(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 424 189 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
04.09.2024 Bulletin 2024/36

(21) Application number: **24151449.6**

(22) Date of filing: **11.01.2024**

(51) International Patent Classification (IPC):
A24F 40/60 *(2020.01)* ***A24F 40/53*** *(2020.01)*
A24F 40/49 *(2020.01)*

(52) Cooperative Patent Classification (CPC):
A24F 40/53; A24F 40/60; A24F 40/49

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **03.03.2023 GB 202303187**
03.03.2023 GB 202303245

(71) Applicant: **Nicoventures Trading Limited**
London WC2R 3LA (GB)

(72) Inventors:
- **YOUNOSSI, Najeeb**
  London (GB)
- **MAC CABE, Culann**
  Newcastle (GB)
- **DAVIS, Ian**
  Newcastle (GB)

(74) Representative: **Dehns**
St. Bride's House
10 Salisbury Square
London EC4Y 8JD (GB)

(54) AEROSOL PROVISION SYSTEM

(57) An aerosol provision device (500) comprising: a noise generator (580) configured to generate a deterrent noise for deterrence of a non-intended user, the noise generator (580) comprising one or more sonic transducers (581,582); and a controller (520) configured to control operation of the aerosol provision device (500); wherein the noise generator (580) is configured such that the deterrent noise is directed towards an expected position of a user of the aerosol provision device (500).

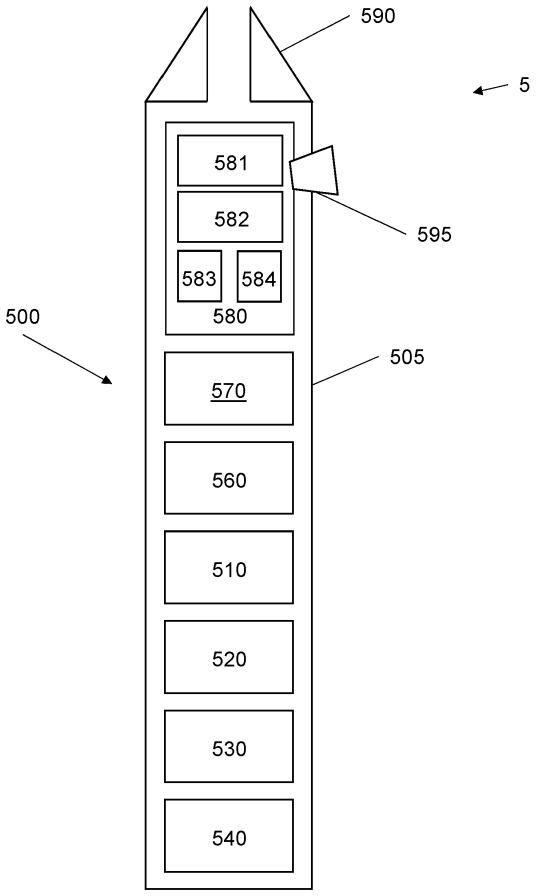

Figure 5

EP 4 424 189 A1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to an aerosol provision system, an aerosol provision device, and a method of generating vapour.

BACKGROUND

[0002] The operation of delivery systems, such as aerosol provision systems, may be controlled by a controller. A delivery system may comprise an outer housing, a memory, a controller configured to control operation of the delivery system, a control interface for receiving inputs to the delivery system and providing outputs from the delivery system, and a power source configured to supply electrical power for operation of the delivery system. The delivery system may also comprise an aerosol generator, configured to generate aerosol from aerosol generating material, which may be in the form of a liquid, solid, or gel. The operation of the delivery system may be controlled by the controller comprised in the delivery system, or by a controller of a further device which communication circuitry of the control interface of the delivery system is configured to connect to and communicate data with. For example, the further device may send data comprising instructions to perform a control action to the communication circuitry of the delivery system. The operation of the delivery system may be controlled by a distributed system, comprising the delivery system and one or more further devices, such as an external power source device, and/or a computing device, which together control the operation of the delivery system.

SUMMARY

[0003] According to an aspect there is provided an aerosol provision device comprising: a noise generator configured to generate a deterrent noise for deterrence of a non-intended user, the noise generator comprising one or more sonic transducers; and a controller configured to control operation of the aerosol provision device; wherein the noise generator is configured such that the deterrent noise is directed towards an expected position of a user of the aerosol provision device.

[0004] In embodiments, the noise generator comprises a plurality of sonic transducers, the plurality of sonic transducers comprising a first sonic transducer configured to generate a first noise signal, and a second sonic transducer configured to generate a second noise signal, such that, when the deterrent noise is generated comprising the first noise signal and the second noise signal, the deterrent noise comprises a region of constructive interference.

[0005] In embodiments, the plurality of sonic transducers is arranged such that, when the deterrent noise is generated, the region of constructive interference encompasses an expected position of a user of the aerosol provision device.

[0006] In embodiments, the controller is configured to cause: the first sonic transducer to generate the first noise signal having one or more first characteristics; and the second sonic transducer to generate the second noise signal having one or more second characteristics.

[0007] In embodiments, the controller is configured to set the one or more first characteristics and one or more second characteristics such that the region of constructive interference encompasses an expected position of a user of the aerosol provision device.

[0008] In embodiments, the aerosol provision device comprises a directing channel configured to direct the deterrent noise.

[0009] In embodiments, the noise generator is arranged to generate the deterrent noise into the directing channel.

[0010] In embodiments, the directing channel comprises an open end, and extends from the noise generator to the open end.

[0011] In embodiments, the directing channel is configured to direct the deterrent noise towards an expected position of a user of the aerosol provision device.

[0012] In embodiments, the expected position of a user of the aerosol provision device is an expected position of a user of the aerosol provision device when the user is performing an inhalation.

[0013] In embodiments the aerosol provision device comprises a control interface configured to receive inputs relating to use of the aerosol provision device, and provide input data to the controller corresponding to the received inputs,
wherein the controller is configured to:

receive the input data from the control interface corresponding to the received inputs relating to use of the aerosol provision device;
responsive to the receipt of the input data, determine whether the input data corresponds to the occurrence of one or more predetermined forms of use of the aerosol provision device; and
responsive to determining that the input data corresponds to the occurrence of the one or more predetermined forms of use of the aerosol provision device, cause the noise generator to generate the deterrent noise.

[0014] In embodiments, the control interface comprises one or more sensors for detecting one or more properties relating to the aerosol provision device, the one or more sensors being configured to provide input data to the controller comprising sensor data corresponding to the detected one or more properties, and wherein the controller is configured to determine whether the input data corresponds to the occurrence of one or more predetermined forms of use of the aerosol provision device by determining whether the sensor data corresponds to

the occurrence of one or more predetermined forms of use of the aerosol provision device.

[0015] In embodiments, the one or more sensors comprises a puff sensor configured to detect a user inhalation on the aerosol provision device, and provide input data to the controller comprising sensor data corresponding to the detected user inhalation.

[0016] In embodiments, the one or more predetermined forms of use of the aerosol provision device comprises a user inhalation on the aerosol provision device.

[0017] In embodiments, the noise generator is configured to generate the deterrent noise having a frequency of 20 Hz to 20 kHz.

[0018] In embodiments, the noise generator is configured to generate the deterrent noise having a frequency of over 16 kHz.

[0019] According to an aspect there is provided an aerosol provision system, comprising: the aerosol provision device of any of the above; and a consumable comprising aerosol generating material.

[0020] According to an aspect there is provided a method for an aerosol provision device, comprising:

providing an aerosol provision device comprising a noise generator configured to generate a deterrent noise for deterrence of a non-intended user, the noise generator comprising one or more sonic transducers; and

generating, by the noise generator, a deterrent noise for deterrence of a non-intended user, wherein the deterrent noise is directed towards an expected position of a user of the aerosol provision device.

[0021] In embodiments, the noise generator comprises a plurality of sonic transducers, the plurality of sonic transducers comprising a first sonic transducer configured to generate a first noise signal, and a second sonic transducer configured to generate a second noise signal, and generating the deterrent noise comprises generating the first noise signal and the second noise signal, such that the deterrent noise comprises a region of constructive interference.

[0022] In embodiments, the plurality of sonic transducers is arranged such that the region of constructive interference encompasses an expected position of a user of the aerosol provision device.

[0023] In embodiments, the first noise signal has one or more first characteristics; and the second noise signal has one or more second characteristics.

[0024] In embodiments, the method comprises setting, by a controller configured to control operation of the aerosol provision device, the one or more first characteristics and one or more second characteristics such that the region of constructive interference encompasses an expected position of a user of the aerosol provision device.

[0025] In embodiments, the method comprises directing, by a directing channel, the deterrent noise.

[0026] In embodiments, the deterrent noise is generated into the directing channel.

[0027] In embodiments, the directing channel comprises an open end, and extends from the noise generator to the open end.

[0028] In embodiments, the directing channel directs the deterrent noise towards an expected position of a user of the aerosol provision device.

[0029] In embodiments, the expected position of a user of the aerosol provision device is an expected position of a user of the aerosol provision device when the user is performing an inhalation.

[0030] In embodiments, the method comprises:

receiving, by a control interface of the aerosol provision device, inputs relating to use of the aerosol provision device;

providing, by the control interface, input data corresponding to the received inputs to a controller configured to control operation of the aerosol provision device;

receiving, by the controller, the input data;

responsive to the receipt of the input data, determining, by the controller, whether the input data corresponds to the occurrence of one or more predetermined forms of use of the aerosol provision device; and

responsive to determining that the input data corresponds to the occurrence of the one or more predetermined forms of use of the aerosol provision device, generating, by the noise generator, the deterrent noise for deterrence of a non-intended user.

[0031] In embodiments, the control interface comprises one or more sensors for detecting one or more properties relating to the aerosol provision device, and wherein receiving inputs relating to user of the aerosol provision device comprises detecting, by the one or more sensors, one or more properties relating to the aerosol provision device, and the method comprises;

providing input data to the controller corresponding to the received inputs comprises providing, by the control interface, input data to the controller corresponding to the detected one or more properties, and determining whether the input data corresponds to the occurrence of one or more predetermined forms of use of the aerosol provision device comprises determining whether the sensor data corresponds to the occurrence of one or more predetermined forms of use of the aerosol provision device.

[0032] In embodiments, the one or more sensors comprises a puff sensor configured to detect a user inhalation on the aerosol provision device, wherein receiving inputs relating to use of the aerosol provision device comprises detecting, by the puff sensor, a user inhalation on the aerosol provision device, and wherein providing input data to the controller corresponding to the received inputs

comprises providing, by the control interface, input data to the controller corresponding to the detected user inhalation.

[0033] In embodiments, the one or more predetermined forms of use of the aerosol provision device comprises a user inhalation on the aerosol provision device.

[0034] In embodiments, the noise generator is configured to generate the deterrent noise having a frequency of 20 Hz to 20 kHz.

[0035] In embodiments, the noise generator is configured to generate the deterrent noise having a frequency of over 16 kHz.

[0036] Any aspect may comprise any feature or functional step described with respect to another aspect.

FIGURES

[0037] Aspects of the invention will now be described, by way of example only, with reference to accompanying drawings, in which:

Figure 1 shows a cross-sectional view through a schematic representation of an aerosol provision system in accordance with certain embodiments.

Figure 2 shows a cross-sectional view through a schematic representation of an aerosol provision system in accordance with certain embodiments.

Figure 3 shows a cross-sectional view through a schematic representation of an aerosol provision system in accordance with certain embodiments.

Figure 4 shows a schematic representation of system comprising an aerosol provision device, a consumable, an external power source device, a local computing device, and a remote computing device, in accordance with certain embodiments.

Figure 5 shows a cross-sectional view through a schematic representation of an aerosol provision system in accordance with certain embodiments.

Figure 6 shows a flow chart representation of a method for an aerosol provision system, in accordance with certain embodiments.

DETAILED DESCRIPTION

[0038] Aspects and features of certain examples and embodiments are discussed or 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.

[0039] The present application is generally directed to the field of "delivery systems", i.e. systems that deliver at least one substance to a user. Generally, the aim of delivering that substance to a user will be to satisfy a particular "consumer moment". To this end, the substance may comprise constituents which impart a physiological effect on the user, a sensorial effect on the user, or both. In this context, the substance will generally be present in an aerosol-generating material or another material that is not intended to be aerosolised. The material itself (whether for aerosolisation or not) will typically contain a range of constituents. These are generally broken down as active substances, flavours, aerosol-former materials and other functional materials like fillers. An active substance, when delivered to a user, may result in some form of psychological effect on the user.

[0040] The delivery systems take many forms. According to the present disclosure, a "combustible" aerosol provision system is one where a constituent aerosol-generating material of the aerosol provision system (or component thereof) is combusted or burned during use in order to facilitate delivery of at least one substance to a user.

