housing component 120 may have an open end 122 which mates with flow regulator 140. Together, open end 122 and flow regulator 140 may define a path for aerosolisable material to flow from the storage area 121 to the pad 150. An optional mouthpiece (not shown) may be sleeved over the outside of the first outer housing component 110a (or the outer housing can form the mouthpiece).

The flow regulator 140 may contain a recess 141 into which the open end 122 of the inner housing component 120 can be received. The recess 141 may contain one or more openings 142 which allow for the flow of aerosolisable material through the flow regulator. In this specific example, the openings are slot shaped, but it will be appreciated that one or more of the openings may take a different cross section, such as circular, oval, or polygonal. Moreover, the cross sectional area of the one or more openings may vary through the length of the flow regulator. Thus, the one or more openings may have a larger cross sectional area at a location which is towards the liquid storage area compared to the cross sectional area at a location towards the pad 150. The flow regulator 140 may comprise an annular seal 143 around its perimeter which serves to inhibit egress of aerosolisable material from the boundary between inner housing component 120 and the flow regulator 140. The flow regulator 140 may comprise a surface against which the aerosol generating component may be biased, and thus in some instances acts as a heater support.

The pad 150 may be formed of a capillary material which is suited to holding aerosolisable material. In particular, as aerosolisable material flows through flow regulator 140, the pad 150 may become saturated with aerosolisable material. However, due to the capillary nature of pad 150, leakage of aerosolisable material from pad 150 is inhibited. The aerosol generating component 130 may be located in proximity to pad 150 such that when the aerosol generating component 130 is energised (resistively heated in this specific example), aerosolisable material present in the pad 150 is vaporised. As explained above, the pad 150 and the aerosol generating component 130 may be combined as a single component.

In this specific example, the aerosol generating component 130 is arranged towards the second outer housing component 110b. Electrical contacts (e.g. pins) 116 on outer housing component 110b may contact the aerosol generating component 130 at electrical connectors (e.g.

tabs) 130C so as to allow for electrical current to flow through aerosol generating component 130 during actuation of the system.

The second outer housing component 110b may contain at least one air inlet 117 which allows for air ingress into the article 100. During use, air may enter the article 100 via the at least one air inlet 117 whereby it mixes with vapour produced from aerosol generating component 130. The resulting aerosol may be then directed to the one or more air outlets 115 via at least one airflow channel 180 which extends between the first outer housing component 110a and the inner housing component 120. For example, in this specific example, there are two airflow channels 180 that extend longitudinally along the length of the article 100 and cooperate with air outlets 115 so as to create a flow path through the article.

According to one aspect, there is provided an aerosol generating component comprising a material having a grain, wherein the orientation of the grain of the material is substantially orthogonal to an axis upon which electrical connectors of the aerosol generating component are located. By providing the grain of the material in this direction, the aerosol generating component can be manufactured so as to be more resistant to material failure or cracking, e.g. when the aerosol generating component is forced into a curved shape by curving the aerosol generating component against the grain orientation. Also, the aerosol generating component can be manufactured so as to be more resistant to permanent deformation, which may otherwise occur e.g. when the aerosol generating component is forced into a curved shape by curving the aerosol generating component against the grain orientation. It will be understood that the “orientation of the grain” refers to the orientation in which regions of the material are aligned. Materials such as metals can be processed to include a particular grain orientation.

This aspect is most clearly illustrated in the sketch of Fig. 4, in which the orientation of the grain of the material is designated by the dashed lines. Exemplary aerosol generating components 130, which may have the grain orientation of this aspect, are illustrated in Figs. 5 and 6 (although the grain orientation is not shown in Figs. 5 and 6).

The axis upon which electrical connectors of the aerosol generating component are located may correspond to a first axis.

The material may have a crystalline structure. It will be appreciated that any suitable material may be used, as will be known by those skilled in the art. For example, the material may be an electrically conductive material. For example, the material may be a metallic material, e.g. a metal, or a metal alloy such as stainless steel. Other materials are also envisaged, e.g. nichrome alloys and NiCrFe alloys.

The orientation of the grain of the material may be substantially orthogonal to an axis around which the aerosol generating component 130 is curved (e.g. in use). Advantageously, this may help ensure that the curved form of the aerosol generating component 130 is maintained. In this regard, the aerosol generating component 130 may either comprise permanent curvature, or may be curved when assembled in the article in use (e.g. due to the connectivity to and shape of its surrounding components). The axis around which the aerosol generating component is curved may correspond to a second axis.

