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(54) **HEATING SYSTEM**

(57) A heating system (100) for an aerosol-generating system, the heating system (100) comprising: a wicking body (110) having a concave surface (112); and a heating element (120) at least partially disposed on the concave surface (112). An aerosol-generating component comprising said heating system (100) and a liquid

storage tank. An aerosol-generating device containing said heating system (100) or said aerosol-generating component and an aerosol-generating device comprising a power supply for powering the heating system (100).

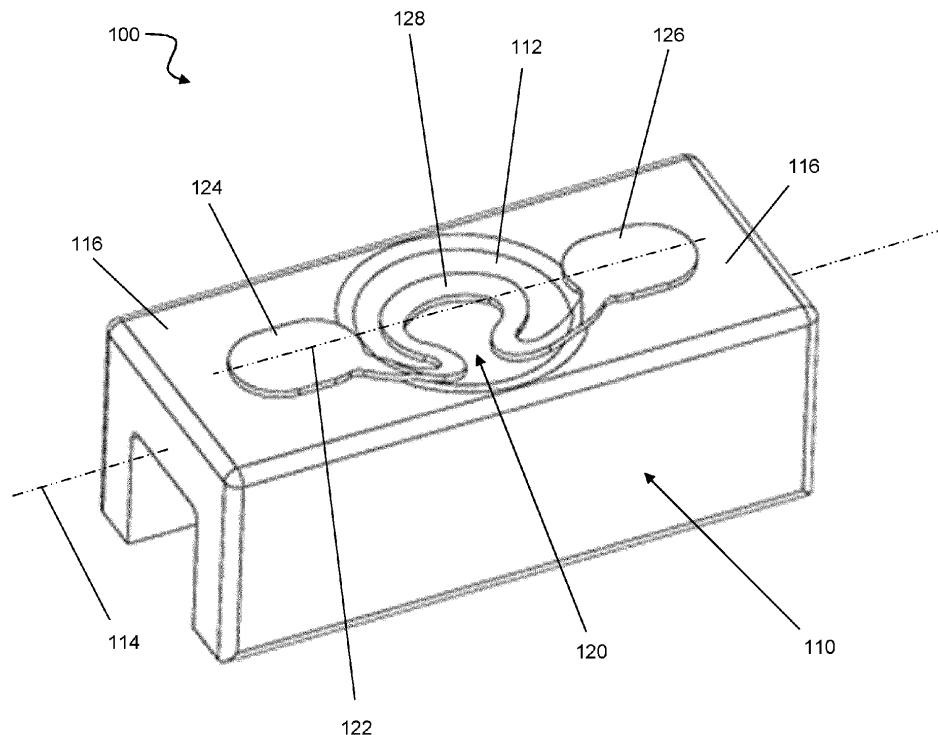


Fig. 4

Description

FIELD

[0001] The present disclosure relates to a heating system, in particular, a heating system for an aerosol-generating apparatus (e.g. a smoking substitute apparatus).

BACKGROUND

[0002] A typical aerosol-generating apparatus (e.g. a smoking substitute apparatus) may comprise a power supply, a heating system that is powered by the power supply, and an aerosol precursor, which in use is aerosolised by the heating system to generate an aerosol to be inhaled by a user of the aerosol-generating apparatus.

[0003] A drawback with known aerosol-generating apparatuses is that the performance of the heating system may diminish over time due to thermal cycling of constituent components. For example, a typical heating system may comprise a ceramic wicking body having a planar surface upon which a planar metallic alloy heating element is deposited. The wicking body may hold liquid aerosol precursor for aerosolization by the heating element when in use. However, the wicking body and heating element typically have different coefficients of thermal expansion resulting in the heating element expanding more than the wicking body when in use. This unequal expansion may cause the heating element to become detached and buckle away from the planar surface of the wicking body. This leads to ineffective heating of the wicking body and thus ineffective aerosolisation of the aerosol precursor. Furthermore, without contact with the wicking body to provide heat dissipation, the heating element may degrade and burn out.

[0004] A heating system which ameliorates these problems is required.

SUMMARY

[0005] In a first aspect, the present disclosure provides a heating system for an aerosol-generating apparatus, the heating system comprising:

a wicking body having a concave surface; and
a heating element at least partially disposed on the concave surface.

[0006] The concave surface allows the forces acting upon the heating element as it expands to reinforce the contact between the heating element and the wicking body. This, in turn, can reduce the likelihood of the heating element becoming detached from the wicking body. Urging the heating element against (as opposed to buckling away from) the wicking body also helps to ensure effective heating of the wicking body by the heating element and thus effective aerosolisation of aerosol pre-

cursor within the wicking body. Furthermore, it can reduce the likelihood of failure of the heating element due to overheating caused by non-contact with the wicking body. In use, the wicking body is typically saturated with liquid aerosol precursor thereby dissipating heat from a heating element urged into good contact with the wicking body.

[0007] Optional features of the invention will now be set out. These are applicable singly or in any combination with any aspect of the invention.

[0008] The concave surface may curve in a first direction. The concave surface may be continuous in the first direction. Thus, the concave surface may be free from discontinuities in the first direction to form a continuous surface in the first direction. The concave surface may have a continuous (e.g. smooth) gradient in the first direction e.g. the concave surface may gradually transition in the first direction between portions (e.g. flat portions, curved portions) having different gradients. Thus, the concave surface may be smoothly continuous in the first direction. Alternatively, the gradient of the concave surface in the first direction may be discontinuous. For example, the concave surface may include one or more corner portions in the first direction. In other examples, the concave surface may curve continuously in the first direction.

[0009] The concave surface may further curve in a second direction which may be perpendicular to the first direction. Alternatively, the concave surface may be uncurved in a second direction which may be perpendicular to the first direction. The concave surface may be continuous in the second direction. Thus, the concave surface may be free from discontinuities in the second direction to form a continuous surface in the second direction. The concave surface may have a continuous (e.g. smooth) gradient in the second direction e.g. the concave surface may gradually transition in the second direction between portions (e.g. flat portions, curved portions) having different gradients. Thus, the concave surface may be smoothly continuous in the second direction. Alternatively, the gradient of the concave surface in the second direction may be discontinuous. For example, the concave surface may include one or more corner portions in the second direction. In other examples, the concave surface may curve continuously in the second direction.

[0010] By curving in two perpendicular directions, the concave surface may provide a dish-shaped recess in the wicking body. The part of the heating element disposed on the concave surface may conform to the concave surface (e.g. conform to the dish-shaped recess).