[0041] Exemplary combustible aerosol provision systems include cigarettes, cigarillos, cigars, and tobacco for pipes or for roll-your-own or for make-your-own cigarettes (whether based on tobacco, tobacco derivatives, expanded tobacco, reconstituted tobacco, tobacco substitutes or other smokable material). Exemplary non-combustible aerosol provision systems include heat-not-burn aerosol provision systems (such as Tobacco Heating Products (THPs) and Carbon-tipped Tobacco Heating Products (CTHPs)) in which a solid material is heated to generate aerosol without combusting the material, vapour aerosol provision systems (commonly known as "electronic cigarettes" or "e-cigarettes") in which liquid material is heated to generate aerosol, and hybrid aerosol provision systems that are similar to vapour aerosol provision systems except that the aerosol generated from the liquid material passes through a second material (such as tobacco) to pick up additional constituents before reaching the user. Exemplary aerosol-free delivery systems that deliver the at least one substance to a user orally, nasally, transdermally or in another way without forming an aerosol, including but not limited to, lozenges, gums, patches, articles comprising inhalable powders, and oral products such as oral tobacco which includes snus or moist snuff, wherein the at least one substance may or may not comprise nicotine.

[0042] While various techniques will be described herein with regard to non-combustible aerosol provision systems, these may readily be applied in the context of any of the aforementioned delivery systems, for example by implementation within a delivery system where feasible, or in a "smart" container for delivery systems, e.g. for storing delivery systems. The delivery system described herein can be implemented as a combustible aer-

osol provision system, a non-combustible aerosol provision system or an aerosol-free delivery system.

[0043] In particular, but not exclusively, the present disclosure relates to a non-combustible aerosol provision system. A "non-combustible" aerosol provision system is an aerosol provision system where a constituent aerosol generating material of the aerosol provision system (or component thereof) is not combusted or burned in order to facilitate delivery of at least one substance to a user. The delivery system may be a non-combustible aerosol provision system, such as a powered non-combustible aerosol provision system. The non-combustible aerosol provision system may be 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. The non-combustible aerosol provision system may be an aerosol generating material heating system, such as a heat-not-burn system. An example of such a system is a tobacco heating system. In particular, but not exclusively, the present disclosure relates to an electronic aerosol provision system, which may (or may not) be an electronic non-combustible aerosol provision system.

[0044] Aerosol-generating material is a material that is capable of generating aerosol, for example when heated, irradiated or energized in any other way. Aerosol-generating material may, for example, be in the form of a solid, liquid or semi-solid (such as a gel) which may or may not contain an active substance and/or flavourants. The aerosol-generating material may comprise one or more active substances and/or flavours, one or more aerosol-former materials, and optionally one or more other functional material. The aerosol-generating material may comprise a binder, such as a gelling agent, and an aerosol former. Optionally, a substance to be delivered and/or filler may also be present. Optionally, a solvent, such as water, is also present and one or more other components of the aerosol-generating material may or may not be soluble in the solvent. In some embodiments, the aerosol-generating material is substantially free from botanical material. In particular, in some embodiments, the aerosol-generating material is substantially tobacco free.

[0045] The aerosol-generating material may comprise or be in the form of an aerosol-generating film. The aerosol-generating film may comprise a binder, such as a gelling agent, and an aerosol former. Optionally, a substance to be delivered and/or filler may also be present. The aerosol-generating film may be substantially free from botanical material. In particular, in some embodiments, the aerosol-generating material is substantially tobacco free. The aerosol-generating film may have a thickness of about 0.015 mm to about 1 mm. For example, the thickness may be in the range of about 0.05 mm, 0.1 mm or 0.15 mm to about 0.5 mm or 0.3 mm. The aerosol-generating film may be continuous. For example, the film may comprise or be a continuous sheet of material. The sheet may be in the form of a wrapper, it may be gathered to form a gathered sheet or it may be shredded to form a shredded sheet. The shredded sheet may comprise one or more strands or strips of aerosol-generating material. The aerosol-generating film may be discontinuous. For example, the aerosol-generating film may comprise one or more discrete portions or regions of aerosol-generating material, such as dots, stripes or lines, which may be supported on a support. In such embodiments, the support may be planar or non-planar. The aerosol-generating film may be formed by combining a binder, such as a gelling agent, with a solvent, such as water, an aerosol-former and one or more other components, such as one or more substances to be delivered, to form a slurry and then heating the slurry to volatilise at least some of the solvent to form the aerosol-generating film. The slurry may be heated to remove at least about 60 wt%, 70 wt%, 80 wt%, 85 wt% or 90 wt% of the solvent.

[0046] The aerosol-generating material may comprise or be an "amorphous solid". In some embodiments, the aerosol-generating materiel comprises an aerosol-generating film that is an amorphous solid. The amorphous solid may be a "monolithic solid". The amorphous solid may be substantially non-fibrous. In some embodiments, 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 embodiments, the amorphous solid may, for example, comprise from about 50wt%, 60wt% or 70wt% of amorphous solid, to about 90wt%, 95wt% or 100wt% of amorphous solid. The amorphous solid may be substantially free from botanical material. The amorphous solid may be substantially tobacco free.

[0047] The aerosol-former material may comprise one or more constituents capable of forming an aerosol. In some embodiments, the aerosol-former material may comprise one or more of 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.

[0048] As is common in the technical field, the terms "vapour" and "aerosol", and related terms such as "vaporise", "volatilise" and "aerosolise", may generally be used interchangeably. In use, an inhalation on the aerosol provision system occurs when a user inhales aerosol generated from the aerosol generating material. A sequence of inhalations can be considered a "session". A sequence may correspond to a characteristic pattern of inhalations. A sequence may correspond to a predetermined number, or range, or inhalations on the aerosol provision system by the user. For example, a session may be defined as 10 inhalations, or between 8 to 12

inhalations. Additionally or alternatively, a session may be defined by a predetermined time from an initial inhalation on the aerosol provision system (for example, with aerosol generating material being heated to a target temperature for the predetermined time). For example the predetermined time may be under 4 four minutes, under 6 minutes, or under 10 minutes. Hence, a session can be defined when the total number inhalations reaches a predetermined number, or range, of inhalations and/or when the time elapsed from the initial inhalation reaches the predetermined time. It should be appreciate that the values for the predetermined number of inhalations and predetermined time have been given purely as an example, and other numbers and times may be used in other implementations as appropriate.

[0049] Additionally or alternatively, in an embodiment a session corresponds to a sequence of inhalations, the sequence separated from another session by a pause of more than a threshold duration. The threshold duration may be selected for ease of comprehension by the user (e.g. 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 or 55 minutes, or more preferably a period in the range 5-45 minutes, or more preferably a period in the range 10-30 minutes, or still more preferably a period in the range 15-20 minutes), or it may be selected on a pharmokinetic basis, such as the so-called half-life of nicotine in the body (approximately 2 hours) or a physiological basis, such as a perceived drop in brain stimulation by the nicotine (for example in the order of 15-25 minutes, averaging around 18-20 minutes). Optionally this half- life may in turn be individualised, e.g. on the basis of sex, build (size, weight etc), ethnicity and the like. A look-up table of half-life values, and/or a scaling value for one or more physiological factors of the user may be used to refine an otherwise generic half-life value. Hence an inhalation session may comprise a characteristic pattern and/or may be separated from another session by a threshold duration of non-use.

[0050] Typically, the aerosol provision system may comprise an aerosol provision device (e.g. a reusable part) and a consumable for use with the aerosol provision device (e.g. a disposable part). In many cases, the consumable is sold separately from the device, and often in a multipack. The terms "consumable" and "article" may generally be used interchangeably. Often the consumable will comprise the aerosol generating material, and the aerosol provision device will comprise a power source, controller, control interface, and memory (each of which will be discussed in more detail herein) enclosed at least partly within an outer housing which may be formed from any suitable material, for example a plastics material or a metal. In use, the consumable may be engaged with the aerosol provision device. For example, at least part of the consumable may be received by the aerosol provision device, for example in a consumable chamber of the aerosol provision device which is configured to receive at least part of the consumable. The aerosol provision device is configured to generate aerosol from the aerosol generating material of the consumable. Once the aerosol generating material of consumable has been exhausted, the user can remove the consumable, e.g. by disengaging the aerosol provision device and the consumable, dispose of it, and replace it with a (new) consumable. Devices conforming to this type of two-piece modular configuration may generally be referred to as two-piece aerosol provision devices, which together with a consumable may generally be referred to as two-piece aerosol provision systems.

[0051] In such two-piece aerosol provision systems, the consumable and aerosol provision device are able to engage with one another. For example, the consumable may be mechanically and/or electrically coupled to the aerosol provision device, using an engagement interface of the aerosol provision device and a corresponding engagement interface of the consumable. The engagement interface of the aerosol provision device may comprise mechanical engagement means for mechanical coupling with the consumable, e.g. with corresponding mechanical engagement means of the consumable. The engagement interface may comprise an electrical engagement interface for electrically connecting with the consumable, e.g. with a corresponding electrical engagement interface of the consumable. The electrical engagement interface of the aerosol provision device may be configured to supply electrical power to the consumable, for example to an aerosol generator of the consumable (as will be discussed in more detail herein).

[0052] While a consumable commonly comprises a single portion of aerosol generating material, in some cases the consumable may comprise a plurality of portions of aerosol generating material, each of which may be different. In such cases, the consumable may be received by an aerosol provision device which is configured to generate aerosol from one or more of the plurality of portions of aerosol generating material. For example, the aerosol provision device may be configured to generate aerosol independently from each of the portions of aerosol generating material. Each portion of aerosol generating material may be a discrete portion, wherein the plurality of discrete potions are separate from one another such that each of the discrete portions may be energised (e.g. heated) individually, and/or may be energised (e.g. heated) independently, to generate an aerosol.

[0053] In some cases, the aerosol provision device may be configured to receive a plurality of consumables, which may each comprise different aerosol generating material respectively. In use, the plurality of consumables are received by the aerosol provision device, and the aerosol provision device is configured to generate aerosol from the aerosol generating material of one or more of the consumables, each of which aerosol may be generated from independently. Devices conforming to this type of configuration may generally be referred to as multi-consumable devices, which together with the plurality of consumables may generally be referred to as multi-consumable systems. Multi-consumable devices and

systems such as these may use any of the features used in a two-piece aerosol provision devices and systems, such as, but not limited to the aerosol generating material, aerosol generator, power source, control interface, controller, and memory (as will be discussed in more detail herein). Likewise, these components may be enclosed at least partly within an outer housing which may be formed from any suitable material, for example a plastics material or a metal.

[0054] Embodiments are also envisaged in which the aerosol provision device is a one-piece aerosol provision device, which is not configured to receive a removable consumable, and instead the aerosol provision device itself comprises the aerosol generating material. The one-piece aerosol provision device may be configured to be refillable, such that when at least a portion of the (initial) aerosol generating material of the aerosol provision device is exhausted, it can be refilled with (new) aerosol generating material. Alternatively, the one-piece aerosol provision device may be a disposable one-piece aerosol provision device, which the user can dispose of once the aerosol generating material has been exhausted (for example, after a predetermined number of inhalations), and for example is not configured to be refillable by the user. Further, the one-piece aerosol provision device may be a non-rechargeable one-piece aerosol provision device, not comprising a charging interface (as will be discussed in more detail herein) for receiving power from an external power source. A one-piece aerosol provision device such as these (either refillable or disposable) may use any of the features used in two-piece (and/or multi-consumable) aerosol provision systems, such as, but not limited to, the aerosol generating material, aerosol generator, power source, control interface, controller, and memory (as will be discussed in more detail herein). Likewise, these components may be enclosed at least partly within an outer housing which may be formed from any suitable material, for example a plastics material or a metal.

[0055] The aerosol provision system comprises a mouthpiece, through which the user can draw aerosol that has been generated from the aerosol generating material. The mouthpiece may comprise a material that feels comfortable to the lips of the user, for example a plastic or rubber material. As a user inhales on the mouthpiece, air is drawn through the aerosol provision system, which combines with the aerosol generated from the aerosol generating material. The user can then inhale this combination of air and aerosol, such that substance of the aerosol can be delivered to the user. An aerosol provision system may comprise one or more air inlets, which can be located away from a mouthpiece of the system. When a user sucks on the mouthpiece, air is drawn in through the one or more air inlets, and past the location where the aerosol is generated. There may be a flow path connecting between this location and an opening in the mouthpiece, so that the air drawn in through the one or more air inlets continues along the flow path to the opening, carrying the aerosol with it. The aerosol then exits the aerosol provision system through the mouthpiece, e.g. the opening thereof, for inhalation by the user. The mouthpiece may be a part of the consumable, or a part of the aerosol provision device, or may be a separate component which forms a part of the aerosol provision system in addition to the aerosol provision device and the consumable.