The aerosol generating component 130 may be substantially planar. The aerosol generating component 130 may be formed of a single layer.

Each of the electrical connectors 130C may be configured to connect to a respective electrical contact. The electrical connectors 130C may be located on an axis.

It will be appreciated that the form and dimensions of the electrical connectors 130C may be varied. For example, the or each electrical connector 130C may be configured to connect to a respective electrical contact 116. In this way, the aerosol generating component 130 can be powered by a power source such as a battery. The or each electrical connector 130C may be configured to releasably or permanently connect to a respective electrical contact 116. The or each electrical connector 130C may be configured to connect to a respective electrical contact by a clearance fit, an interference fit, and/or a transition fit. The or each electrical connector 130C may be configured to connect to a respective electrical contact 116 by a push fit. The electrical connectors 130C provide means by which the aerosol generating component 130 can be electrically connected to a power source.

The aerosol generating component 130 may comprise a heating section 130A and one or more of electrical connectors 130C. In various examples, the aerosol generating component comprises a heating section 130A and two electrical connectors 130A, each electrical connector 130C being provided at a respective opposite end of the heating section 130A. The heating section 130A can be considered as the part of the aerosol generating component 130 that is heated in use so as to vaporise aerosolisable material and generate aerosol. The heating section 130A may be provided between the electrical connectors 130C. One or more elongate apertures 130B, which are also referred to herein as one or more longitudinal gaps 130B, may be provided in the aerosol generating component 130, e.g. in the heating section 130A. The one or more elongate apertures 130B may facilitate the provision of “hot spots”, typically around the end(s) thereof, at which aerosol generating material can be rapidly vaporised. The aerosol generating component 130, e.g. the heating section 130A, may comprise a plurality of elongate heating portions 130E, which may be arranged side-by side. The heating portions 130E may extend between respective terminal portions 130F. An elongate gap 130B may be provided between adjacent heating portions 130E.

The aerosol generating component 130 may be manufactured using various different techniques, as will be familiar to those skilled in the art. For example, various different material processing techniques may be used to orientate the grain of the material as desired.

According to an alternative aspect, there is provided an aerosol generating component comprising a material having a grain, wherein the orientation of the grain of the material is substantially parallel to one or more elongate apertures within the aerosol generating component. By providing the grain of the material in this direction, the aerosol generating component can be manufactured so as to be more resistant to material failure or cracking, e.g. when the aerosol generating component is forced into a curved shape by curving the aerosol generating component against the grain orientation. Also, the aerosol generating component can be manufactured so as to be more resistant to permanent deformation, which may otherwise e.g. when the aerosol generating component is forced into a curved shape by curving the aerosol generating component against the grain orientation.

This aspect is most clearly illustrated in the sketch of Fig. 4, in which the orientation of the grain of the material is designated by the dashed lines. Exemplary aerosol generating components 130, which may have the grain orientation of this aspect, are illustrated in Figs. 5 and 6 (although the grain orientation is not shown in Figs. 5 and 6).

The aerosol generating component 130, including the elongate aperture(s) 130B and any other features thereof, may be as defined elsewhere herein.

The aerosol generating component 130 may be manufactured using various different techniques, as will be familiar to those skilled in the art. For example, various different material processing techniques may be used to orientate the grain of the material as desired.

There is also provided an article 100 for use as part of a non-combustible aerosol provision system, the article 100 comprising: an aerosol generating component 130 as defined herein; and one or more of a reservoir for aerosolisable material, and an aerosol generation chamber.

In some examples, the aerosol generating component 103 is at least partly located in the aerosol generation chamber.

In some examples, the reservoir is configured to provide aerosolisable material to the aerosol generating component 103.

In some examples, the reservoir is configured to hold a liquid aerosolisable material.

There is also provided a non-combustible aerosol provision system comprising: an article comprising the aerosol generating component 103 as defined herein; and a device comprising one or more of a power source and a controller.

In some examples, the power source is configured to provide power to the aerosol generating component 103 via the electrical connectors 130C.

According to one aspect, there is provided an aerosol generating component comprising: a plurality of elongate heating portions extending between terminal portions, wherein an elongate aperture is provided between adjacent heating portions, wherein at least one of the elongate apertures tapers longitudinally. Without being bound by theory, it is believed that the taper of the longitudinal aperture(s) introduces a temperature gradient in the heating portions, as a consequence of a central part of each aperture(s) being situated further from an edge of an adjacent one of the heating portions at the wider end of each aperture(s), compared to at the narrower end, and that this temperature gradient helps to drive aerosolisable material along the heating portions and distribute aerosolisable material across the heating portions. This provides more effective heating of the aerosolisable material, reduces the amount of aerosolisable material that is “static” on the aerosol generating component, and reduces the “crackling” sound that can occur when said static aerosolisable material is heated.