[0011] The concave surface may have a minimum at a geometric centre of the concave surface. A minimum may be understood to be a point where a gradient (of the concave surface) is zero e.g. is zero in two perpendicular directions. The geometric centre of a surface may be understood to be the arithmetic mean position of all points on said surface. In this way, uniformity of heat dissipation

from the heating element into the wicking body may be facilitated thereby improving aerosol generation.

[0012] The concave surface (e.g. the dish-shaped recess) may be implemented as a variety of shapes (e.g. circular, oval or polygonal (e.g. rectangular)). Thus, a perimeter of the dish-shaped recess may be a circle, an oval (e.g. an ellipse, mandorla or stadium) or a polygon (e.g. rectangle).

[0013] In some examples, the wicking body is elongate (or includes an elongate portion) such that the wicking body has a longitudinal axis. The first direction of the concave surface may be parallel with the longitudinal axis of the wicking body. The second direction of the concave surface may be perpendicular to the longitudinal axis of the wicking body.

[0014] The concave surface may be formed in a first face of the wicking body. The first face may further comprise a planar (flat) surface at least partially (e.g. fully) surrounding the concave surface. The concave surface may be located at a geometric centre of the first face. Thus, a geometric centre of the concave surface may be directly beneath a geometric centre of the first face. The planar surface may transition to the concave surface via a rounded lip i.e. the transition between the concave surface and planar surface may be smoothly continuous. The wicking body may have a second face (e.g. opposing the first face) which may be planar and/or which may comprise at least one groove, recess and/or channel.

[0015] The wicking body may be cuboid (i.e. the wicking body may have a cuboid shape) or include a cuboid portion. In these embodiments, the first face will be substantially rectangular. The first face may be opposed by a second (rectangular) face. The second (rectangular) face may be planar (i.e. flat).

[0016] The wicking body may be formed of a first material having a first coefficient of thermal expansion. The wicking body may be ceramic. Example ceramics include silica dioxide (SiO₂), aluminium oxide (Al₂O₃) and calcium oxide (CaO) or any combination thereof. The wicking body may be porous e.g. such that liquid aerosol precursor can be retained in the wicking body (e.g. via capillary action).

[0017] The heating element may be formed of a second material having a second coefficient of thermal expansion. The first coefficient of thermal expansion may be different to the second coefficient of thermal expansion (e.g. the heating element may have a higher coefficient of thermal expansion than the wicking body). The heating element may be metallic, a metallic alloy and/or an inter-metallic compound (e.g. iron monosilicide (FeSi)) or a combination thereof. In this way, heating element performance and/or lifespan may be improved. In some examples, the heating element is printed onto the wicking body (e.g. the concave surface (e.g. and the planar surface)).

[0018] In some examples, the heating element is elongate such that the heating element has a longitudinal axis. The longitudinal axis of the heating element may be

parallel with the first (e.g. curved) direction of the concave surface. The longitudinal axis of the heating element may be parallel with the longitudinal axis of the elongate wicking body. The second (e.g. curved or uncurved) direction of the concave surface may be perpendicular to the longitudinal axis of the heating element.

[0019] In some examples, the heating element includes a first terminal pad, a second terminal pad and an elongate central portion connecting the first terminal pad to the second terminal pad. The first terminal pad, the elongate central portion and the second terminal pad form an electrical pathway (e.g. such that current can flow through the heating element). The longitudinal axis of the heating element may be understood to extend between the first terminal pad and the second terminal pad.

[0020] The first terminal pad may have a substantially circular, elliptical or polygonal shape. The first terminal pad may be disposed at least partially (e.g. fully) on the planar surface of the first face of wicking body. In this way, reliability of a connection between a first electrode and the first terminal pad may be improved. The second terminal pad may have a substantially circular, elliptical or polygonal shape. The second terminal pad may be disposed at least partially (e.g. fully) on the planar surface of the wicking body. In this way, reliability of a connection between a second electrode and the second terminal pad may be improved.

[0021] The first and second terminal pads may be disposed on the planar surface opposed (e.g. diametrically opposed) across the concave surface such that the elongate central portion of the heating element is disposed on the concave surface. The longitudinal axis of the central portion of the heating element may overlie the geometric centre of the concave surface. In some examples, the central portion of the heating element is fully disposed on the concave surface of the wicking body (e.g. the entirety of the elongate central portion is located on the concave surface e.g. such that the elongate central portion conforms to the concave surface). In this way, the likelihood of the central portion of the heating element buckling away from the wicking body may be reduced.

[0022] In some examples, e.g. in addition to conforming to the concave surface, the heating element (e.g. the (elongate) central portion) may be curved across the concave surface (e.g. in a direction perpendicular to the longitudinal axis of the heating element e.g. in a direction perpendicular to the first (e.g. curved) direction of the concave surface). The heating element may have mirror symmetry about a plane perpendicular to the longitudinal axis of the heating element (e.g. the heating element may have an Ω shape).

[0023] The heating element (e.g. the central portion) may have a serpentine shape (e.g. a sinusoidal or boustrophodonic shape). Thus, the heating element may include one or more undulations transverse to the first (e.g. curved) direction of the concave surface of the wicking body.

[0024] The amplitude of the transverse undulations may increase towards a longitudinal midpoint of the heating element. A longitudinal midpoint of the heating element may be understood to mean a midpoint between the first terminal pad and the second terminal pad. The longitudinal midpoint may overlie the geometric centre of the concave surface. In these ways, the heating element may contact a greater area of the wicking body (e.g. concave surface) leading to improved heat distribution across and/or through the wicking body thereby facilitating aerosol generation.

[0025] When the heating element includes transverse undulations, it may be particularly beneficial for the concave surface to be curved in two (perpendicular) directions to facilitate retention of the heating element against the concave surface (e.g. retention in both directions).

[0026] In a second aspect, the present disclosure provides an aerosol-generating component comprising: a heating system according to the first aspect and a liquid storage tank.

[0027] The liquid storage tank is suitable for storing liquid aerosol precursor. The aerosol-generating component may include a housing in which the heating system (and typically the tank) are located. The tank may be integrally formed with the housing (e.g. the tank may be delimited by the housing). The aerosol-generating component may include an aerosol delivery structure (e.g. a tube) delimiting an aerosol delivery flow pathway (e.g. from the wicking body to the external environment). The aerosol delivery structure may include a mouthpiece portion. The aerosol delivery structure may be integrally formed with the housing. The aerosol-generating component may be elongate such that the aerosol-generating component has a (central) longitudinal axis. The longitudinal axis of the wicking body may be aligned substantially perpendicularly to the (central) longitudinal axis of the aerosol-generating component. The aerosol delivery flow path may be aligned with the (central) longitudinal axis of the aerosol-generating component.