[0056] The aerosol provision system (e.g. the aerosol provision device thereof) may be elongate, extending along a longitudinal axis. The aerosol provision system (e.g. the aerosol provision device thereof) has a proximal end, which will be closest to the user (e.g. the user's mouth) when in use by the user to inhale aerosol generated by the aerosol provision system, and a distal end which will be furthest from the user when in use, i.e. at an end opposing the proximal end.

[0057] The proximal end may also be referred to as the "mouth end". The aerosol provision system (e.g. the aerosol provision device thereof) accordingly defines a proximal direction, which is directed towards the user when in use, e.g. along the longitudinal axis from the distal end to the proximal end. Further, the aerosol provision system likewise defines a distal direction, which is directed away from the user when in use, e.g. along the longitudinal axis from the proximal end to the distal end. The terms 'proximal' and 'distal' as applied to features of the aerosol provision system (e.g. aerosol provision device) will be described by reference to the relative positioning of such features with respect to each other in a proximal or distal direction along the longitudinal axis.

[0058] The construction of the aerosol provision system (and aerosol provision device thereof) may change depending upon the form of the aerosol generating material which it is configured to generate aerosol from. However, while examples will be discussed below with regard to various different forms of aerosol generating material, and correspondingly different aerosol provision device constructions, the techniques discussed herein may be applied in all forms of the aerosol generating material.

[0059] The aerosol provision system (e.g. the aerosol provision device thereof) comprises an aerosol generator configured to generate aerosol from the aerosol generating material, the aerosol being generated at an aerosol generation area of the aerosol provision system. The aerosol generator often, but not always, comprises a heating assembly configured to heat the aerosol generating material and cause it to volatise, thereby generating aerosol which can be inhaled by the user. While many features will be discussed herein with regard to an aerosol generator which comprises a heating assembly, we note that these features may likewise be applied to an aerosol generator which does not necessarily comprise a heating assembly.

[0060] The aerosol provision system (e.g. the aerosol provision device thereof) often comprises a heating chamber, which the heating assembly is configured to

heat, such that aerosol generating material in the heating chamber is heated. In such arrangements, the heating chamber may correspond to the aerosol generation area. The heating chamber is configured to receive aerosol generating material. The heating chamber may be comprised in the consumable. The aerosol provision system (e.g. the aerosol provision device thereof) may comprise a consumable chamber configured to receive at least part of the consumable. The heating chamber may correspond to the consumable chamber, however, such as in arrangements where the heating chamber is comprised in the consumable, the heating chamber may not necessarily correspond to the consumable chamber, but rather a region within the consumable which, when connected to the aerosol provision device in use, is received in the consumable chamber. The consumable may be configured to be partially or fully inserted into the aerosol provision device by inserting it into the consumable chamber through an opening in the outer housing of the aerosol provision device.

[0061] The heating assembly may comprise a heating element, and the heating assembly is configured to heat the heating element. The heating element is for heating the aerosol generating material, e.g. by being configured to heat the heating chamber. The heating element may be a part of the aerosol provision device, or a part of the consumable, or may be a separate component which is a part of the aerosol provision system in addition to the aerosol provision device and the consumable. A plurality of corresponding heating elements may be used, which the heating assembly may be configured to heat independently, e.g. such that they can heat individually or in combination. In the case of a system comprising a plurality of portions of aerosol generating material (regardless of the plurality of portions being in the same consumable, a plurality of consumables, or in the aerosol provision device), a plurality of corresponding heating elements may be used, each being configured to heat a corresponding portion of aerosol generating material. A plurality of heating elements may also be configured to heat different regions of the same portion of aerosol generating material.

[0062] In some arrangements the heating assembly is configured to cause the heating element to become heated by resistive heating, wherein a current is passed through the heating element in order to cause heating to occur as a result of the electrical resistance of the heating element. In some arrangements the heating assembly is configured to cause a heating element to become heated by inductive heating, in which case a magnetic field generator of the heating assembly is configured to generate a varying magnetic field that penetrates the heating element, and causes susceptor material within the heating element to become heated. In other words, the susceptor material is configured to be heated by penetration with a varying magnetic field. The magnetic field generator may comprise a coil, such as a helical coil, which may encircle at least part of the heating chamber.

[0063] The heating element may become heated by penetration with a varying magnetic field because the susceptor material comprises electrically conductive material, and the varying magnetic field causes the induction of eddy currents within the susceptor material that cause heating to occur. This may, in alternative or in addition, be because the susceptor material comprises magnetic material, and the varying magnetic field causes the heating of the susceptor material by the mechanism of magnetic hysteresis. In embodiments, the susceptor material may comprise material which is both electrically conductive and magnetic.

[0064] The heating element, e.g. the susceptor material thereof (when present), may comprise one or more materials selected from the group comprising a metallic material such as aluminium, gold, iron, nickel, cobalt, plain-carbon steel, stainless steel, ferritic stainless steel, copper, and bronze, or a non-metallic material such as conductive carbon or graphite.

[0065] Arrangements are contemplated in which the heating assembly comprises a radiation heating component configured to generate radiation for heating the aerosol generating material, e.g. for heating the heating chamber. The radiation may comprise electromagnetic radiation, such as infrared radiation or microwave radiation, or sonic radiation, such as ultrasonic radiation. In such arrangements, as with arrangements discussed above with regard to a heating element, the heating assembly may be configured to heat independently different portions of aerosol generating material, or different regions of the same portion of aerosol generating material. Generally, this may be enabled by the heating assembly being configured to heat independently different regions of the heating chamber.

[0066] Each of these heating techniques may be applied to any of the aerosol generating materials discussed above, and in the context of one-piece aerosol provision systems, two-piece aerosol provision systems, and multi-consumable aerosol provision systems, or any other form of delivery system which uses heating to generate aerosol from aerosol generating material.

[0067] In arrangements where the aerosol generating material is a liquid, the aerosol generating can be stored within a reservoir comprised in the aerosol provision system. The reservoir may a part of the aerosol provision device, particularly in the case that the aerosol provision device is a one-piece aerosol provision device, or may a part of the consumable (when present). In arrangements where the reservoir storing the aerosol generating material is a part of the consumable, the consumable may also comprise the heating element, which may be heated using resistive or inductive heating. In such arrangements where the consumable comprises a reservoir storing aerosol generating material, the consumable may be referred to as a cartridge.

[0068] The reservoir may have the form of a storage tank, being a container or receptacle in which aerosol generating material can be stored such that the liquid is

free to move and flow within the confines of the tank. In arrangements in which the reservoir is comprised in the consumable, the reservoir may be sealed after filling during manufacture so as to be disposable after the aerosol generating material is consumed, otherwise, it may have an inlet port through which new aerosol generating material can be added by the user. In such arrangements the heating element may be comprised in the consumable, and the heating element may be located externally of the reservoir tank for generating the aerosol by vaporisation of the aerosol generating material by heating. A transfer arrangement which may comprise a wick or other porous element may be provided to deliver aerosol generating material from the reservoir to the heating element. The transfer arrangement may have one or more parts located inside the reservoir, or otherwise be in fluid communication with the aerosol generating material in the reservoir, so as to be able to absorb aerosol generating material and transfer it, e.g. by wicking or capillary action, to other parts of the transfer arrangement that are adjacent or in contact with the heating element. This aerosol generating material is thereby heated and vaporised, to be replaced by new aerosol generating material from the reservoir for transfer to the heating element by the wick transfer arrangement. The transfer arrangement may be thought of as a conduit between the reservoir and the heating element that transfers aerosol generating material from the reservoir to the heating element. Although discussed in the context of a reservoir and heating element comprised in the consumable, these features may likewise be applied in an aerosol provision device, for example in the case the aerosol provision device is a one-piece aerosol provision device.

[0069] In arrangements where the aerosol generating material is a solid or a gel, the aerosol generating material can be provided in the consumable. The consumable may be in a rod format, which may also interchangeably be referred to as a "stick" format, and which may have a cylindrical shape. In some cases, the consumable further comprises a filter and/or a cooling element. In such cases, the consumable may comprise the mouthpiece. The consumable may comprise a wrapper, which at least partially surrounds other components of the consumable, including one or more of a filter, a cooling element, a mouthpiece and the aerosol generating material. In some cases, the wrapper may comprise a paper layer. In some cases, the wrapper may comprise a non-combustible layer (e.g. a layer which is resistant to combustion), such as a metallic foil. Suitably, the wrapper may comprise an aluminium foil layer. The wrapper may comprise a laminate structure, and in some cases, the laminate structure may comprise a least one paper layer and at least one non-combustible layer.

[0070] The consumable may be provided in a differently shaped format such as a planar format, in which case the consumable comprises a sheet. The aerosol generating material can be present on or in a support, to form a substrate. The support may, for example, be or comprise paper, card, paperboard, cardboard, reconstituted material, a plastics material, a ceramic material, a composite material, glass, a metal, or a metal alloy.

[0071] When present, the heating element may be a part of the aerosol provision device, such that it comes into proximity (e.g. in contact) with the consumable when the consumable is received by the aerosol provision device. Alternatively, the heating element may be a part of the consumable. This may be the case in arrangements where the aerosol generating material is liquid, solid, or gel.

[0072] The non-combustible aerosol provision system (e.g. the aerosol provision device or consumable thereof) may comprise an aerosol-modifying agent. An aerosol-modifying agent is a substance, typically located downstream of the aerosol generation area, that is configured to modify the aerosol generated, for example by changing the taste, flavour, acidity or another characteristic of the aerosol. The aerosol-modifying agent may be provided in an aerosol-modifying agent release component, that is operable to selectively release the aerosol-modifying agent. The aerosol-modifying agent may, for example, be an additive or a sorbent. The aerosol-modifying agent may, for example, comprise one or more of a flavourant, a colourant, water, and a carbon adsorbent. The aerosol-modifying agent may, for example, be a solid, a liquid, or a gel. The aerosol-modifying agent may be in powder, thread or granule form. The aerosol-modifying agent may be free from filtration material.

[0073] In some embodiments, the non-combustible aerosol provision system, such as a non-combustible aerosol provision device thereof, may comprise a power source. The power source may, for example, comprise an electric power source or an exothermic power source. In some embodiments, the exothermic power source comprises a carbon substrate which may be energised so as to distribute power in the form of heat to an aerosol-generating material or to a heat transfer material in proximity to the exothermic power source. In some embodiments, the power source comprises a battery, such as a rechargeable battery. Examples of suitable batteries include, for example, a lithium battery (such as a lithium-ion battery), a nickel battery (such as a nickel-cadmium battery), and an alkaline battery. The power source is connected to the heating assembly and configured to supply power to the heating assembly, such that the power source is configured to supply power to the heating assembly, and the heating assembly is configured to use power supplied by the power source to heat aerosol generating material.

[0074] In some embodiments, the aerosol provision system (e.g. the aerosol provision device thereof) comprises a controller configured to control operation of the aerosol provision system. It will be appreciated the functionality of the controller can be provided in various different ways, for example using one or more suitably programmed programmable computer(s) and / or one or more suitably configured application-specific integrated

circuit(s) / circuitry / chip(s) / chipset(s) configured to provide the desired functionality. It will be appreciated the controller may comprise a microcontroller (MCU), an application specific integrated circuit (ASIC), a central processing unit (CPU), and/or a micro-processor. The controller may be considered to be processing circuitry. The operations of the controller are generally controlled at least in part by software programs executed on the controller. Generally, the aerosol provision device of the aerosol provision system comprises the controller, but this need not always be the case, and in arrangements the consumable may comprise the controller.

[0075] The controller may be configured to control operation of the aerosol generator, e.g. the heating assembly thereof. While many arrangements will be discussed with regard to the controller being configured to control operation of the heating assembly of the aerosol generator, these may be more generally applied to an aerosol generator which may or may not comprise a heating assembly. The controller is connected to the power source and the aerosol generator, and is configured to control the supply of power from the power source to the aerosol generator. As such, the controller may be configured to control the heating of aerosol generating material by the heating assembly.

[0076] The controller may be configured to heat aerosol generating material in accordance with a heating profile, e.g. by causing the heating assembly to heat the aerosol generating material in accordance with the heating profile. A heating profile refers to the variation of temperature of a material over time. For example, the varying temperature of a heating element measured at the heating element for the duration of a session of use may be referred to as the heating profile of that heating element (or equally as the heating profile of the heating assembly unit comprising that heating element). The heating element provides heat to the aerosol generating material during use, to generate an aerosol. The heating profile of the heating element therefore induces the heating profile of aerosol-generating material, e.g. which is disposed near the heating element.