This aspect is most clearly illustrated in Fig. 5, in which the aerosol generating component 130 comprises a plurality of elongate heating portions 130E extending between terminal portions 130E (not all of the heating portions 130E are numbered for clarity). An elongate aperture 130B (also referred to herein as a slotted aperture) is provided between adjacent heating portions 130E. At least one of the elongate apertures 130B tapers longitudinally (i.e. along the length of the aperture 130B). In use, aerosolisable material is distributed along the elongate aperture 130B in the direction of the increasing taper. In this example, the heating portions 130E are arranged side-by-side.

A plurality of elongate apertures 130B that taper longitudinally may be provided in the aerosol generating component 130. Each elongate aperture 130B may be provided between a respective pair of adjacent heating portions 130E. At least two adjacent elongate apertures 130B may taper in opposite directions. For example, where there is a plurality of the elongate apertures 130B, the elongate apertures 130B may taper in alternatingly opposite directions. This can help to provide a more even distribution of aerosolisable material across the heating portions 130E, and thus improve aerosol generation.

At least one elongate heating portion 130E may have a substantially constant cross sectional area, wherein the cross section may be orthogonal to the length of the heating portion 130E.

At least one of the elongate apertures 130B may be enclosed. This is particularly advantageous in effecting movement of aerosolisable material via the enclosed elongate aperture structure (e.g. by capillary force between adjacent heating portions 130E enclosing the elongate aperture 130B) so as to provide an even distribution of aerosolisable material across the heating portions 130E, and especially at the "hot spots", which may be located at the ends of the elongate apertures 130B. In some examples, at least one elongate aperture 130B is enclosed within or by the periphery of the aerosol generating component 130. For example, at least one elongate aperture 130 may be enclosed by adjacent heating portions 130E and opposing terminal portions 130F.

For example, at least one (or each) of the elongate apertures 130B may have a maximum width of up to 2.0 mm, or up to 1.8 mm, or up to 1.6 mm, or up to 1.5 mm, or up to 1.4 mm, or up to 1.2 mm, or up to 1.0 mm. For example, at least one (or each) of the elongate apertures 130B may have a minimum width of at least 0.1 mm, or at least 0.2 mm, or at least 0.3 mm, or at least 0.4 mm. This may also help promote movement of aerosolisable material along the opposing edges of the heating portions 130E, e.g. by capillary force.

In some examples, the aerosol generating component 130 is formed of a single layer.

In some examples, the aerosol generating component 130 is formed of an electrically conductive material.

The aerosol generating component 130 may include any other features as defined elsewhere herein.

There is also provided an article for use as part of a non-combustible aerosol provision system, the article comprising: the aerosol generating component 130; and one or more of a reservoir for aerosolisable material, and an aerosol forming chamber.

There is also provided a non-combustible aerosol provision system comprising: an article comprising the aerosol generating component 130; and a device comprising one or more of a power source and a controller.

According to an alternative aspect, there is provided an aerosol generating component comprising: a plurality of elongate heating portions extending between terminal portions; wherein an elongate aperture is provided between the adjacent heating portions, wherein at least one of the heating portions tapers longitudinally. In use, the most tapered (i.e. thinnest) part of the heating portion heats to an operating temperature first (as it has the highest electrical resistance), following which the progressively less tapered parts of the heating portion heat to the operating temperature (as they have a relatively low electrical resistance). This non-uniformity in heating along the heating portions results in a temperature gradient that can help to drive aerosolisable material along the heating portions and distribute aerosolisable material across the heating portions. This provides more effective heating of the aerosolisable material, reduces the amount of aerosolisable material that is "static" on the aerosol generating component, and reduces the "crackling" sound that can occur when said static aerosolisable material is heated.

This aspect is most clearly illustrated in Fig. 6, in which the aerosol generating component 130 comprises: a plurality of elongate heating portions 130E (not all of which are numbered for clarity) extending between terminal portions 130F. An elongate aperture 130B (also referred to herein as a slotted aperture 130B) is provided between adjacent heating portions 130E. At least one of the heating portions 130E tapers longitudinally (i.e. along the length of the heating portion 130E). In this example, the heating portions 130E are arranged side-by-side.