[0028] The second face of the wicking body (i.e. the face opposing the first face having the concave surface) may face the tank such that liquid aerosol precursor can flow from the tank to the wicking body. In these embodiments, the concave surface faces away from the tank. The first face with the concave surface may be located within a vaporisation chamber.

[0029] The aerosol-generating component may include a first electrode in contact with the first terminal pad and a second electrode in contact with the second terminal pad. The first electrode and second electrode may be integrated into (a base of) the housing.

[0030] In an orientation under normal use, the first face of the wicking body may be a lower face and the second face of the wicking body may be an upper face. Thus, the concave surface may be on the lower face such that the electrodes contact the terminal pads from beneath the wicking body. The aerosol delivery structure may be located proximal (e.g. abut) the second face of the wick-

ing body. Hence, the aerosol delivery structure may be located on the opposite side of the wicking body to the concave surface. In this way, current may be supplied from the electrodes to the heating element thereby aerosolising liquid aerosol precursor from the tank. The aerosol may then pass from the wicking body and through the aerosol delivery structure for inhalation by a user.

[0031] In a third aspect, the present disclosure provides an aerosol-generating apparatus comprising:

a heating system according to the first aspect; or
an aerosol-generating component according to the second aspect; and
an aerosol-generating device comprising a power supply for powering the heating system.

[0032] The preceding summary is provided for purposes of summarizing some examples to provide a basic understanding of aspects of the subject matter described herein. Accordingly, the above-described features should not be construed to narrow the scope or spirit of the subject matter described herein in any way. Moreover, the above and/or proceeding examples may be combined in any suitable combination to provide further examples, except where such a combination is clearly impermissible or expressly avoided. Other features, aspects, and advantages of the subject matter described herein will become apparent from the following text and the accompanying drawings.

BRIEF DESCRIPTION OF THE FIGURES

[0033] Aspects, features and advantages of the present disclosure will become apparent from the following description of examples in reference to the appended drawings in which like numerals denote like elements.

Fig. 1 is a block system diagram showing an example aerosol generating apparatus.

Fig. 2 is a block system diagram showing an example implementation of the apparatus of Fig. 1, where the aerosol generating apparatus is configured to generate aerosol from a liquid precursor.

Figs. 3A and 3B are schematic diagrams showing an example implementation of the apparatus of Fig. 2.

Fig. 4 shows a heating system according to the present disclosure.

Fig. 5 shows the heating system of Fig. 4 with a corner section removed.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0034] Before describing several examples implementing the present disclosure, it is to be understood that the present disclosure is not limited by specific construction details or process steps set forth in the following description and accompanying drawings. Rather, it will

be apparent to those skilled in the art having the benefit of the present disclosure that the systems, apparatuses and/or methods described herein could be embodied differently and/or be practiced or carried out in various alternative ways.

[0035] Unless otherwise defined herein, scientific and technical terms used in connection with the presently disclosed inventive concept(s) shall have the meanings that are commonly understood by those of ordinary skill in the art, and known techniques and procedures may be performed according to conventional methods well known in the art and as described in various general and more specific references that may be cited and discussed in the present specification.

[0036] Any patents, published patent applications, and non-patent publications mentioned in the specification are hereby incorporated by reference in their entirety.

[0037] All examples implementing the present disclosure can be made and executed without undue experimentation in light of the present disclosure. While particular examples have been described, it will be apparent to those of skill in the art that variations may be applied to the systems, apparatus, and/or methods and in the steps or in the sequence of steps of the methods described herein without departing from the concept, spirit, and scope of the inventive concept(s). All such similar substitutions and modifications apparent to those skilled in the art are deemed to be within the spirit, scope, and concept of the inventive concept(s) as defined by the appended claims.

[0038] The use of the term "a" or "an" in the claims and/or the specification may mean "one," as well as "one or more," "at least one," and "one or more than one." As such, the terms "a," "an," and "the," as well as all singular terms, include plural referents unless the context clearly indicates otherwise. Likewise, plural terms shall include the singular unless otherwise required by context.

[0039] The use of the term "or" in the present disclosure (including the claims) is used to mean an inclusive "and/or" unless explicitly indicated to refer to alternatives only or unless the alternatives are mutually exclusive. For example, a condition "A or B" is satisfied by any of the following: A is true (or present) and B is false (or not present), A is false (or not present) and B is true (or present), and both A and B are true (or present).

[0040] As used in this specification and claim(s), the words "comprising," "having," "including," or "containing" (and any forms thereof, such as "comprise" and "comprises," "have" and "has," "includes" and "include," or "contains" and "contain," respectively) are inclusive or open-ended and do not exclude additional, unrecited elements or method steps.

[0041] Unless otherwise explicitly stated as incompatible, or the physics or otherwise of the embodiments, examples, or claims prevent such a combination, the features of examples disclosed herein, and of the claims, may be integrated together in any suitable arrangement, especially ones where there is a beneficial effect in doing

so. This is not limited to only any specified benefit, and instead may arise from an "ex post facto" benefit. This is to say that the combination of features is not limited by the described forms, particularly the form (e.g. numbering) of example(s), embodiment(s), or dependency of claim(s). Moreover, this also applies to the phrase "in one embodiment," "according to an embodiment," and the like, which are merely a stylistic form of wording and are not to be construed as limiting the following features to a separate embodiment to all other instances of the same or similar wording. This is to say, a reference to 'an,' 'one,' or 'some' embodiment(s) may be a reference to any one or more, and/or all embodiments, or combination(s) thereof, disclosed. Also, similarly, the reference to "the" embodiment may not be limited to the immediately preceding embodiment. Further, all references to one or more embodiments or examples are to be construed as non-limiting to the claims.

[0042] The present disclosure may be better understood in view of the following explanations, wherein the terms used that are separated by "or" may be used interchangeably:

As used herein, an **"aerosol-generating apparatus"** (or **"electronic(e)-cigarette"**) may be an apparatus configured to deliver an aerosol to a user for inhalation by the user. The apparatus may additionally/alternatively be referred to as a "smoking substitute apparatus", if it is intended to be used instead of a conventional combustible smoking article. As used herein a combustible "smoking article" may refer to a cigarette, cigar, pipe or other article, that produces smoke (an aerosol comprising solid particulates and gas) via heating above the thermal decomposition temperature (typically by combustion and/or pyrolysis). An aerosol generated by the apparatus may comprise an aerosol with particle sizes of 0.2 to 7 microns, or less than 10 microns, or less than 7 microns. This particle size may be achieved by control of one or more of: heater temperature; cooling rate as the vapour condenses to an aerosol; flow properties including turbulence and velocity. The generation of aerosol by the aerosol generating apparatus may be controlled by an input device. The input device may be configured to be user-activated, and may for example include or take the form of an actuator (e.g. actuation button) and/or an airflow sensor.