[0077] The aerosol provision system (e.g. the aerosol provision device thereof) may also comprise a memory. The memory may comprise volatile memory, such as random access memory (RAM) or flash memory, and/or non-volatile memory, such as read only memory (ROM), electrically erasable read only memory (EEROM), or electrically erasable programmable read only memory (EEPROM). In embodiments, this memory comprises controller memory which is a part of the controller, and which may be integrated in the controller. The memory may additionally or alternatively comprise external memory, connected to the controller, and external to the controller. The external memory may be removable from the aerosol provision system (e.g. the aerosol provision device thereof), and may comprise an SD card or a microSD card. Software programs for execution by the controller may be stored on the memory.

[0078] The aerosol provision system (e.g. the aerosol provision device thereof) may also comprise a control interface for receiving inputs and/or providing outputs. For instance, the control interface may be configured to receive inputs, and provide input data to the controller corresponding to the received inputs. The control interface may be configured to receive output data from the controller, and provide outputs corresponding to the output data received from the controller.

[0079] The control interface may comprise a user interface comprising one or more input components for receiving inputs from a user, and one or more output components for providing outputs to a user. The one or more input components are configured to receive inputs from a user, and provide corresponding input data to the controller. The one or more input components may be configured to receive the inputs from a user in the form of physical manipulation by the user. The one or more input components may comprise a button (such as a rolling button), a switch, a dial, a microphone, a camera, an accelerometer, a touchscreen, or any plurality or combination thereof. The one or more input components may be assigned to functions such as switching the aerosol provision device on and off, and selecting an operating mode of the aerosol provision system (as will be discussed in more detail herein). The one or more output components are configured to receive output data from the controller, and provide corresponding outputs to a user. The one or more output components may comprise a light, such as an LED, a speaker, a haptic component, a display, such as a screen, or any plurality or combination thereof. The controller may be configured to cause the one or more output components to provide an output indicative of a property of the aerosol provision system, for example a property of the aerosol generating material, or the remaining power of the power source, and so forth.

[0080] The control interface may comprise one or more sensors for detecting one or more properties relating to the aerosol provision system (e.g. the aerosol provision device thereof), which may be configured to provide input data to the controller comprising sensor data relating to the detected one or more properties. The one or more sensors may comprise a puff sensor configured to detect a user inhalation on the aerosol provision system. The one or more sensor may comprise a temperature sensor configured to detect a temperature relating to the aerosol provision system, e.g. the temperature of the heating assembly, the heating element, the consumable, the aerosol generating material, the environment surrounding the aerosol provision system. The one or more sensors may comprise a consumable detection sensor configured to detect when a consumable has been engaged with the aerosol provision device, e.g. at least partly received by the aerosol provision device. The one or more sensors may comprise a consumable identification sensor configured to detect a property of a consumable, e.g. a property of the aerosol generating material of a consumable. The one or more sensors may comprise a biometric sen-

sor configured to detect a biometric property relating to the user, e.g. a fingerprint, a heart rate, a breathing property.

[0081] The control interface may comprise communication circuitry configured to connect to one or more further devices, and/or communicate data with one or more further devices. The communication circuitry communicating data with one or more further devices may comprise sending data to one or more further devices (e.g. to transfer data from the aerosol provision device to the one or more further devices), receiving data from one or more further devices (e.g. to transfer data from the one or more further devices to the aerosol provision device), or both sending data to and receiving data from one or more further devices. The term "send" with regard to data can be understood to be the emission of data from a device, while the term "transfer" can be understood to be the emission of data from a device and receipt of the data by another device. For example, the communication circuitry may be configured to establish a data connection with one or more further devices. In some embodiments, the communication circuitry is integrated into the controller, and in other embodiments it is implemented separately (comprising, for example, separate application-specific integrated circuit(s), circuitry, chip(s), and/or chipset(s)). The data connection may be impermanent or otherwise transient, in the sense that the data connection may be established for a period of time necessary to carry out specific functionalities, but may also be disconnected when not required. In this context, a further device to the aerosol provision device may be another aerosol provision device, a consumable, or (as described further herein) an external power source device, or a computing device.

[0082] The communication circuitry may be configured to receive inputs, comprising data, from a further device, and provide (e.g. send) outputs, comprising data, to a further device. The communication circuitry may be configured to provide input data to the controller corresponding to inputs, comprising data, received from a further device, and configured to provide (e.g. send) outputs, comprising data, to a further device corresponding to output data provided by the controller. As such, the controller may receive (via the communication circuitry) data sent to the aerosol provision system (e.g. the aerosol provision device thereof) by a further device, and the controller may send (via the communication circuitry) data from the aerosol provision system (e.g. the aerosol provision device thereof) to a further device. The data received from the further device may comprise instructions for the controller of the aerosol provision system (e.g. the aerosol provision device thereof) to perform one or more control actions. The data provided to (e.g. sent to) the further device may comprise instructions for the further device to perform one or more control actions. Reference to a device sending data to a further device may be understood to correspond to the controller of the device causing communication circuitry of the device to send data to be received by control circuitry of the further device, corresponding input data to which is then received by the controller of the further device from the control circuitry of the further device.

[0083] The communication circuitry may comprise a wireless communication module configured to establish a wireless data connection with one or more further devices, and/or communicate data with one or more further devices using a wireless data connection. For example, the wireless communication module may comprise a Bluetooth module (e.g. a Bluetooth Low Energy module), a ZigBee module, a WiFi module (e.g. a Wifi Direct module), a 2G module, a 3G module, a 4G module, a 5G module, an LTE module, an NFC module, an RFID module, an optical communication module configured to communicate data using optical signals, an audio communication module configured to communicate data using audio signals, or other wireless communication module. As a result, the wireless data connection may correspondingly be a Bluetooth connection (e.g. a Bluetooth Low Energy connection), a ZigBee connection, a WiFi connection (e.g. a WiFi Direct connection), a 2G connection, a 3G connection, a 4G connection, a 5G connection, an LTE connection, and NFC connection, and RFID connection, an optical data connection, and audio data connection, or other wireless data connection. More generally, it will be appreciated that any wireless protocol can in principle be used for the wireless data connection.

[0084] The communication circuitry may also or alternatively comprise a wired communication module configured to establish a wired data connection with one or more further devices, and/or communicate data with one or more further devices using a wired data connection. For example, the wired communication module may comprise a wired interface such as a USB interface (e.g. a USB-A interface, a USB-B interface, a mini-USB interface, a micro-USB interface, a USB-C interface, or a USB-3 interface), a Thunderbolt interface, or other wired data interface. As a result, the wired data connection may correspondingly be a USB connection (e.g. a USB-A connection, a USB-B connection, a mini-USB connection, a micro-USB connection, USB-C connection, or a USB-3 connection), a Thunderbolt connection, or other wired data connection. More generally, it will be appreciated the wired module may comprise any wired interface using a wired protocol which enables the transfer of data, according to, for example, a packet data transfer protocol, and may comprise pin or contact pad arrangements configured to engage cooperating pins or contact pads on a further device which can be connected to the aerosol provision system (e.g. aerosol provision device thereof).

[0085] The controller may be configured to control operation of the aerosol provision system in dependence of input data received from the control interface. This input data may comprise input data provided from the one or more input components of the user interface, input data provided from the one or more sensors comprising sensor data, and input data provided from the commu-

nication circuitry corresponding to data received from a further device. In dependence of an event (e.g. responsive to the event) such as the receipt of input data, the controller may be configured to perform a control action, such as initiate functionality of a component of the aerosol provision system (e.g. cause the heating assembly to begin heating, cause the one or more output components to provide outputs to a user, or cause the communication circuitry to provide outputs to further device), change the parameters associated with functionality of a component of the aerosol provision system, enable or disable functionality of a component of the aerosol provision system.

[0086] The controller may be configured to perform a control action in dependence of an event, in which case the controller will determine whether and how to perform the control action depending on the occurrence or not of the event, and e.g. depending on the properties of the event. For example, the controller may cause a heating assembly to heat aerosol generating material in dependence of a detected property of a consumable, such that a particular heating profile is used for a particular detected property of a consumable when heating is initiated by the controller, and for another particular detected property of a consumable no heating is used. However, while this control action may be performed directly after the event, i.e. as triggered by the event, this need not be the case, and the control action may be performed at a later time. The controller may be configured to perform a control action responsive to an event, in which case the controller will then perform the action (directly after or at a later time), i.e. the performance of the action is triggered by the event. For example, the controller may cause a heating assembly to heat aerosol generating material responsive to a puff sensor detecting a user inhalation, directly after the inhalation is detected.

[0087] The controller may also be configured to control operation of the aerosol provision system (e.g. the aerosol provision device thereof) according to a selected mode (or plural selected modes). Each mode is associated with predetermined rules regarding the functionality of one or more components of the aerosol provision system (e.g. the aerosol provision device thereof). For example, operating parameters and/or logic may vary between modes. These components can include, but are not limited to, the memory, the control interface, the aerosol generator, and the power source. In some modes, particular functionality of one or more components may be enabled, such that the controller can cause the functionality to be performed by the aerosol provision system (e.g. the aerosol provision device thereof) when input data comprising an instruction to perform the functionality is received, e.g. by the controller. However, in some modes, particular functionality of one or more components may be disabled, such the controller does not cause the functionality to be performed by the aerosol provision system (e.g. the aerosol provision device thereof) when input data comprising an instruction to perform the functionality is received, e.g. by the controller.

[0088] The consumable itself may comprise either or both of a controller and memory. The controller and memory of the consumable may use any of the discussed above in regard to the aerosol provision system. The consumable may also likewise comprise a control interface for receiving inputs and/or providing outputs, which may use any of the features of the control interface discussed above in regard to the aerosol provision system. For instance, the control interface may comprise communication circuitry configured to connect to one or more further devices, and enable a data connection to be established with one or more further devices. In this context, a further device to the consumable may be the aerosol provision device, another consumable, or (as described further herein) an external power source device, or a computing device.

[0089] The aerosol provision device may comprise a charging interface for receiving power from an external power source. For example, the charging interface may be for receiving power from an external power source comprising a charging cable. Also provided as part of a system comprising the aerosol provision system may be an external power source device configured to connect to the aerosol provision device, for example the charging interface thereof, and supply power to the aerosol provision device. The external power source device may comprise an electrical power source, comprising a battery, such as a rechargeable battery. Examples of suitable batteries include, for example, a lithium battery (such as a lithium-ion battery), a nickel battery (such as a nickel-cadmium battery), and an alkaline battery. The external power source device may be configured to provide power to charge the electrical power source of the aerosol provision device. The external power source device may be a "charging case", comprising a recess configured to receive at least part of the aerosol provision device, wherein the external power source device is configured to connect to the charging interface when the aerosol provision device is received in the recess.

[0090] The external power source device may comprise either or both of a controller and memory. The controller and memory of the external power source device may use any of the features discussed with regard to the controller and memory discussed above in regard to the aerosol provision system. The controller of the external power source device may be configured to control the supply of power to the aerosol provision device. The external power source device may also likewise comprise a control interface for receiving inputs and/or providing outputs, which may use any of the features of the control interface discussed above in regard to the aerosol provision system. For instance, the control interface may comprise communication circuitry configured to connect to one or more further devices, and enable a data connection to be established with one or more further devices. In this context, a further device to the external power source device may be the aerosol provision device, the consumable, another external power source device, or

(as described further herein) a computing device.

[0091] The charging interface of the external power source device may also be configured to communicate data with the external power source, when connected. In such arrangements, the charging interface corresponds to a wired communication component (i.e. of the communication circuitry of the external power source device) configured to communicate data using a wired data connection. The charging interface may comprise a wired interface such as a USB interface (e.g. a USB-A interface, USB-B interface, mini-USB interface, micro-USB interface, USB-C interface, or USB-3 interface), Thunderbolt interface, or other wired interface.

[0092] A system comprising the aerosol provision system may also comprise one or more computing devices, configured to connect to the aerosol provision system (e.g. the aerosol provision device thereof), and communicate with the aerosol provision system (e.g. the aerosol provision device thereof) using a data connection (e.g. wired or wireless). The one or more computing devices may comprise a local computing device which may be controlled or owned by the user, which may comprise a smartphone, a tablet, a personal computer (PC), a wearable device (e.g. a smart watch), a refilling device for refilling an aerosol provision device or consumable with aerosol generating material, or a connectivity hub. Additionally or alternatively, the one or more computing devices may comprise a remote computing device, which may be not controlled or owned by the user, such as a server.

[0093] The computing device may comprise either or both of a controller and memory. The controller and memory of the computing device may use any of the features discussed with regard to the controller and memory discussed above in regard to the aerosol provision system. The computing device may also likewise comprise a control interface for receiving inputs (e.g. from a user) and/or providing outputs (e.g. to a user), which may use any of the features of the control interface discussed above in regard to the aerosol provision system. The control interface may comprise communication circuitry configured to connect to a further device, and communicate data with a further device. In this context, a further device to the computing device may be the aerosol provision device, the consumable, the external power source device, or another computing device.