In some examples, a plurality of the elongate heating portions 130E may taper longitudinally.

A plurality of elongate apertures 130B may be provided in the aerosol generating component. Each elongate aperture130B may be provided between a respective pair of adjacent heating portions 130E.

At least one elongate heating aperture 130B may have a substantially constant width (see Fig. 6).

At least two adjacent heating portions 130E may taper in opposite directions. For example, where there is a plurality of the heating portions 130E, the heating portions 130E may taper in alternatingly opposite directions. This can help to provide a more even distribution of aerosolisable material across the heating portions 130E.

At least one of the elongate apertures130B may be enclosed. In some examples, at least one elongate aperture 130B is enclosed within or by the periphery of the aerosol generating component 130. For example, at least one elongate aperture 130B may be enclosed by adjacent heating portions 130E and opposing terminal portions 130F.

For example, at least one (or each) of the heating portions 130E may have a maximum width of up to 2.0 mm, or up to up to 1.8 mm, or up to 1.6 mm, or up to 1.5 mm, or up to 1.4 mm, or up to 1.2 mm, or up to 1.0 mm. For example, at least one (or each) of the heating portions 130E may have a minimum width of at least 0.1 mm, or at least 0.2 mm, or at least 0.3 mm, or at least 0.4 mm. This can further help promote movement of aerosolisable material along the heating portions.

The aerosol generating component 130 may include any other features as defined elsewhere herein.

There is also provided an article for use as part of a non-combustible aerosol provision system, the article comprising: an aerosol generating component 130 as defined herein; and one or more of a reservoir for aerosolisable material, and an aerosol generation chamber.

In some examples, the aerosol generating component 103 is at least partly located in the aerosol generation chamber.

In some examples, the reservoir is configured to provide aerosolisable material to the aerosol generating component 103.

In some examples, the reservoir is configured to hold a liquid aerosolisable material.

There is also provided a non-combustible aerosol provision system comprising: an article comprising the aerosol generating component 103 as defined herein; and a device comprising one or more of a power source and a controller.

In some examples, the power source is configured to provide power to the aerosol generating component 103 via the electrical connectors 130C.

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 generating component comprising a material having a grain, wherein the orientation of the grain of the material is substantially orthogonal to an axis upon which electrical connectors of the aerosol generating component are located.

2. An aerosol generating component according to claim 1, wherein the material has a crystalline structure.

3. An aerosol generating component according to claim 1 or 2, wherein the orientation of the grain of the material is substantially orthogonal to an axis around which the aerosol generating component is curved.

4. An aerosol generating component according to any one of claims 1-3, comprising a heating section.

5. An aerosol generating component according to claim 4, wherein the heating section is provided between the electrical connectors.

6. An aerosol generating component according to any one of claims 1-5, wherein one or more elongate apertures are provided in the aerosol generating component.

7. An aerosol generating component according to any one of claims 1-6, wherein the aerosol generating component comprises a plurality of elongate heating portions arranged side-by-side.

8. An aerosol generating component according to claims 5 and 7, wherein an elongate aperture is provided between adjacent heating portions.

9. An aerosol generating component according to any one of claims 1-8, wherein the aerosol generating component is substantially planar.

10. An aerosol generating component according to any one of claims 1-9, wherein the aerosol generating component is formed of a single layer.

11. An aerosol generating component according to any one of claims 1-10, wherein the aerosol generating component is formed of an electrically conductive material.

12. An aerosol generating component comprising a material having a grain, wherein the orientation of the grain of the material is substantially parallel with one or more elongate apertures provided in the aerosol generating component.

13. An aerosol generating component according to claim 12, wherein the orientation of the grain of the material is substantially orthogonal to an axis around which the aerosol generating component is curved.

14. An aerosol generating component according to claims 12 or 13, comprising a heating section.

15. An aerosol generating component according to claim 14, wherein the heating section is provided between electrical connectors of the aerosol generating component.

16. An aerosol generating component according to any one of claims 12-15, wherein the aerosol generating component comprises a plurality of elongate heating portions arranged side-by-side.

17. An aerosol generating component according to claims 16, wherein an elongate aperture is provided between adjacent heating portions.

18. An aerosol generating component according to any one of claims 12-17, wherein the aerosol generating component is substantially planar.

19. An aerosol generating component according to any one of claims 12-18, wherein the aerosol generating component is formed of a single layer.

20. An aerosol generating component according to any one of claims 12-19, wherein the aerosol generating component is formed of a conductive material.