[0043] Each occurrence of the aerosol generating apparatus being caused to generate aerosol for a period of time (which may be variable) may be referred to as an **"activation"** of the aerosol generating apparatus. The aerosol generating apparatus may be arranged to allow an amount of aerosol delivered to a user to be varied per activation (as opposed to delivering a fixed dose of aerosol), e.g. by activating an aerosol generating unit of the apparatus for a variable amount of time, e.g. based on the strength/duration of a draw of a user through a flow path of the apparatus (to replicate an effect of smoking a conventional combustible smoking article).

[0044] The aerosol generating apparatus may be por-

table. As used herein, the term "**portable**" may refer to the apparatus being for use when held by a user.

[0045] As used herein, an "**aerosol-generating system**" may be a system that includes an aerosol generating apparatus and optionally other circuitry/components associated with the function of the apparatus, e.g. one or more external devices and/or one or more external components (here "external" is intended to mean external to the aerosol generating apparatus). As used herein, an "external device" and "external component" may include one or more of a: a charging device, a mobile device (which may be connected to the aerosol generating apparatus, e.g. via a wireless or wired connection); a networked-based computer (e.g. a remote server); a cloud-based computer; any other server system.

[0046] An example aerosol generating system may be a system for managing an aerosol generating apparatus. Such a system may include, for example, a mobile device, a network server, as well as the aerosol generating apparatus.

[0047] As used herein, an "**aerosol**" may include a suspension of precursor, including as one or more of: solid particles; liquid droplets; gas. Said suspension may be in a gas including air. An aerosol herein may generally refer to/include a vapour. An aerosol may include one or more components of the precursor.

[0048] As used herein, a "**precursor**" may include one or more of a: liquid; solid; gel; loose leaf material; other substance. The precursor may be processed by an aerosol generating unit of an aerosol generating apparatus to generate an aerosol. The precursor may include one or more of: an active component; a carrier; a flavouring. The active component may include one or more of nicotine; caffeine; a cannabidiol oil; a non-pharmaceutical formulation, e.g. a formulation which is not for treatment of a disease or physiological malfunction of the human body. The active component may be carried by the carrier, which may be a liquid, including propylene glycol and/or glycerine. The term "flavouring" may refer to a component that provides a taste and/or a smell to the user. The flavouring may include one or more of: Ethylvanillin (vanilla); menthol, Isoamyl acetate (banana oil); or other. The precursor may include a substrate, e.g. reconstituted tobacco to carry one or more of the active component; a carrier; a flavouring.

[0049] As used herein, a "**storage portion**" may be a portion of the apparatus adapted to store the precursor. It may be implemented as fluid-holding reservoir or carrier for solid material depending on the implementation of the precursor as defined above.

[0050] As used herein, a "**flow path**" may refer to a path or enclosed passageway through an aerosol generating apparatus, e.g. for delivery of an aerosol to a user. The flow path may be arranged to receive aerosol from an aerosol generating unit. When referring to the flow path, upstream and downstream may be defined in respect of a direction of flow in the flow path, e.g. with an outlet being downstream of an inlet.

[0051] As used herein, a "**delivery system**" may be a system operative to deliver an aerosol to a user. The delivery system may include a mouthpiece and a flow path.

5 [0052] As used herein, a "**flow**" may refer to a flow in a flow path. A flow may include aerosol generated from the precursor. The flow may include air, which may be induced into the flow path via a puff by a user.

10 [0053] As used herein, a "**puff**" (or "**inhale**" or "**draw**") by a user may refer to expansion of lungs and/or oral cavity of a user to create a pressure reduction that induces flow through the flow path.

[0054] As used herein, an "**aerosol-generating unit**" may refer to a device configured to generate an aerosol from a precursor. The aerosol generating unit may include a unit to generate a vapour directly from the precursor (e.g. a heating system or other system) or an aerosol directly from the precursor (e.g. an atomiser including an ultrasonic system, a flow expansion system operative to carry droplets of the precursor in the flow without using electrical energy or other system). A plurality of aerosol generating units to generate a plurality of aerosols (for example, from a plurality of different aerosol precursors) may be present in an aerosol generating apparatus.

20 [0055] As used herein, a "**heating system**" may refer to an arrangement of at least one heating element, which is operable to aerosolise a precursor once heated. The at least one heating element may be electrically resistive to produce heat from the flow of electrical current there-through. The at least one heating element may be arranged as a susceptor to produce heat when penetrated by an alternating magnetic field. The heating system may be configured to heat a precursor to below 300 or 350 degrees C, including without combustion.

30 [0056] As used herein, a "**consumable**" may refer to a unit that includes a precursor. The consumable may include an aerosol generating unit, e.g. it may be arranged as a cartomizer. The consumable may include a mouthpiece. The consumable may include an information carrying medium. With liquid or gel implementations of the precursor, e.g. an e-liquid, the consumable may be referred to as a "capsule" or a "pod" or an "e-liquid consumable". The capsule/pod may include a storage portion, e.g. a reservoir or tank, for storage of the precursor. With solid material implementations of the precursor, e.g. tobacco or reconstituted tobacco formulation, the consumable may be referred to as a "stick" or "package" or "heat-not-burn consumable". In a heat-not-burn consumable, the mouthpiece may be implemented as a filter and the consumable may be arranged to carry the precursor. The consumable may be implemented as a dosage or pre-portioned amount of material, including a loose-leaf product.

40 [0057] As used herein, an "**information carrying medium**" may include one or more arrangements for storage of information on any suitable medium. Examples include: a computer readable medium; a Radio

Frequency Identification (RFID) transponder; codes encoding information, such as optical (e.g. a bar code or QR code) or mechanically read codes (e.g. a configuration of the absence or presents of cut-outs to encode a bit, through which pins or a reader may be inserted).

[0058] As used herein "heat-not-burn" (or "HNB" or "heated precursor") may refer to the heating of a precursor, typically tobacco, without combustion, or without substantial combustion (i.e. localised combustion may be experienced of limited portions of the precursor, including of less than 5% of the total volume).