[0094] The aerosol provision system (e.g. the aerosol provision device thereof) may establish communication with a remote computing device directly, using one of the wireless protocols described above, for example by connecting with a communication node (such as a telecommunications "base station") which provides connectivity with the remote computing device. Alternatively or in addition, the aerosol provision system (e.g. the aerosol provision device thereof) may establish communication with the remote computing device via a local computing device, for example using a wired or wireless communication protocol to communicate with a local computing device, which then communicates with the remote communication device. The local computing devices may also communicate indirectly with the remote computing device via a relay device (which may be a further computing device), either to fulfil an aspect of their own functionality, or on behalf of the aerosol provision system (for example as a relay or co-processing unit).

[0095] The computing devices may also send data to each other, either directly or indirectly via any of the wired or wireless communication protocols set out above. Thus, in embodiments, a given first device and second device (e.g. any of the aerosol provision device, consumable, external power source device, and computing devices) may generally be in either a connected or unconnected state with respect to each other. The unconnected state may also be referred to as an idle state, and in such a state a given first device may not be detectable by other second devices (i.e. the first device is not transmitting any signalling enabling its existence and/or identity to be determined), or it may be available for establishing a data connection with a second device (i.e. it may be advertising its existence and/or identity using advertisement signalling). In a connected state, the first and second devices are configured such that data may be transferred from the first to the second device (e.g. 'uplink' transmission) and/or transferred from the second to the first device (e.g. 'downlink' transmission). Accordingly, establishment of a data connection between a first and second device may be considered to comprise the establishment of any state wherein the two devices can exchange data, regardless of the direction of data transfer. Non-limiting examples of connected states are the establishment of an RRC connected state according to the Long Term Evolution (LTE) standard, or a connected state according to the Bluetooth (e.g. Bluetooth Low Energy (BLE)) standard.

[0096] When a first and second device are configured to communicate wirelessly, a transition from an unconnected to a connected state will generally follow a procedure such as the following. In an initial enquiry step, a first device (for example, an aerosol provision device or consumable, although this may be applied to any aforementioned device) establishes the existence of a second device (for example, a computing device, although this may be applied to any aforementioned device) by receiving a beacon signal or other identifying signal from the second device. In an authentication step, the first and second devices exchange messaging to establish information relating to the data transfer protocol to be used for exchanging data (for example comprising coding and encryption parameters to be used when exchanging data). In a data transfer step, the first and second devices transfer data over a wireless interface established in accordance with an agreed data transfer protocol. This data transmission may be bi- or uni-directional. The data communication process for wired communications may be broadly similar with the difference that data is sent over a wired interface as opposed to a wireless interface.

[0097] A system comprising any aerosol provision sys-

tem and any combination of an external power source device and computing devices, as described further herein, may be used to support functions of the aerosol provision system. These functions may be referred to as "connected" functions, in that they relate to the transmission of data between the aerosol provision system and other connected devices (e.g. one or more computing devices). Such an arrangement may be considered advantageous for enhancing aspects of the operation of an aerosol provision system. For example, an aerosol provision device enabled to receive data from further devices may be able to receive software updates or updated parameters (e.g. relating to the generating of aerosol by an aerosol generator) from a computing device. Determination of suitable parameters may entail significant processing overheats which are more efficiently carried out on computing devices, having higher processing capability than is typically provided on an aerosol provision system, where low energy consumption (for extended battery life) and reduced complexity (for cost reduction) are generally considered advantageous.

[0098] A computing device (such as a smartphone) may also be used by a user to provide inputs to the control interface of the aerosol provision system, which may be particularly advantageous where motivations exist to keep input components or output components on an aerosol provision system to a minimum, for example to reduce complexity and cost. Thus an application ("app") running on a computing device may support what are in effect offloaded or relayed functions for an aerosol provision device which has a direct or indirect (e.g. relayed) data connection with the computing device according to the approaches described above. Hence, the aerosol provision system may, via its communication circuitry, send data to a computing device (e.g. data based on sensor data received by the controller of the aerosol provision system, relating to the usage of the aerosol provision system), and the computing device may provide information relating to the aerosol provision system to the user via the app. Alternatively, or in addition, the user may select a control action via the app, and data relating to the control action may be sent by the computing device to the aerosol provision system, whereupon the controller of the aerosol provision system performs the control action.

[0099] Herein will be described various methods of operating an aerosol provision system. While these methods may be described in the context of control of an aerosol provision system by a controller of the aerosol provision system (e.g. the aerosol provision device thereof), it is recognised that these methods may be performed by any of the controllers of a broader system comprising any combination of one or more aerosol provision devices, one or more of consumables, one or more external power source devices, and one or more computing devices, or by any of these controllers in combination. In particular, as each of these controllers may be able to communicate with some or any of the other controllers in a system comprising any of an aerosol provision device, a consumable, an external power source, and a computing device, data such as instructions to perform one or more control actions may be communicated between any of these, either directly or indirectly. As such, a method of operating an aerosol provision system may be performed by a "distributed" aerosol provision system comprising any combination of the aerosol provision device, the consumable, the external power source device, and the computing device discussed above, for example performed by any one or more controllers of these. Accordingly, even though particular method steps may be described in the context of the controller of a particular device, it is anticipated that such control actions may be, where feasible, in alternative arrangements be performed by another of these controllers, and that various method steps may be performed by various corresponding different controllers.

[0100] Various embodiments will now be described in more detail.

[0101] Figure 1 shows a cross-sectional view through a schematic representation of a two-piece aerosol provision system 1 in accordance with certain embodiments.

[0102] The aerosol provision system 1 is a two-piece aerosol provision system, comprising an aerosol provision device 100 and a consumable 150 comprising aerosol generating material 170. The aerosol provision device 100 comprises an outer housing 105, a memory 110, a controller 120 configured to control operation of the aerosol provision system 1, a control interface 130 for receiving inputs to the aerosol provision device and providing outputs from the aerosol provision device 100, and a power source 140 configured to supply electrical power for operation of the aerosol provision device 100. The outer housing 160 may also enclose at least partly the other components of the aerosol provision device 100, namely the memory 110, controller 120, the control interface 130, and the power source 140. The aerosol provision device 100 is a handheld electronic vapour device, meaning that the outer housing 160 enclosing the other components is dimensioned and configured to be held in the hand of a user. In other words, the device is portable.

[0103] The consumable 150 comprises a reservoir containing liquid aerosol generating material 170, and a mouthpiece 190 through which the user can draw aerosol that has been generated from the aerosol generating material 180. The consumable also comprises a heating assembly 160 configured to heat the aerosol generating material 170. In use, an engagement interface 101 of the aerosol provision device 100 is engaged with an engagement interface 151 of the consumable, each of these engagement interfaces comprising mechanical engagement means for mechanically coupling to one another. Each engagement interface 101, 151 also comprises an electrical engagement interface, such that the aerosol provision device 100 can be electrically connected with the consumable 150. The electrical engagement inter-

face 101 of the aerosol provision device is configured to supply electrical power, from the power source 140, to the consumable, in particular to the heating assembly 160 of the consumable. The controller 120 is configured to control the supply of electrical power from the power source 140 to the heating assembly 160, so as to control the heating of the aerosol generating material 170 by the heating assembly 160.

[0104] Figure 2 shows a cross-sectional view through a schematic representation of a one-piece aerosol provision system 2 in accordance with certain embodiments.

[0105] The aerosol provision system 2 is a one-piece aerosol provision device 200. The aerosol provision device 200 comprises an outer housing 205, a memory 210, a controller 220 configured to control operation of the aerosol provision device 200, a control interface 230 for receiving inputs to the aerosol provision device and providing outputs from the aerosol provision device 200, a power source 240 configured to supply electrical power for operation of the aerosol provision device 200, a reservoir containing liquid aerosol generating material 270, and a heating assembly 260 configured to heat the aerosol generating material 270. The outer housing 205 may also enclose at least partly the other components of the aerosol provision device 200, namely the memory 210, the controller 220, the control interface 230, the power source 240, the reservoir containing liquid aerosol generating material 270, and the heating assembly 260. The aerosol provision device 200 also comprises a mouthpiece 290 through which the user can draw aerosol that has been generated from the aerosol generating material 270.

[0106] The aerosol provision device 200 is a handheld electronic vapour device, meaning that the outer housing 205 enclosing the other components is dimensioned and configured to be held in the hand of a user. In other words, the device is portable. The aerosol provision device 200 is a disposable one-piece aerosol provision device, which the user can dispose of once the aerosol generating material 180 has been exhausted, and which is not configured to receive a consumable, and is not configured to be refillable by the user.

[0107] Figure 3 shows a cross sectional view through a schematic representation of a two-piece aerosol provision system 3 in accordance with certain embodiments.

[0108] The aerosol provision system 3 is a two-piece aerosol provision system, comprising an aerosol provision device 300 and a consumable 350 comprising aerosol generating material 370. The aerosol provision device 300 comprises an outer housing 305, a memory 310, a controller 320 configured to control operation of the aerosol provision system 3, a control interface 330 for receiving inputs to the aerosol provision device and providing outputs from the aerosol provision device 300, a heating assembly comprising a magnetic field generator 360 configured to generate a varying magnetic field, and a power source 340 configured to supply electrical power for operation of the aerosol provision device 300. The outer housing 305 may also enclose at least partly the other components of the aerosol provision device 300, namely the controller 320, the control interface 330, the magnetic field generator 360, and the power source 340. The aerosol provision device 300 is a handheld electronic vapour device, meaning that the outer housing 305 enclosing the other components is dimensioned and configured to be held in the hand of a user. In other words, the device is portable.

[0109] The consumable 350 comprises aerosol generating material 370 which is in the form of a solid or gel. The consumable 350 is in a rod format, and is received by a heating chamber 315 of the aerosol provision device 300. The magnetic field generator 360 is configured cause the heating chamber 315 to become heated, and the aerosol generating material 370 of the consumable 350 within the heating chamber 315. To do this, the heating assembly comprises a heating element 365 in the consumable, having susceptor material which is susceptible to heating by penetration with a varying magnetic field generated by the magnetic field generator 360. The magnetic field generator 360 is configured to generate this varying magnetic field, which penetrates the heating chamber 315, and the heating element 365 of the consumable 350, causing it to become heated, and in turn heat the aerosol generating material 370.

[0110] In this arrangement, the consumable comprises a mouthpiece 390, through which the user can draw aerosol that has been generated from the aerosol generating material 370. The aerosol provision device 300 and consumable 350 do not require respective engagement interfaces configured to enable the aerosol provision device 300 and consumable 350 to be electrically connected to one another, as an electrical connection therebetween is not used to heat the aerosol generating material 370.

[0111] Figure 4 shows a schematic representation of system, comprising an aerosol provision system 4 comprising an aerosol provision device 400 and a consumable 450, an external power source device 460, local computing devices 471, 472, 473, and a remote computing device 480. The aerosol provision device 400 and consumable 450 may have any of the properties of the aerosol provision devices 100, 200, 300, and consumables 150, 350 discussed above.

[0112] In this arrangement, the remote computing device 480 is a server, which exists on the cloud 490. The aerosol provision system 4 may correspond to any of the aerosol provision systems 1, 2, or 3 discussed above, or any other aerosol provision system. Each of the local computing devices 471, 472, 471 are connected to each other, as well as being connected to each further device. Various data connections 40 between each of these devices is depicted, illustrating how data may be sent between any given first and second device.

[0113] In use, when these data connections 40 are established (either using wired or wireless protocols), data can be sent from a first device, such as the aerosol pro-

vision device 400, to a second device, such as the remote computing device 480, either directly via the direct data connection between these two devices (if it exists), or indirectly, relayed by another device or multiple other devices.

[0114] In the case of the aerosol provision device 400 and the remote computing device 480, data such as usage data collected by the aerosol provision device can be sent to the remote computing device 480 by sending the data to the external power source device 460 through a wired data connection. Then, the external power source device sends the data to first local computing device 471, which is a smartphone 471, through a wireless data connection. The wireless data connection between the smartphone 471 and the external power source device 460 is a Bluetooth connection, established using a Bluetooth module of the smartphone 471 and a Bluetooth module of the external power source device 460.

[0115] The smartphone 471 then sends the data to the remote computing device 480 through a wireless data connection. The wireless data connection between the smartphone 471 and the remote computing device 480 is a 3G wireless connection, established using a 3G module of the local computing device, connected with a corresponding communication node (such as a telecommunications "base station") which provides connectivity with the remote computing device 480.

[0116] A user may also use this network of data connections 40 to cause control actions to be performed on the aerosol provision device 400 by the controller thereof. Using an app on second local computing device 472 such as a smartphone or a personal computer, the user can select a control action, and the personal computer 472 then sends data relating to the control action to the remote computing device 480 through a wired data connection. The remote computing device 480 then sends data relating to the control action to the smartphone 471, using the 3G wireless connection discussed above.