21. An article for use as part of a non-combustible aerosol provision system, the article comprising: an aerosol generating component as claimed in any one of claims 1-20; and one or more of a reservoir for aerosolisable material, and an aerosol generation chamber.

22. An article as claimed in claim 21, wherein the aerosol generating component is at least partly located in the aerosol generation chamber.

23. An article as claimed in claim 21 or 22, wherein the reservoir is configured to provide aerosolisable material to the aerosol generating component.

24. An article as claimed in any one of claims 21-23, wherein the reservoir is configured to hold a liquid aerosolisable material.

25. A non-combustible aerosol provision system comprising: an article comprising the aerosol generating component as claimed in any one of claims 1-20; and a device comprising one or more of a power source and a controller.

26. A non-combustible aerosol provision system as claimed in claim 25, wherein the power source is configured to provide power to the aerosol generating component via the electrical connectors.

27. A method of manufacturing an aerosol generating component, the method comprising: providing an aerosol generating component comprising a material having a grain; and processing the material so that the orientation of the grain of the material is substantially orthogonal to an axis upon which electrical connectors of the aerosol generating component are located.

28. A method of manufacturing an aerosol generating component, the method comprising: providing an aerosol generating component comprising a material having a grain; and processing the material so that the orientation of the grain of the material is substantially parallel to one or more elongate apertures provided in the aerosol generating component.

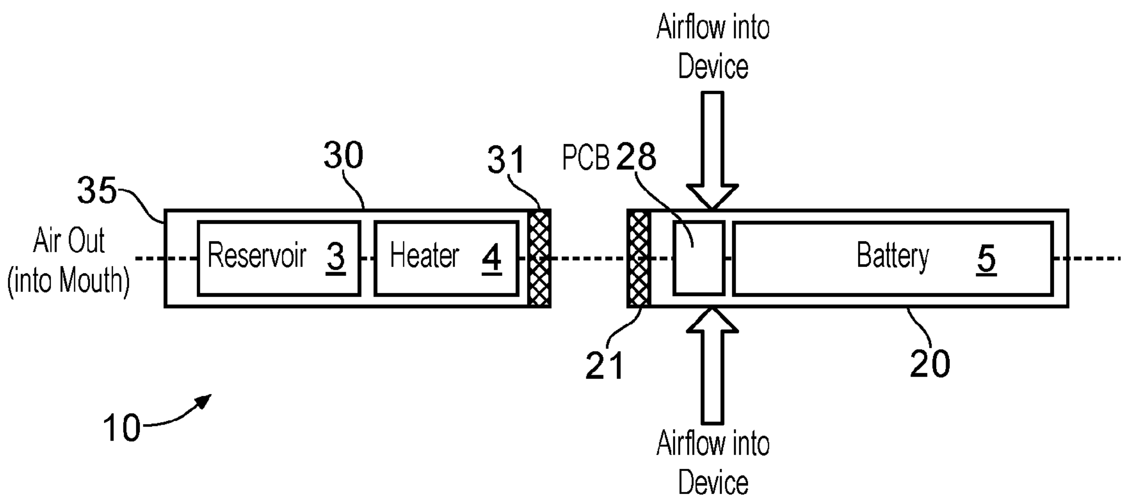
Airflow into
Device
30
31
PCB 28
35
Air Out
(into Mouth)
Reservoir 3
Heater 4
Battery 5
21
20
10
Airflow into
Device