[0059] Referring to Fig. 1, an example aerosol generating apparatus 1 includes a power supply 2, for supply of electrical energy. The apparatus 1 includes an aerosol generating unit 4 that is driven by the power supply 2. The power supply 2 may include an electric power supply in the form of a battery and/or an electrical connection to an external power source. The apparatus 1 includes a precursor 6, which in use is aerosolised by the aerosol generating unit 4 to generate an aerosol. The apparatus 2 includes a delivery system 8 for delivery of the aerosol to a user.

[0060] Electrical circuitry (not shown in Fig. 1) may be implemented to control the interoperability of the power supply 4 and aerosol generating unit 6.

[0061] In variant examples, which are not illustrated, the power supply 2 may be omitted since, e.g. an aerosol generating unit implemented as an atomiser with flow expansion may not require a power supply.

[0062] Fig. 2 shows an implementation of the apparatus 1 of Fig. 1, where the aerosol generating apparatus 1 is configured to generate aerosol from a liquid precursor.

[0063] In this example, the apparatus 1 includes a device body 10 and a consumable 30.

[0064] In this example, the body 10 includes the power supply 4. The body may additionally include any one or more of electrical circuitry 12, a memory 14, a wireless interface 16, one or more other components 18.

[0065] The electrical circuitry 12 may include a processing resource for controlling one or more operations of the body 10 and consumable 30, e.g. based on instructions stored in the memory 14.

[0066] The wireless interface 16 may be configured to communicate wirelessly with an external (e.g. mobile) device, e.g. via Bluetooth.

[0067] The other component(s) 18 may include one or more user interface devices configured to convey information to a user and/or a charging port, for example (see e.g. Fig. 3).

[0068] The consumable 30 includes a storage portion implemented here as a tank 32 which stores the liquid precursor 6 (e.g. e-liquid). The consumable 30 also includes a heating system 34, one or more air inlets 36, and a mouthpiece 38. The consumable 30 may include one or more other components 40.

[0069] The body 10 and consumable 30 may each include a respective electrical interface (not shown) to provide an electrical connection between one or more

components of the body 10 with one or more components of the consumable 30. In this way, electrical power can be supplied to components (e.g. the heating system 34) of the consumable 30, without the consumable 30 needing to have its own power supply.

[0070] In use, a user may activate the aerosol generating apparatus 1 when inhaling through the mouthpiece 38, i.e. when performing a puff. The puff, performed by the user, may initiate a flow through a flow path in the consumable 30 which extends from the air inlet(s) 34 to the mouthpiece 38 via a region in proximity to the heating system 34.

[0071] Activation of the aerosol generating apparatus 1 may be initiated, for example, by an airflow sensor in the body 10 which detects airflow in the aerosol generating apparatus 1 (e.g. caused by a user inhaling through the mouthpiece), or by actuation of an actuator included in the body 10. Upon activation, the electrical circuitry 12 (e.g. under control of the processing resource) may supply electrical energy from the power supply 2 to the heating system 34 which may cause the heating system 32 to heat liquid precursor 6 drawn from the tank to produce an aerosol which is carried by the flow out of the mouthpiece 38.

[0072] In some examples, the heating system 34 may include a heating filament and a wicking body, wherein a first portion of the wicking body extends into the tank 32 in order to draw liquid precursor 6 out from the tank 32, wherein the heating filament coils around a second portion of the wicking body located outside the tank 32. The heating filament may be configured to heat up liquid precursor 6 drawn out of the tank 32 by the wicking body to produce the aerosol.

[0073] In this example, the aerosol generating unit 4 is provided by the above-described heating system 34 and the delivery system 8 is provided by the above-described flow path and mouthpiece 38.

[0074] In variant embodiments (not shown), any one or more of the precursor 6, heating system 34, air inlet(s) 36 and mouthpiece 38, may be included in the body 10. For example, the mouthpiece 36 may be included in the body 10 with the precursor 6 and heating system 32 arranged as a separable cartomizer.

[0075] Figs. 3A and 3B show an example implementation of the aerosol generating device 1 of Fig. 2. In this example, the consumable 30 is implemented as a capsule/pod, which is shown in Fig. 3A as being physically coupled to the body 10, and is shown in Fig. 3B as being decoupled from the body 10.

[0076] In this example, the body 10 and the consumable 30 are configured to be physically coupled together by pushing the consumable 30 into an aperture in a top end 11 the body 10, with the consumable 30 being retained in the aperture via an interference fit.

[0077] In other examples (not shown), the body 10 and the consumable 30 could be physically coupled together in other ways, e.g. by screwing one onto the other, through a bayonet fitting, or through a snap engagement

mechanism, for example.

[0078] The body 10 also includes a charging port (not shown) at a bottom end 13 of the body 10.

[0079] The body 10 also includes a user interface device configured to convey information to a user. Here, the user interface device is implemented as a light 15, which may e.g. be configured to illuminate when the apparatus 1 is activated. Other user interface devices are possible, e.g. to convey information haptically or audibly to a user.

[0080] In this example, the consumable 30 has an opaque cap 31, a translucent tank 32 and a translucent window 33. When the consumable 30 is physically coupled to the body 10 as shown in Fig. 3A, only the cap 31 and window 33 can be seen, with the tank 32 being obscured from view by the body 10. The body 10 includes a slot 15 to accommodate the window 33. The window 33 is configured to allow the amount of liquid precursor 6 in the tank 32 to be visually assessed, even when the consumable 30 is physically coupled to the body 10.

[0081] Referring to Figs. 4 and 5 a heating system 100, which may be implemented in any of the preceding examples, comprises a wicking body 110 having a concave surface 112. The wicking body 110 is an elongate cuboid and has a longitudinal axis 114 defining a longitudinal direction of the wicking body 110. The longitudinal direction of the wicking body 110 is parallel to the longitudinal axis 114 of the wicking body 110. A transverse direction of the wicking body 110 is perpendicular to the longitudinal axis 114 of the wicking body 110. The concave surface 112 of the wicking body 110 is smoothly and continuously curved in the longitudinal and transverse directions of the wicking body 110 to form a dish-like recess in the wicking body 110.

[0082] The cuboid wicking body 110 includes a rectangular first face in which the concave surface 112 is formed. The rectangular first face also includes a planar surface 116 surrounding the concave surface 112. The coefficient of thermal expansion of the heating element 120 is greater than the coefficient of thermal expansion of the wicking body 110. The wicking body 110 is ceramic and porous such that liquid aerosol precursor can be retained in the wicking body 110 to facilitate aerosol generation by the heating element 120.