[0117] The smartphone 471 then sends data relating to the control action to the external power source device 460 using the Bluetooth connection discussed above, and the external power source device 460 then sends data relating to the control action to the aerosol provision device 400 through the wired data connection between the aerosol provision device 400 and the external power source device 460. The data relating to the control action is received by the controller of the aerosol provision device 400, and the controller causes the aerosol provision device 400 to perform the control action.

[0118] For an aerosol provision device, such as aerosol provision devices 100, 200, 300, 400, it is desirable to deter non-intended users from using the aerosol provision device, a non-intended user being an individual who the aerosol provision device is not intended for use by, e.g. to generate aerosol for inhalation. In particular, it can be desired to provide the aerosol provision device with functionality to deter a non-intended user, but not deter an intended user who the aerosol provision device is intended to be used by, e.g. to generate aerosol for inhalation.

[0119] A non-intended user may be an individual of an age below a threshold age, wherein individuals below the threshold age may be considered not to be appropriate users of the aerosol provision device, for example because legislation within a particular jurisdiction does not permit an aerosol provision device to be used by individuals of an age below the threshold age. An individual may be a non-intended user for all forms of aerosol provision device, or may be a non-intended user for aerosol provision devices which generate aerosol comprising particular regulated constituents, such as active substances e.g. nicotine.

[0120] The present application seeks to provide an aerosol provision device which may allow a non-intended user to be deterred from use, but which may not deter an intended user. An aerosol provision system, in accordance with embodiments of the invention, is depicted in Figure 5. The aerosol provision system 5 is a one-piece aerosol provision device 500, although these techniques may equally be applied to any aerosol provision device or aerosol provision system, such as the aerosol provision devices 100, 200, 300 and aerosol provision systems 1, 2, 3.

[0121] As before, the aerosol provision device 500 comprises an outer housing 505, a memory 510, a controller 520 configured to control operation of the aerosol provision device 500, a control interface 530 for receiving inputs to the aerosol provision device 500 and providing outputs from the aerosol provision device 500, a power source 540 configured to supply electrical power for operation of the aerosol provision device 500, a reservoir for storing liquid aerosol generating material 570, and a heating assembly 560 configured to heat the aerosol generating material 570. The outer housing 505 may also enclose at least partly the other components of the aerosol provision device 500, namely the memory 510, the controller 520, the control interface 530, the power source 540, the reservoir containing liquid aerosol generating material 570, and the heating assembly 560. The aerosol provision device 500 also comprises a mouthpiece 590 through which the user can draw aerosol that has been generated from the aerosol generating material 570.

[0122] The aerosol provision device 500 may be a disposable one-piece aerosol provision device 500 that is not configured to be refillable with aerosol generating material by a user. As such, the user can dispose of the aerosol provision device 500 once the aerosol generating material has been exhausted (for example, after a predetermined number of inhalations). Further, the one-piece aerosol provision device 500 may be a non-rechargeable one-piece aerosol provision device, not comprising a charging interface for receiving power from an external power source. However, other arrangements are contemplated in which the one-piece aerosol provision device 500 is configured to be refillable with aerosol

generating material by a user. The one-piece aerosol provision device 500 may also be rechargeable, having a charging interface for receiving power from an external source. The one-piece aerosol provision device 500 may comprise any or all of the features of the aerosol provision device 200 and repeated description of some features is omitted.

[0123] The aerosol provision device 500 also comprises a noise generator 580, which is configured to generate a deterrent noise for deterrence of a non-intended user. The noise generator 580 is configured to generate the deterrent noise having a frequency in the audible range for humans, e.g. having a frequency of 20 Hz to 20 kHz. Further, if the deterrent noise is of a higher frequency within this range, then the deterrent noise may only be audible to individuals below a threshold age. By selecting the frequency of the deterrent noise with this in mind, it may be possible to generate a deterrent noise which is audible to a non-intended user who is a non-intended user because they are younger than a particular threshold age, for example as defined by legislation of a jurisdiction. Advantageously, this high frequency deterrent noise may not be audible to an individual who is an intended user because they are older than the threshold age.

[0124] As such, the noise generator 580 may be configured to generate the deterrent noise having a frequency of 10 kHz to 20 kHz, for example 15 kHz to 20 kHz, or 16 kHz to 20 kHz. The range of 16 kHz to 20 kHz in particular may be advantageous, as a deterrent noise generated in this range may be audible to below under the age of 18, but not individuals above the age of 18; and as such this may enable the deterrent noise to be heard by individuals who are non-intended users as they are younger than a threshold age of 18 years. However, it is noted that approaches are also contemplated in which the deterrent noise is beyond these ranges, for example in cases in which the deterrent noise is at a frequency which is audible to individuals of all ages. In such approaches, the deterrent noise may be generated, for example during one or more predetermined forms of use of the aerosol provision device, until a user verifies that they are an intended user, as will be discussed in more detail.

[0125] The noise generator 580 may be arranged such that the deterrent noise generated by the noise generator 580 is directed in a particular direction. In particular, the noise generator 580 may be arranged such that the deterrent noise is directed towards a user, e.g. the head of the user (specifically, the ears of the user) of the aerosol provision device 500, for example when they are using the aerosol provision device 500 according to one or more predetermined forms of use. For example, the noise generator 580 may be arranged such that the deterrent noise is directed towards a user when the user is using the aerosol provision device 500 by performing an inhalation of aerosol generated by the aerosol provision device 500, for example by drawing on the mouthpiece 590 of the aerosol provision device (or, in approaches in which the mouthpiece is a part of a consumable or a separate component from the consumable and/or device, the mouthpiece of the aerosol provision system). For example, the noise generator 580 may be arranged such that the deterrent noise is directed in a direction not opposed to the proximal direction of the aerosol provision device 5.

[0126] The controller 520 is configured to control operation of the noise generator 580. In particular, the controller 520 may be configured to control operation of the aerosol provision device 500 according to a first mode, wherein, in the first mode (i.e. when the controller 520 is controlling operation of the aerosol provision device 500 according to the first mode), the controller 520 is configured to control operation of the noise generator 580 in dependence of input data received by the controller 520 from the control interface 530, corresponding to inputs received by the control interface 530, so as to cause the noise generator 580 to generate the deterrent noise in dependence of input data received by the control 520 from the control interface 530. In the first mode, the controller 520 can therefore cause the noise generator 580 to generate the deterrent noise when appropriate, in order to deter a non-intended user. This first mode may be understood to be used when it may be difficult or unfeasible to determine whether a user is an intended user or a non-intended user, for example because the aerosol provision device 500 has not yet received an input indicating that the user is an intended user.

[0127] The controller 520 may also be configured to switch from controlling operation of the aerosol provision device 500 according to the first mode to controlling operation of the aerosol provision device 500 according to a second mode, when the control interface 530 receives an input indicating that the user of the aerosol provision device 500 is an intended user. The control interface 530 is configured to receive the input indicating that the user of the aerosol provision device 500 is an intended user, and provide input data to the control interface 530 corresponding to the input indicating that the user of the aerosol provision device 500 is an intended user. The control interface 530 is configured to provide input data to the controller 530 corresponding to the input received indicating that the user is an intended user, and the controller 520 is configured to, responsive to receiving this input (and possibly after performing a predetermined test to determine the authenticity of the input), switch to controlling operation of the aerosol provision device 500 according to the second mode. In the second mode, the controller 520 is not configured to cause the noise generator 580 to generate the deterrent noise, for example the functionality of the noise generator 580 to generate the deterrent noise may be disabled. As such, once a user has indicated that they are an intended user, the aerosol provision device 500 may cease to generate the deterrent noise.

[0128] This input indicating that the user is an intended

user may be provided in a variety of different mechanisms. In one approach, the control interface 530 comprises one or more input components configured to receive an input, and the input indicating that the user is an intended user may be provided to these one or more input components. The one or more input components may be configured to be manipulated by a user, such that the user provides an input comprising physical manipulations of the one or more input components by a user. For example, the one or more input components may comprise one or more buttons configured to receive inputs comprising presses of the one or more buttons by a user, one or more switches configured to receive inputs comprising pushes of the one or more switches by a user, one or more dials configured to receive inputs comprising rotations of the one or more dials by a user, and/or an accelerometer configured to receive inputs comprising motion of the aerosol provision device 500 by a user. In such an approach, the input provided by a user to the one or more input components is encoded with information, which may be assessed by the controller 520.

[0129] In an approach, the control interface 530 comprises one or more input components configured to receive an input generated by a further device, such as a local computing device. For example, the one or more input components may comprise a light sensitive component configured to receive inputs comprising (e.g. visible) light generated by a further device, a vibration sensitive component configured to receive inputs comprising vibration provided to the aerosol provision device 500 by a further device, and/or a sonic sensitive component configured to receive inputs comprising sonic signals provided to the aerosol provision device 500 by a further device. In such an approach, the input provided by a further device to the control interface 530 of the aerosol provision device 500 is encoded with information, which again may be assessed by the controller 520.

[0130] The control interface 530 may comprise communication circuitry, configured to communicate data with a further device, e.g. and establish a data connection with a further device. This communication circuitry may comprise a wireless communication module configured to establish a wireless data connection with a further device, or a wired communication module configured to establish a wired data connection with a further device. A further device may send an input comprising data to the communication circuitry of the control interface 530, e.g. via the data connection, the data comprising information which may be assessed by the controller 520.

[0131] Whichever of the above approaches is used to provide the input to the control interface 530, the control interface 530 provides input data corresponding to the input to the controller 520. The controller 520 is then configured to assess the authenticity of the input, by determining whether the input passes a predetermined test, wherein passing the predetermined test indicates that the user is an intended user and the input is authentic.

[0132] The controller 520 may determine whether the input passes the predetermined test, by being configured to determine whether the information in the input (e.g. encoded or comprised in the input as discussed above) is associated with an identifier of the aerosol provision device 500. In other words, this may determine whether the aerosol provision device 500 is the intended recipient of the input, or if the input is intended for a different aerosol provision device. This identifier of the aerosol provision device 500 may be a unique identifier of the aerosol provision device 500, and may be stored in the memory 510. To determine whether the input passes the predetermined test in this manner, the controller 520 may be configured to determine whether the information was generated using the identifier of the aerosol provision device 500. For example, the controller 520 may be configured to determine whether the information was generated by applying a predetermined software function to the identifier.

[0133] The controller 520 may, additionally or alternatively, determine whether the input passes the predetermined test, by being configured to determine whether the information in the input was generated by an authorised computing device. An authorised computing device may be a remote computing device, such as remote computing device 480 on the cloud 490. The authorised computing device may, in arrangements, comprise a plurality of computing devices, for example a network of computing devices. The authorised computing device is controlled by the manufacturer of the aerosol provision device 500, or an entity operating with or on behalf of the manufacturer to perform verification of users as appropriate users. The authorised computing device has the authority to indicate that the user is an intended user, and generate the necessary input to be provided to the aerosol provision device 500 which can cause the controller 520 to switch from controlling operation of the aerosol provision device according to the first mode to the second mode.

[0134] The controller 520 may determine whether the information in the input was generated by an authorised computing device, by being configured to determine whether the information has a cryptographic association with a cryptographic first key of the aerosol provision device 500, e.g. which is stored in memory 510. For example, the information may have been generated by the authorised computing device using a cryptographic second key, which has a cryptographic association with the first key of the aerosol provision device 500. In an approach known as "asymmetric encryption", the controller 520 is configured to determine whether the information was generated by an authorised computing device by using the first key of the aerosol provision device 500 which is a public key to test whether a corresponding second key of the authorised computing device which is a private key was used to generate the information. In an approach known as "symmetric encryption", the controller 520 is configured to determine whether the information was generated by an authorized computing device by using the first key of the aerosol provision device

500 which is a private key to test whether the information comprises a corresponding second key of the authorized computing device that matches the first key.

[0135] Whichever approach is used, once the controller 520 has received the input data from the control interface 530 corresponding to the input indicating that the user is an intended user (and optionally after assessing the authenticity of the input by determining whether the information in the input passes the predetermined test), the controller 520 switches to controlling operation of the aerosol provision device 500 according to the second mode. Once the controller 520 has switched to controlling operation of the aerosol provision device 500 according to the second mode, the controller 520 may be configured to continue controlling operation of the aerosol provision device 500 according to the second mode, e.g. indefinitely. In such approaches, the switching from the first mode to the second mode can be considered a "one-time" indication of the user being an intended user.

[0136] However, in other approaches, the controller 520 may be configured to switch back from controlling operation of the aerosol provision device 500 according to the second mode to controlling operation of the aerosol provision device 500 according to the first mode responsive an event such as the passing of a period of time (e.g. a predetermined period of time, or the reaching of a particular time event), reaching a threshold number of inhalations of the aerosol provision device 500 detected by a puff sensor, the device arriving in a predetermined location, or a loss of a wired or wireless data connection established with a further device (e.g. a Bluetooth connection). The controller 520 may also be configured to switch back from controlling operation of the aerosol provision device 500 according to the second mode to controlling operation of the aerosol provision device 500 according to the first mode responsive to the receipt of input data from the control interface 530 corresponding to an instruction to switch back from the first mode to the second mode.