FIG. 1

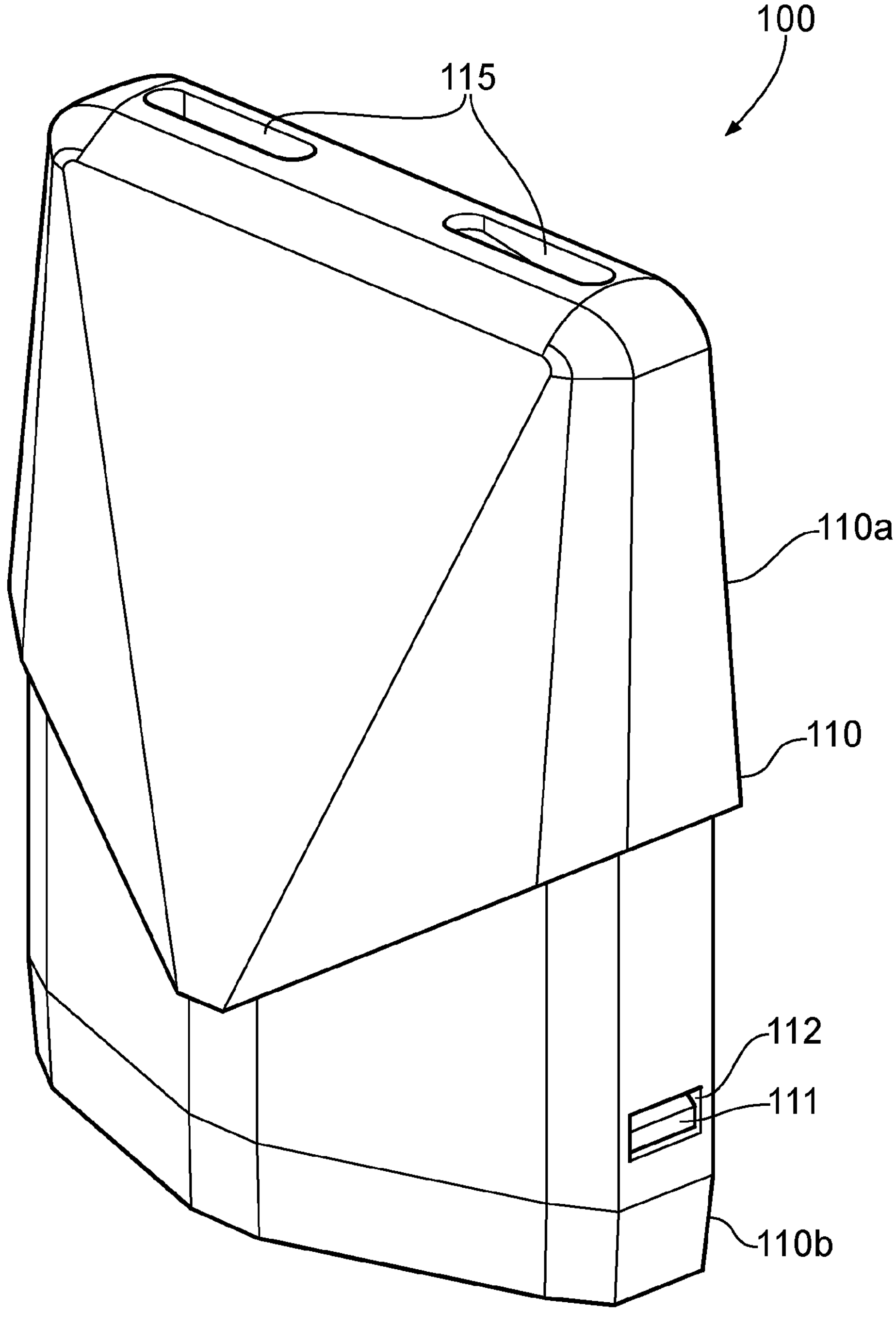

FIG. 2

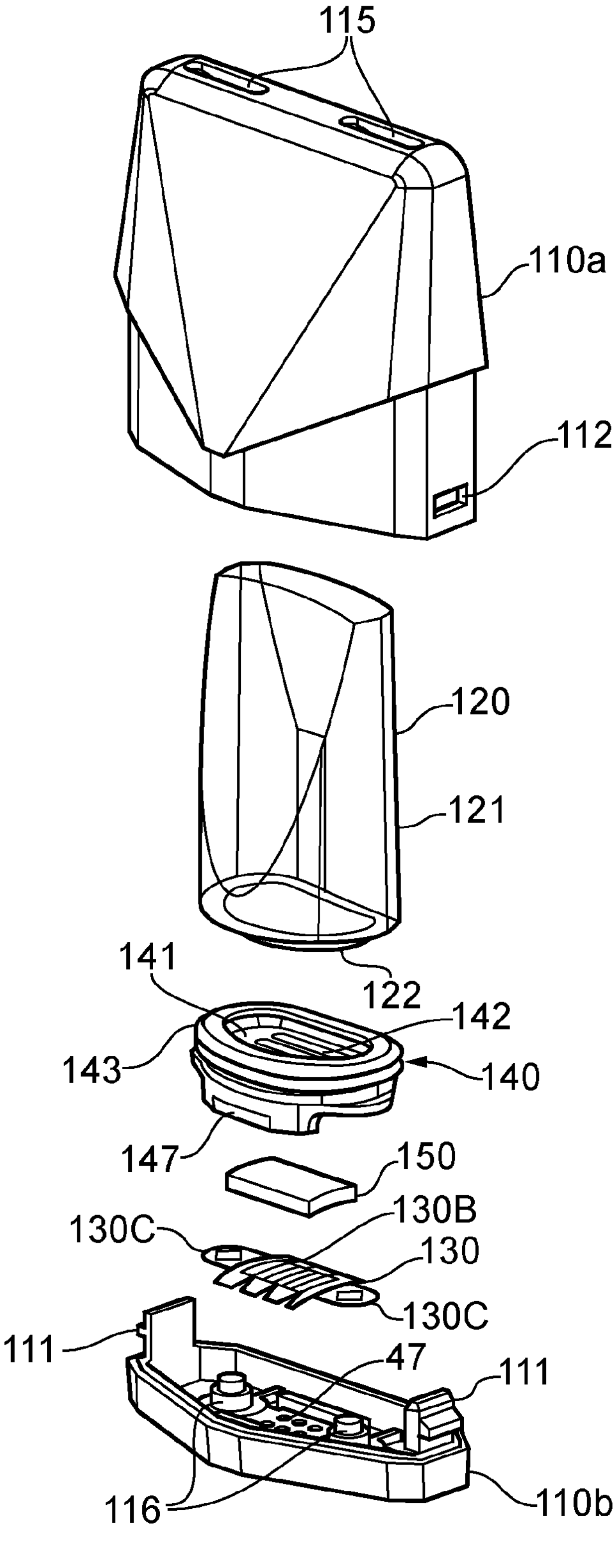
115
110a
112
120
121
122
141
142
143
140
147
150
130B
130C
130
130C
111
47
111
116
110b