[0083] The concave surface 112 is circular and is located at a geometric centre of the rectangular first face of the wicking body 110. Thus, the geometric centre of the concave surface 112 is directly beneath the geometric centre of the first face. The boundary (i.e. edge) between the concave surface 112 and the planar surface 116 of the wicking body 110 is rounded such that the transition between the two surfaces is smooth and continuous. The concave surface 112 has a smooth and continuous gradient in both directions of curvature (i.e. longitudinal and transverse) and the concave surface 112 is free from discontinuities. The gradient of the concave surface 112 is equal to the gradient of the planar surface 116 at the geometric centre of the concave surface 112. The con-

cave surface 112 extends to two of the edges of the rectangular first face of the wicking body 110.

[0084] The heating system 100 includes a heating element 120 disposed on the concave surface 112.

5 The heating element 120 is elongate and has a longitudinal axis 122 defining a longitudinal direction of the heating element 120. The longitudinal direction of the heating element 120 is parallel to the longitudinal axis 122 of the heating element 120. A transverse direction of the heating element 120 is perpendicular to the longitudinal axis 122 of the heating element 120. The heating element 120 is aligned with the wicking body 110 such that the longitudinal axis 122 of the heating element 120 is parallel with the longitudinal axis 114 of the wicking body 110. As such, the concave surface 112 of the wicking body is smoothly and continuously curved in the longitudinal and transverse directions of the heating element 120.

10 **[0085]** The heating element 120 includes a first terminal pad 124, a second terminal pad 126 and an elongate central portion 128 connecting the first terminal pad 124 to the second terminal pad 126. The first terminal pad 124, the elongate central portion 128 and the second terminal pad 126 form an electrical pathway such that
25 current can flow through the heating element 120 to facilitate aerosol generation. The first terminal pad 124 is substantially oval-shaped and is disposed partially on the planar surface 116 and partially on the concave surface 112 of the wicking body 110. The second terminal pad 126 is substantially oval-shaped and is disposed partially on the planar surface 116 and partially on the concave surface 112 of the wicking body 110.

30 **[0086]** The first terminal pad 124 and the second terminal pad 126 are each partially disposed on the planar surface 116 adjacent the concave surface 112 such that the elongate central portion 128 of the heating element 120 is disposed on the concave surface 112. The elongate central portion 128 of the heating element 120 is aligned with the geometric centre of the concave surface 112. The heating element 120 is longitudinally and transversely aligned with the wicking body 110. The elongate central portion 128 of the heating element 110 is fully disposed on the concave surface 112 of the wicking body 110. The first terminal pad 124 diametrically opposes the second terminal pad 126 with respect to the concave surface 112.

45 **[0087]** The elongate central portion 128 of the heating element 120 is symmetrical and curved across the concave surface 112 in the transverse direction of the heating element 120 to the extent it is substantially Ω -shaped. The substantially Ω -shaped elongate central portion 128 includes three lateral undulations across the concave surface 112 of the wicking body 110. The lateral undulations are in the transverse direction of the heating element 120. The amplitude of the transverse undulations increases towards the longitudinal midpoint of the heating element 120. Thus, the central undulation has a higher amplitude than the two adjacent undulations.

The longitudinal midpoint of the heating element 120 is a midpoint between the first terminal pad 124 and the second terminal pad 126. The heating element 120 is iron monosilicide (FeSi) which is an intermetallic compound allowing the heating element 120 to be printed onto the wicking body 110.

[0088] Although not illustrated, the heating system 100 may be implemented in an aerosol-generating component, the aerosol-generating component also including a liquid storage tank.

[0089] Although not illustrated, the heating system 100 may be implemented in an aerosol-generating apparatus, the aerosol-generating apparatus also including an aerosol-generating device comprising a power supply for powering the heating system 100.

Claims

1. A heating system (100) for an aerosol-generating apparatus, the heating system (100) comprising:

a wicking body (110) having a concave surface (112); and
a heating element (120) at least partially disposed on the concave surface (112).

2. The heating system (100) of claim 1, wherein the concave surface (112) is curved in two perpendicular directions to form a dish-like recess in the wicking body (110).

3. The heating system (100) of any preceding claim, wherein the concave surface (112) has a smooth and continuous gradient.

4. The heating system (100) of any preceding claim, wherein the heating element (120) is elongate and the concave surface (112) is curved in a longitudinal direction of the heating element (120).

5. The heating system (100) of claim 4, wherein the concave surface (112) is further curved in a transverse direction of the heating element (120).

6. The heating system (100) of any preceding claim, wherein the concave surface (112) is formed in a first face of the wicking body (110) and the first face further comprises a planar surface (116) at least partially surrounding the concave surface (112).

7. The heating system (100) of claim 6, wherein the concave surface (112) is located at a geometric centre of the first face of the wicking body (110).

8. The heating system (100) of either claim 6 or 7, wherein the planar surface (116) transitions to the concave surface (112) via a rounded edge.

9. The heating system (100) of any preceding claim, wherein:

the heating element (120) includes a first terminal pad (124), a second terminal pad (126) and an elongate central portion (128);
the elongate central portion (128) connects the first terminal pad (124) to the second terminal pad (126); and
the elongate central portion (128) is disposed on the concave surface (112).

10. The heating system (100) of claim 9 when dependent on any one of claims 6 to 8, wherein:

at least one of the first terminal pad (124) and the second terminal pad (126) is at least partially disposed on the planar surface (116).

11. The heating system (100) of either claim 9 or 10, wherein the first terminal pad (124) opposes the second terminal pad (126) with respect to the concave surface (112).

12. The heating system (100) of any preceding claim, wherein the heating element (120) is curved transversely across the concave surface (112).

13. The heating system (100) of claim 12, wherein the heating element (120) includes a series of transverse undulations.

14. An aerosol-generating component comprising:

the heating system (100) of any one of claims 1 to 13; and
a liquid storage tank.

15. An aerosol-generating apparatus comprising:

the heating system (100) of any one of claims 1 to 13; or
the aerosol-generating component of claim 14; and
an aerosol-generating device comprising a power supply for powering the heating system (100).