[0137] It can be advantageous to control where the deterrent noise generated by the noise generator 580 is directed towards a particular position (e.g. relative to the aerosol provision device 500). In this regard, the deterrent noise being "directed" towards a particular position may be understood to correspond to the noise being generated such that at said particular position the noise is more audible at that position than at (the majority of, e.g. all) other positions. By generating the deterrent noise such that it is directed towards a particular position in this manner, the deterrent noise may therefore cause a stronger response at that position than at others, thereby allowing the impact of the deterrent noise to be maximised without incurring the generation of additional deterrent noise in all other directions, which may be power intensive and disruptive.

[0138] During use, the user can be expected to take up a particular position (referred to as an expected position) with regard to the aerosol provision device 500. As such, the noise generator 580 can be configured such that the deterrent noise generated by the noise generator 580 is directed towards the expected position of the user of the aerosol provision device 500. In particular, the noise generator 580 may be arranged such that the deterrent noise is directed towards a user, e.g. the head of the user (specifically, the ears of the user) of the aerosol provision device 500, for example when they are using the aerosol provision device 500 according to one or more predetermined forms of use.

[0139] For example, the noise generator 580 may be configured such that the deterrent noise is directed towards a user when the user is using the aerosol provision device 500 by performing an inhalation of aerosol generated by the aerosol provision device 500, for example by drawing on the mouthpiece 590 of the aerosol provision device (or, in approaches in which the mouthpiece is a part of a consumable or a separate component from the consumable and/or device, the mouthpiece of the aerosol provision system). For example, the noise generator 580 may be configured such that the deterrent noise is directed in a direction not opposed to the proximal direction of the aerosol provision device 5.

[0140] In order to direct the deterrent noise, the aerosol provision device may comprise a directing channel 595 configured to direct the deterrent noise generated by the noise generator 580. The noise generator 580 may be arranged to generate the deterrent noise into the directing channel 595, such that the directing channel 595 defines, at least in part, the spatial structure of the deterrent noise. The directing channel 595 may ensure that the deterrent noise signal is directed towards a particular position, by redirecting portions of the deterrent noise which would otherwise travel away from this particular position towards the particular position. The directing channel 595 may comprise an open end, and extend from the noise generator 580 to the open end. The directing channel 595 may be formed in the housing 505 of the aerosol provision device 500. The directing channel 595 may comprise one or more tubes extending from the noise generator 580 to a plurality of open ends.

[0141] The noise generator 580 comprises one or more sonic transducers, each configured to generate a noise signal having one or more characteristics such as a frequency and an amplitude. While arrangements are contemplated in which the noise generator 580 comprises a single sonic transducer, in the embodiment of aerosol provision device 500 the noise generator 580 comprises a plurality of sonic transducers, comprising a first sonic transducer 581 and second sonic transducer 582. Generating the deterrent noise may therefore comprise causing each (or a selection of) the plurality of sonic transducers to respectively generate a noise signal, such that the deterrent noise comprises one or more noise signals from one or more of the sonic transducers.

[0142] These first sonic transducer 581 and second sonic transducer 582 may be arranged such that, when the deterrent noise is generated comprising a first noise

signal (generated by the first sonic transducer 581) and a second noise signal (generated by the second sonic transducer 582), the deterrent noise comprises a region of constructive interference. A region of constructive interference corresponds to a region in which the one or more noise signals interact with one another constructively, rather than destructively, such that a resulting noise experienced by a user at that location is greater than the noise experienced by a user as a result of the first noise signal or the second noise signal alone. This may be aided by the first sonic transducer 581 and second sonic transducer 582 being spatially separated from one another. For instance, this region of constructive interference may include positions which are equidistant from the first sonic transducer 581 and the second sonic transducer 582. Further, this region of constructive interference may include positions which take an equal time to reach by the first noise signal from the first sonic transducer 581, and the second noise signal from the second sonic transducer 582. The first sonic transducer 581 and second sonic transducer 582 may be arranged such that the first and second noise signals are directed by the directing channel 595, or in other approaches it is contemplated that plural directing channels are provided, with such that the first and second noise signals are each directed by respective directing channel (each of which may have any of the features of a directing channel discussed with regard to directing channel 595).

[0143] The controller 520 is configured to cause the first sonic transducer 581 to generate a first noise signal having one or more first characteristics, and the second sonic transducer 582 to generate a second noise signal having one or more second characteristics. As discussed above, these characteristics may include an amplitude and a frequency. The controller 520 can set the one or more first characteristics and the one or more second characteristics, so as to control the region of constructive interference. For example, by setting an amplitude of the first noise signal as greater than an amplitude of the second noise signal, then the region of constructive interference may move closer to the first sonic transducer 518 than when the amplitudes are equal. Further, the controller 520 may set a frequency of the first noise signal to be different to a frequency of the second noise signal, to control the spatial structure of the region of constructive interference. The controller 520 may also set a time delay between the first noise signal and the second noise signal, e.g. such that (the start of) one is generated after the (the start of) the other. This time delay may be under 1 second, such as under 0.5 seconds. This time delay may be a phase difference between the first noise signal and the second noise signal, in order to control the spatial structure of the region of constructive interference.

[0144] The controller 520 may set the one or more characteristics of the deterrent noise (e.g. of the first noise signal and/or second noise signal) depending on how the aerosol provision device 500 is being used. The control interface 580 is configured to receive inputs relating to use of the aerosol provision device 500, and provide input data to the controller 520 corresponding to the received inputs. The inputs can be used in order to ensure that the deterrent noise is generated by the noise generator 580 in an appropriate manner, which can be optimised for the use of the aerosol provision device 500.

[0145] In order to use these inputs to inform the manner of generating the deterrent noise by the noise generator 580, the controller 520 is configured to receive the input data from the control interface 530 corresponding to the received inputs relating to the use of the aerosol provision device 500. The controller 520 is then configured to set one or more characteristics of a deterrent noise to be generated by the noise generator 580. In order to set the one or more characteristics of a deterrent noise to be generated, the controller 520 first determines the values of the one or more characteristics of the noise to be generated.

[0146] This determining of the values may be achieved by applying a predetermined function, by the controller 520, to information in the input, in order to determine the values at which to set the one or more characteristics. In applying the predetermined function to information in the input, the controller 520 may compare information in the input to predetermined parameters, and depending on the outcome of the comparison then select the values at which to set the one or more characteristics. These values may be predetermined values selected from a plurality of predetermined values for one or more characteristics for a deterrent noise, e.g. which are stored in memory 510. In other approaches, in applying the predetermined function to information in the input, the controller 520 may calculate (e.g. new) values for the one or more characteristics, for example if applying the predetermined function to the information comprises applying a predetermined mathematical function to the information, which generates as an output the values for the one or more characteristics.

[0147] Whichever approach is used to determine the values for the one or more characteristics, once these values have been determined the controller 520 can then be configured to cause these values to be stored in memory (e.g. memory 510), to be used subsequently for the one or more characteristics of a deterrent noise when the deterrent noise is next generated. Accordingly, when the controller 520 subsequently causes the noise generator 580 to generate a deterrent noise (e.g., responsive to the control interface 530 receiving an input corresponding to an instruction to generate a deterrent noise, or responsive to the control interface 530 receiving an input which passes a predetermined test), the controller 520 is configured to cause the noise generator to generate a deterrent noise having the one or more characteristics, e.g. having the values stored in memory for these one or more characteristics. In other words, causing the noise generator 580 to generate a deterrent noise having the one or more characteristics comprises, by the controller, retrieving the determined values for the one or

more characteristics.

[0148] Further, the controller 520 may be configured to determine whether the input data corresponds to the occurrence of one or more predetermined forms of use of the aerosol provision device. These one or more predetermined forms of use may correspond to forms of use which are not permitted for a non-intended user. The controller 520 is then further configured to, responsive to determining that the input data corresponds to the occurrence of the one or more predetermined forms of use of the aerosol provision device 500, cause the noise generator 580 to generate the deterrent noise.

[0149] In particular, the control interface 530 of the aerosol provision device 500 may comprise one or more sensors for detecting one or more properties relating to (e.g. use of) the aerosol provision device 500, the one or more sensors being configured to provide input data to the controller 520 comprising sensor data corresponding to the detected one or more properties. Responsive to this sensor data, the controller 520 can then determine whether the sensor data corresponds to the occurrence of one or more predetermined forms of use of the aerosol provision device 500, these one or more predetermined forms of use being not permitted for a non-intended user, as discussed above. Responsive to determining that the sensor data does correspond to the occurrence of the one or more predetermined forms of use of the aerosol provision device 500, the controller 520 is then configured to cause the noise generator 580 to generate the deterrent noise, with the aim of deterring a non-intended user from using the aerosol provision device 500 in that manner.

[0150] In embodiments, the one or more sensors comprises a puff sensor configured to detect a user inhalation on the aerosol provision device 500. For example, the puff sensor may be configured to detect when a user is drawing on a mouthpiece 590 of the aerosol provision device 500 (or, in arrangements in which the aerosol provision device is not a one-piece aerosol provision device, a mouthpiece of a consumable, or of an aerosol provision system). The puff sensor may comprise a pressure sensor or a microphone. In such an approach, the one or more predetermined forms of use of the aerosol provision device comprises a user inhalation on the aerosol provision device, and so when the controller 520 receives input data from the control interface 530 corresponding to an inhalation detected by the puff sensor, the controller 520 is configured to cause the noise generator 580 to generate the deterrent noise.

[0151] These inputs relating to the use of the aerosol provision device 500 may also be indicative of an expected position of a user of the aerosol provision device 500. As such, the controller may be configured to set the one or more characteristics of the deterrent noise (e.g. the first noise signal and/or the second noise signal) in dependence of input data received from the control interface 530 corresponding to inputs received by the control interface 520 indicating an expected position of a user. The controller may be configured to set the one or more characteristics of the deterrent noise such that the region of constructive interference encompasses an expected position of a user of the aerosol provision device during a predetermined form of use which is determined to be occurring.

[0152] For example, if the controller 520 determines that the input data corresponds to the occurrence of a user inhalation on the aerosol provision device, then the controller may set the one or more characteristics of the deterrent noise (e.g. the first noise signal and/or the second noise signal) such that the region of constructive interference encompasses an expected position of a user of the aerosol provision device during a user inhalation of the aerosol provision device.

[0153] The noise generator 580 may also comprise a signal generator 583, configured to generate an electronic signal defining a deterrent noise to be generated. The noise generator 580 may be configured to receive an instruction from the controller 520 to generate a deterrent noise, for example having one or more characteristics, and the signal generator 583 is configured to receive this instruction to generate a deterrent noise (having one or more characteristics), and responsive to this instruction generate an electronic signal defining a deterrent noise to be generated (having the one or more characteristics). In other words, causing, by the controller 520, the noise generator 580 to generate a deterrent noise having one or more characteristics may comprise providing an instruction, by the controller 520, to the noise generator 580 to generate a deterrent noise having one or more characteristics, which instruction is received by the signal generator 583 of the noise generator 580, and in response to which the signal generator 583 generates an electronic signal defining a deterrent noise to be generated.

[0154] The signal generator 583 is configured to generate the electronic signal defining a deterrent noise to be generated, and provide the electronic signal to a digital to analogue convertor 584 which is configured to receive the electronic signal defining a deterrent noise to be generated, and provide an analogue signal corresponding to the deterrent noise to be generated to the first sonic transducer 581 and second sonic transducer 582, so as to cause the first sonic transducer 581 and second sonic transducer 582 to generate the deterrent noise. The noise generator 580 may also comprise an amplifier configured to amplify an analogue signal, the analogue signal being passed through the amplifier to be provided to the first sonic transducer 581 and second sonic transducer 582. The digital to analogue converter 584 and the amplifier may be integrated on a printed circuit board ("PCB").

[0155] Although the signal generator 583 is discussed as a part of the noise generator 580 above, this component may be excluded, and instead the functionality of this component may be provided by the controller 520. In other words, in providing an instruction to the noise

generator 580 by the controller 520 to generate a deterrent noise (having one or more characteristics), the controller 520 may generate an electronic signal defining a deterrent noise to be generated, and provide this electronic signal to the noise generator 580 (e.g. the digital to analogue converter 584 of the noise generator 580).

[0156] A flow chart representation of a method for an aerosol provision system (e.g. an aerosol provision device thereof), in accordance with certain embodiments, is shown in Figure 6. This method is applicable to the aerosol provision device 500, and will be discussed in the context of this device. However, these techniques may equally be applied to any aerosol provision device or aerosol provision system, such as the aerosol provision devices 100, 200, 300 and aerosol provision systems 1, 2, 3.