FIG. 3

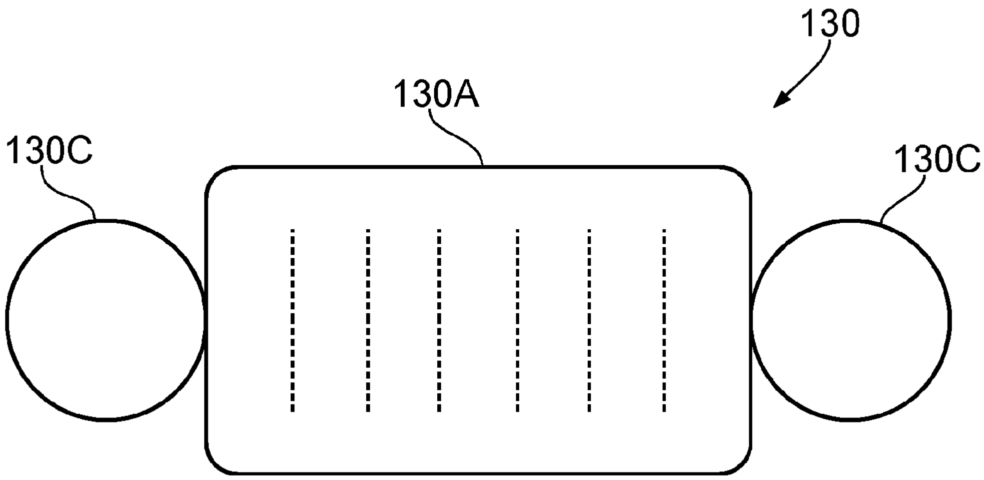

FIG. 4