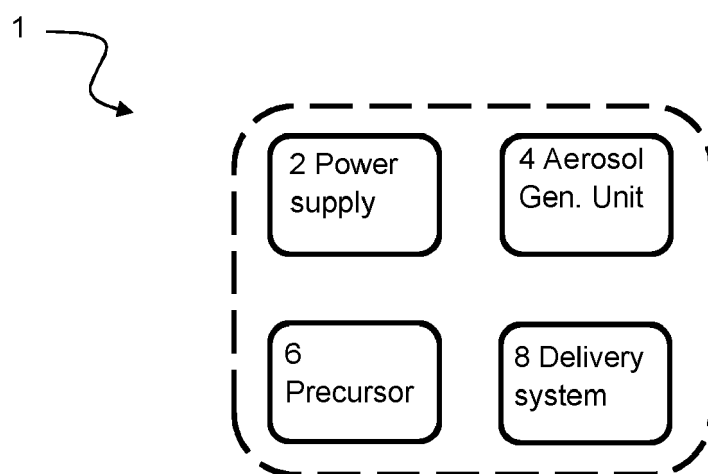


Fig. 1

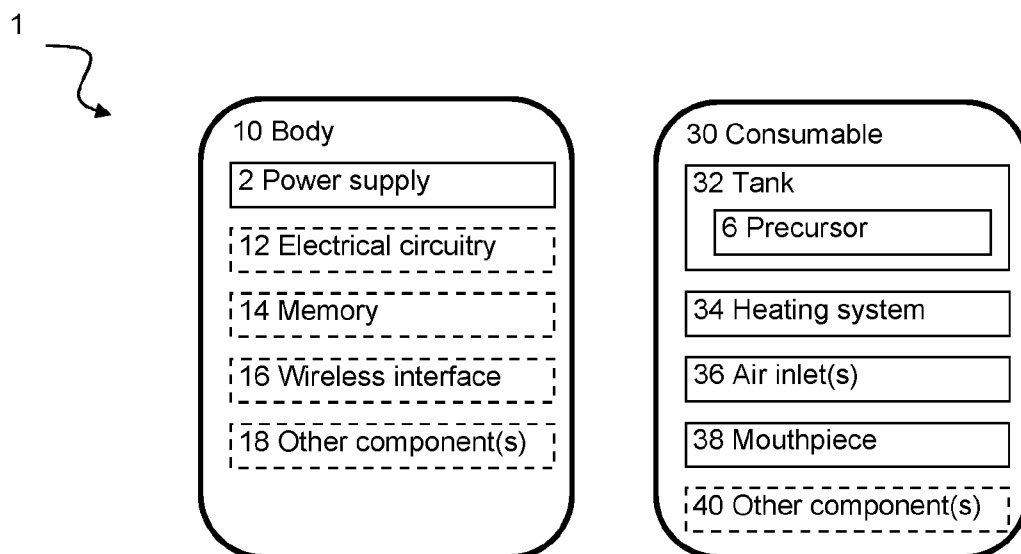


Fig. 2

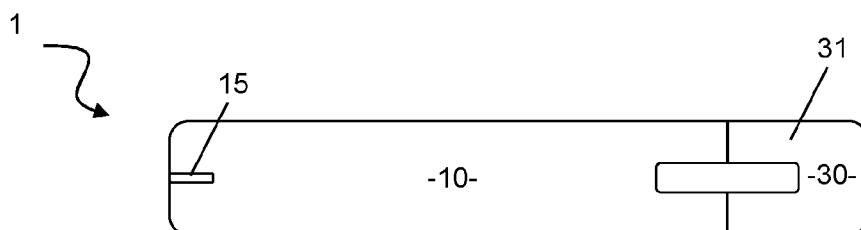


Fig. 3a

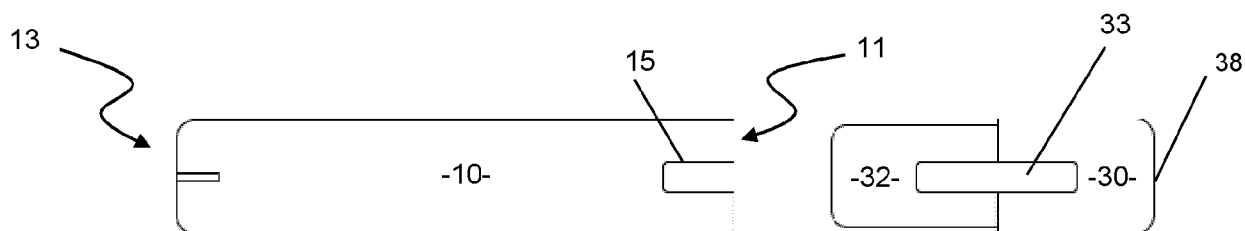


Fig. 3b

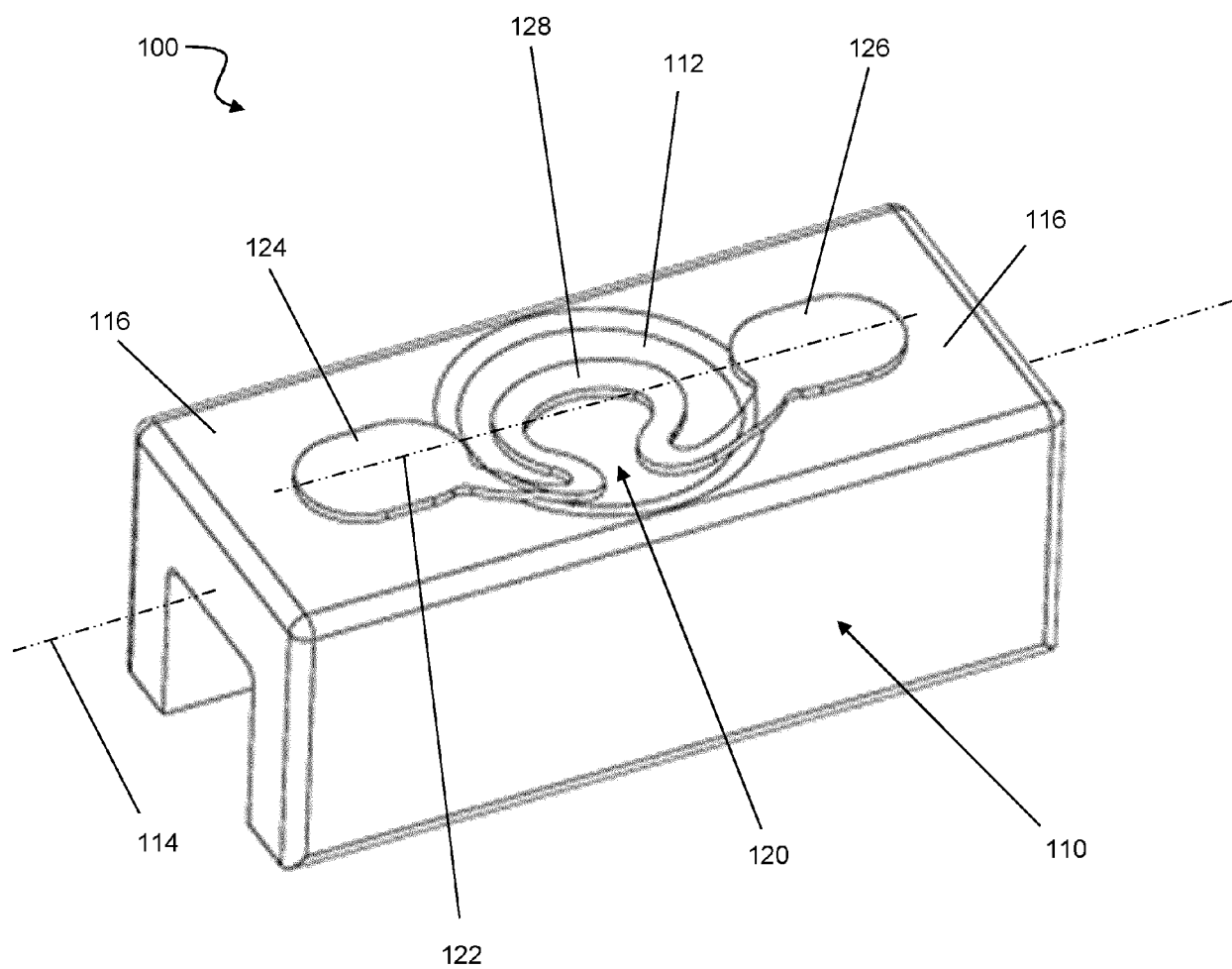
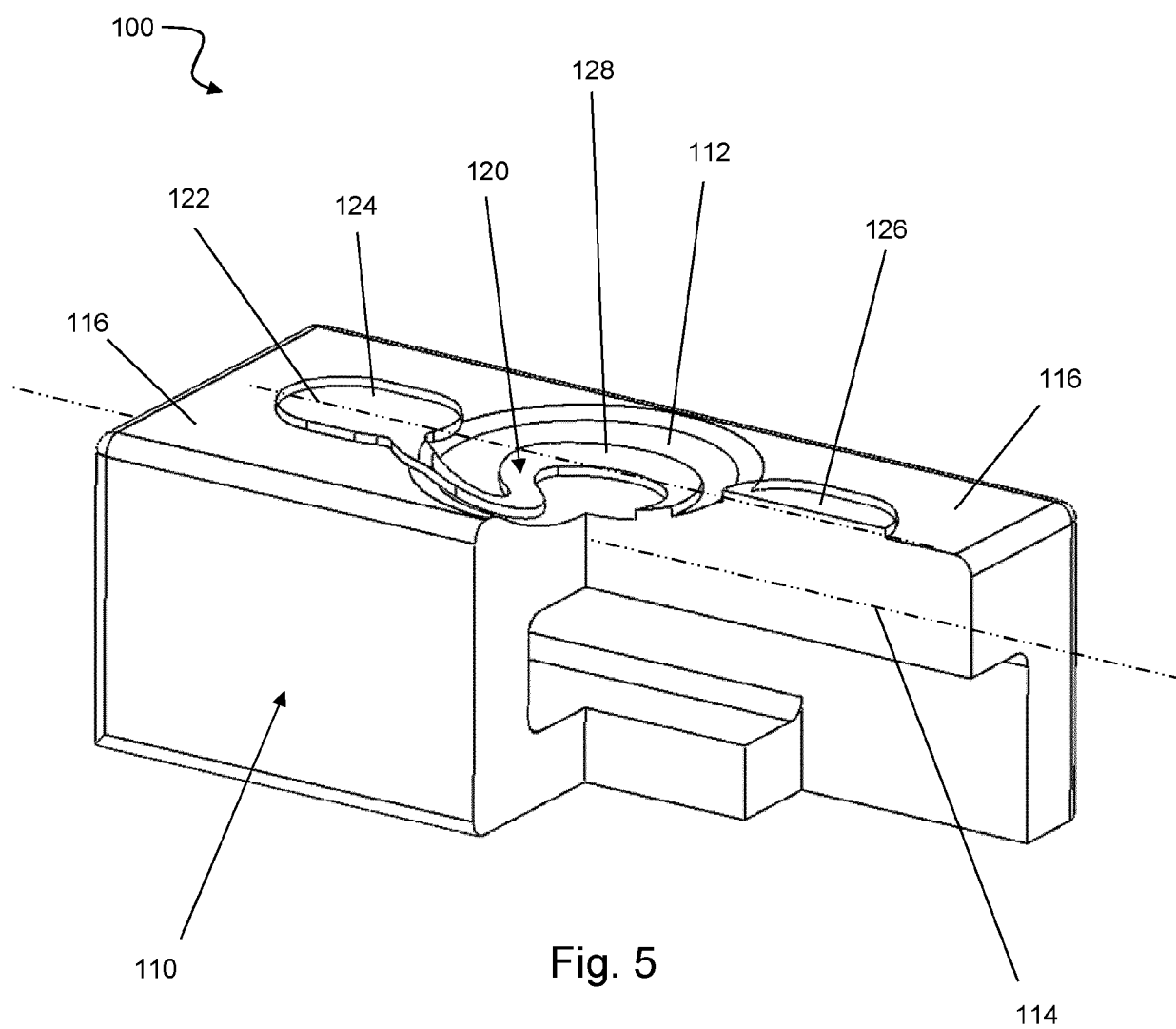


Fig. 4





EUROPEAN SEARCH REPORT

Application Number

EP 23 20 1036

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2023/070595 A1 (SHENZHEN HUACHENGDA PREC INDUSTRY CO LTD [CN]) 4 May 2023 (2023-05-04) * figures *	1-12, 14, 15	INV. A24F40/44 A24F40/46
Y	* paragraphs [0001], [0004], [0007], [0009], [0018], [0038] *	13	ADD. A24F40/10
X	WO 2023/115480 A1 (SHENZHEN HUACHENGDA PREC INDUSTRY CO LTD [CN]) 29 June 2023 (2023-06-29) * figures 1-3 *	1, 3, 9, 11, 13-15	
Y	* paragraphs [0029], [0035] *	13	
A		2, 4-8, 10, 12	
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			TECHNICAL FIELDS SEARCHED (IPC)
			A24F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		18 March 2024	Kirchmayr, Katrin
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