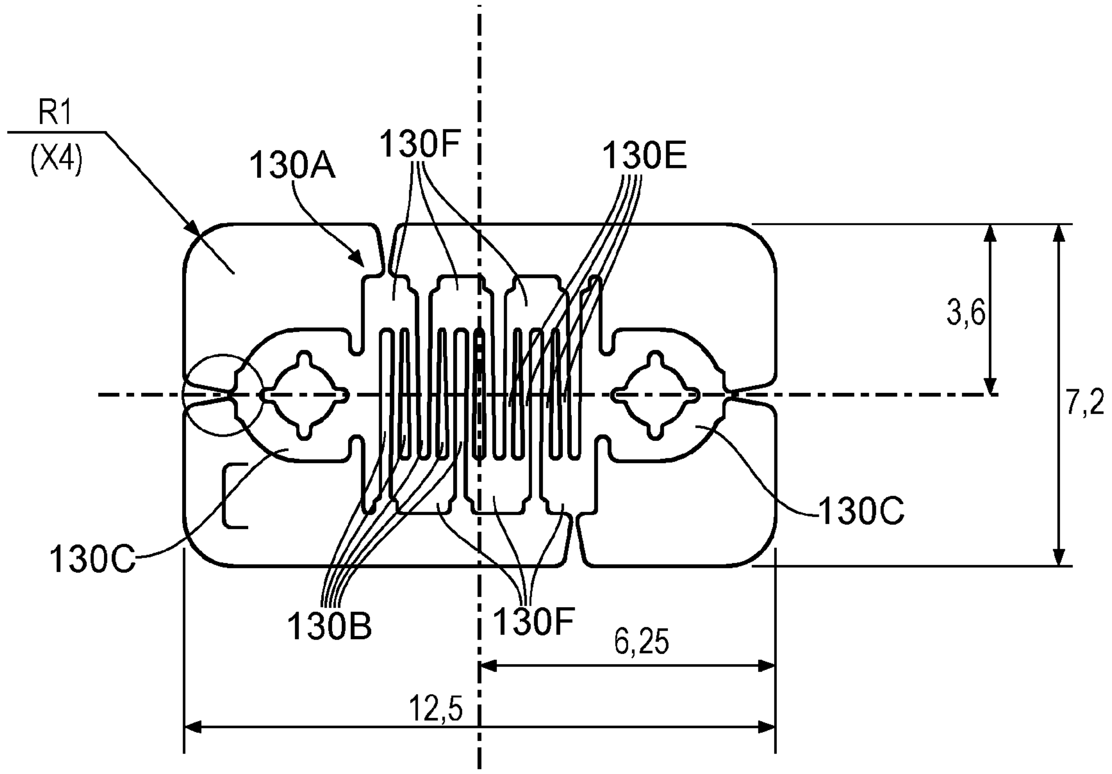

FIG. 5

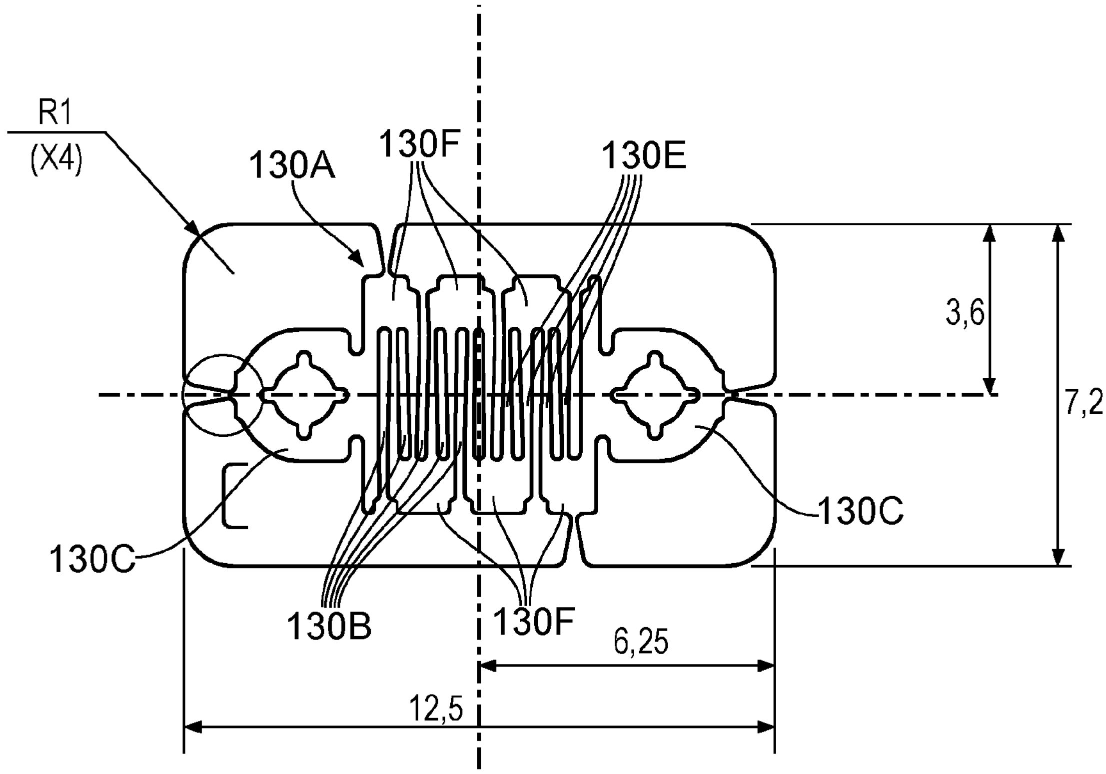

FIG. 6