[0157] In step S1, an aerosol provision device, such as aerosol provision device 500, is provided. As discussed above, this aerosol provision device 500 comprises a noise generator 580, configured to generate a noise. While it is noted that this noise generator 580 is described as generating a deterrent noise for deterrence of a non-intended user, it is also recognised that this noise generator 580 may be more broadly applied for the generation of other types of noise. The noise generator 580 comprises one or more sonic transducers, such as the first sonic transducer 581 and second sonic transducer 582 discussed above.

[0158] In step S2, a noise is generated by the noise generator 580, by the one or more sonic transducers of the noise generator 580. The noise may be directed towards an expected position of a user of the aerosol provision device 500. Again, this noise which is generated by the noise generator 580 may be a deterrent noise for the deterrence of a non-intended user, but other types of noise may be generated. As discussed above, a controller 520 may control operation of the aerosol provision device 500, which may be a controller 520 of the aerosol provision device 500, or a controller of a further device which is configured to communicate data with the aerosol provision device 500, so as to control operation of the aerosol provision device 500. This controller 520 may cause the noise generator 580 to generate the noise.

[0159] The various embodiments described herein are presented only to assist in understanding and teaching the claimed features. These embodiments are provided as a representative sample of embodiments only, and are not exhaustive and/or exclusive. It is to be understood that advantages, embodiments, examples, functions, features, structures, and/or other aspects described herein are not to be considered limitations on the scope of the invention as defined by the claims or limitations on equivalents to the claims, and that other embodiments may be utilised and modifications may be made without departing from the scope of the claimed invention. Various embodiments of the invention may suitably comprise, consist of, or consist essentially of, appropriate combinations of the disclosed elements, components, features, parts, steps, means, etc, other than those specifically described herein. In addition, this disclosure may include other inventions not presently claimed, but which may be claimed in future.

Claims

1. An aerosol provision device comprising:

   a noise generator configured to generate a deterrent noise for deterrence of a non-intended user, the noise generator comprising one or more sonic transducers; and
   a controller configured to control operation of the aerosol provision device;
   wherein the noise generator is configured such that the deterrent noise is directed towards an expected position of a user of the aerosol provision device.

2. The aerosol provision device of claim 1, wherein the noise generator comprises a plurality of sonic transducers, the plurality of sonic transducers comprising a first sonic transducer configured to generate a first noise signal, and a second sonic transducer configured to generate a second noise signal,
   such that, when the deterrent noise is generated comprising the first noise signal and the second noise signal, the deterrent noise comprises a region of constructive interference.

3. The aerosol provision device of claim 2, wherein the plurality of sonic transducers is arranged such that, when the deterrent noise is generated, the region of constructive interference encompasses an expected position of a user of the aerosol provision device.

4. The aerosol provision device of claim 2 or 3, wherein the controller is configured to cause:

   the first sonic transducer to generate the first noise signal having one or more first characteristics; and
   the second sonic transducer to generate the second noise signal having one or more second characteristics.

5. The aerosol provision device of claim 4, wherein the controller is configured to set the one or more first characteristics and one or more second characteristics such that the region of constructive interference encompasses an expected position of a user of the aerosol provision device.

6. The aerosol provision device of any of claims 1 to 5, comprising a directing channel configured to direct the deterrent noise.

7. The aerosol provision device of claim 6, wherein the noise generator is arranged to generate the deterrent noise into the directing channel.

8. The aerosol provision device of claim 7, wherein the directing channel comprises an open end, and extends from the noise generator to the open end.

9. The aerosol provision device of any of claims 6 to 8, wherein the directing channel is configured to direct the deterrent noise towards an expected position of a user of the aerosol provision device.

10. The aerosol provision device of any of claims 1 to 9, wherein the expected position of a user of the aerosol provision device is an expected position of a user of the aerosol provision device when the user is performing an inhalation.

11. The aerosol provision device of any of claims 1 to 10, comprising a control interface configured to receive inputs relating to use of the aerosol provision device, and provide input data to the controller corresponding to the received inputs,
wherein the controller is configured to:

receive the input data from the control interface corresponding to the received inputs relating to use of the aerosol provision device;
responsive to the receipt of the input data, determine whether the input data corresponds to the occurrence of one or more predetermined forms of use of the aerosol provision device; and
responsive to determining that the input data corresponds to the occurrence of the one or more predetermined forms of use of the aerosol provision device, cause the noise generator to generate the deterrent noise.

12. The aerosol provision device of claim 11, wherein the control interface comprises one or more sensors for detecting one or more properties relating to the aerosol provision device, the one or more sensors being configured to provide input data to the controller comprising sensor data corresponding to the detected one or more properties, and wherein the controller is configured to determine whether the input data corresponds to the occurrence of one or more predetermined forms of use of the aerosol provision device by determining whether the sensor data corresponds to the occurrence of one or more predetermined forms of use of the aerosol provision device.

13. The aerosol provision device of any of claims 1 to 12, wherein the noise generator is configured to generate the deterrent noise having a frequency of 20 Hz to 20 kHz.

14. The aerosol provision device of claim 13, wherein the noise generator is configured to generate the deterrent noise having a frequency of over 16 kHz.

15. A method for an aerosol provision device, comprising:

providing an aerosol provision device comprising a noise generator configured to generate a deterrent noise for deterrence of a non-intended user, the noise generator comprising one or more sonic transducers; and
generating, by the noise generator, a deterrent noise for deterrence of a non-intended user, wherein the deterrent noise is directed towards an expected position of a user of the aerosol provision device.

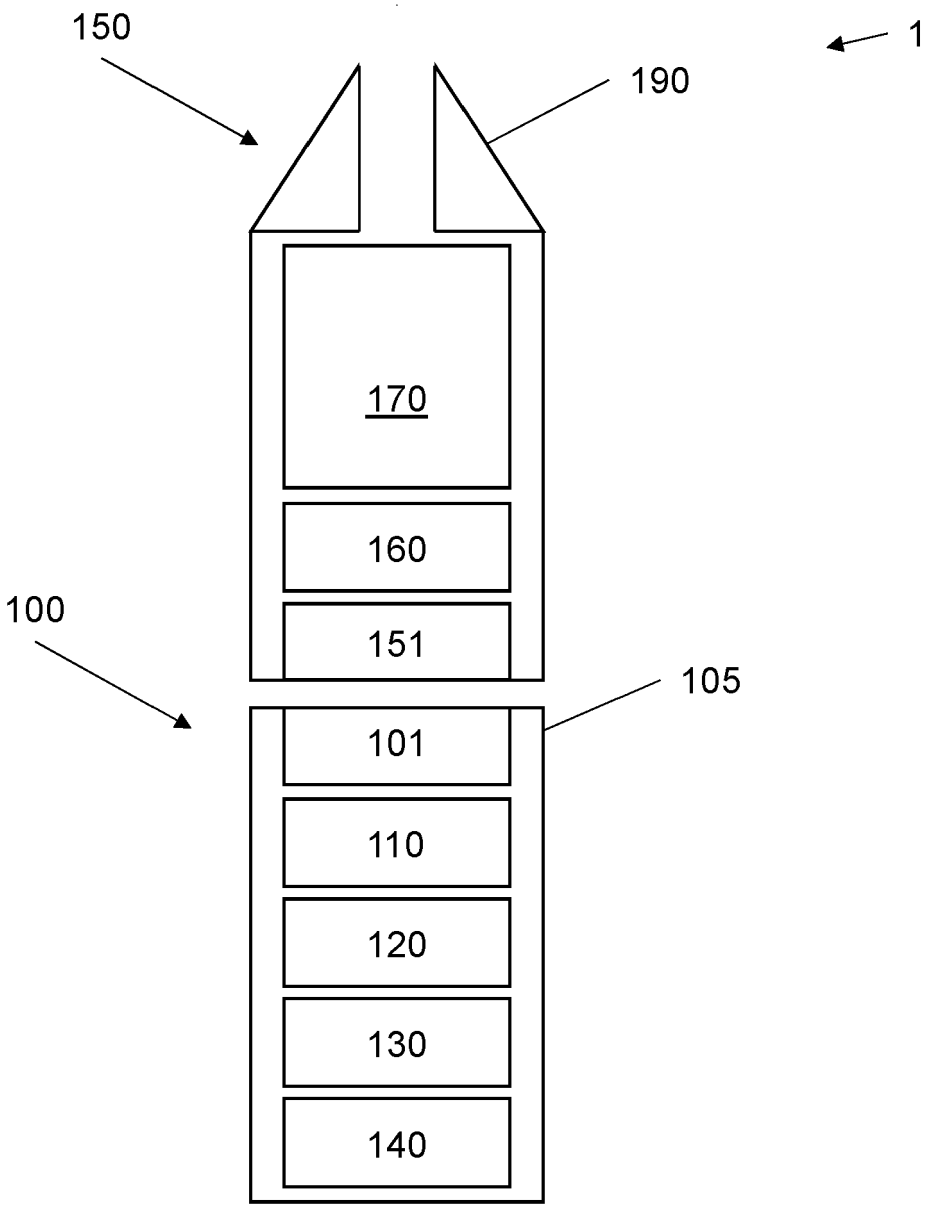

Figure 1

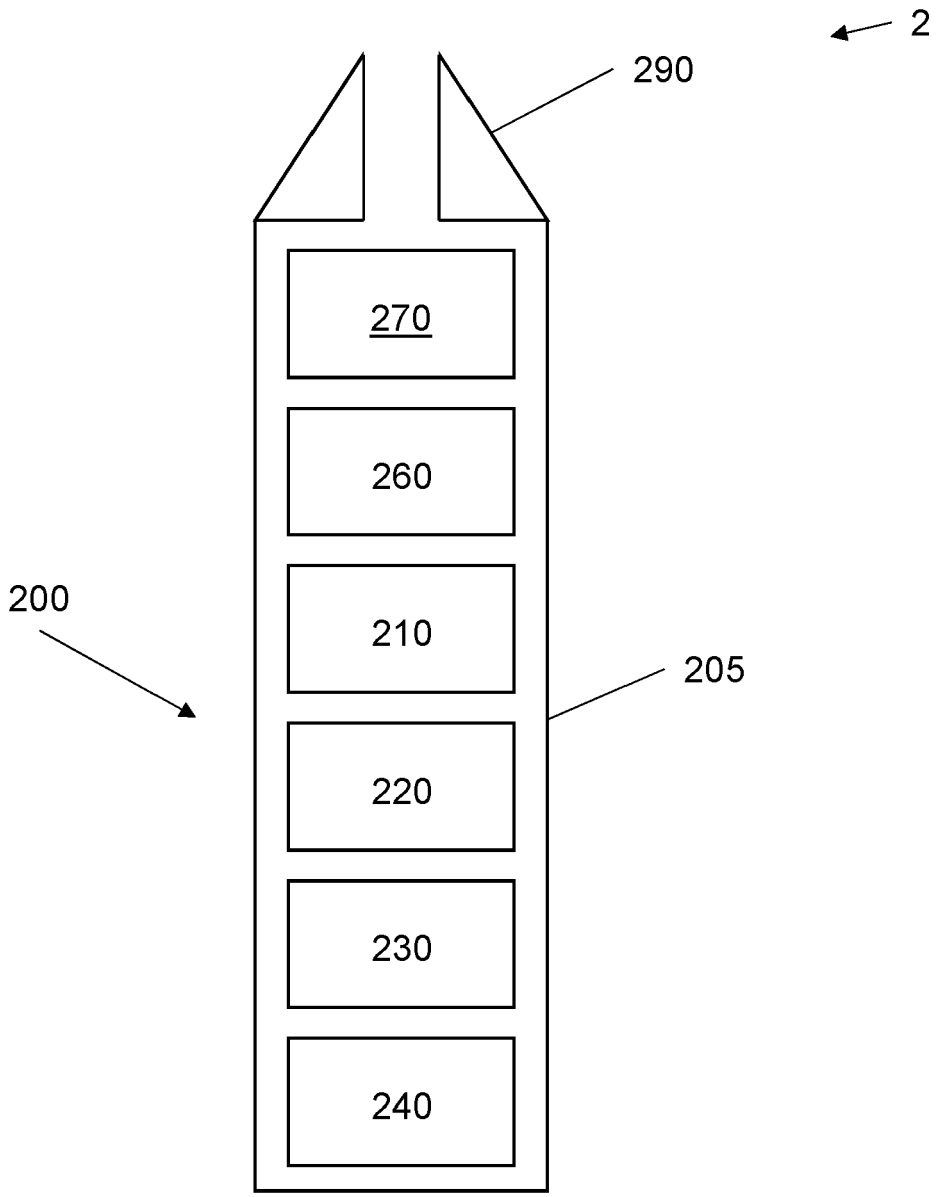

Figure 2

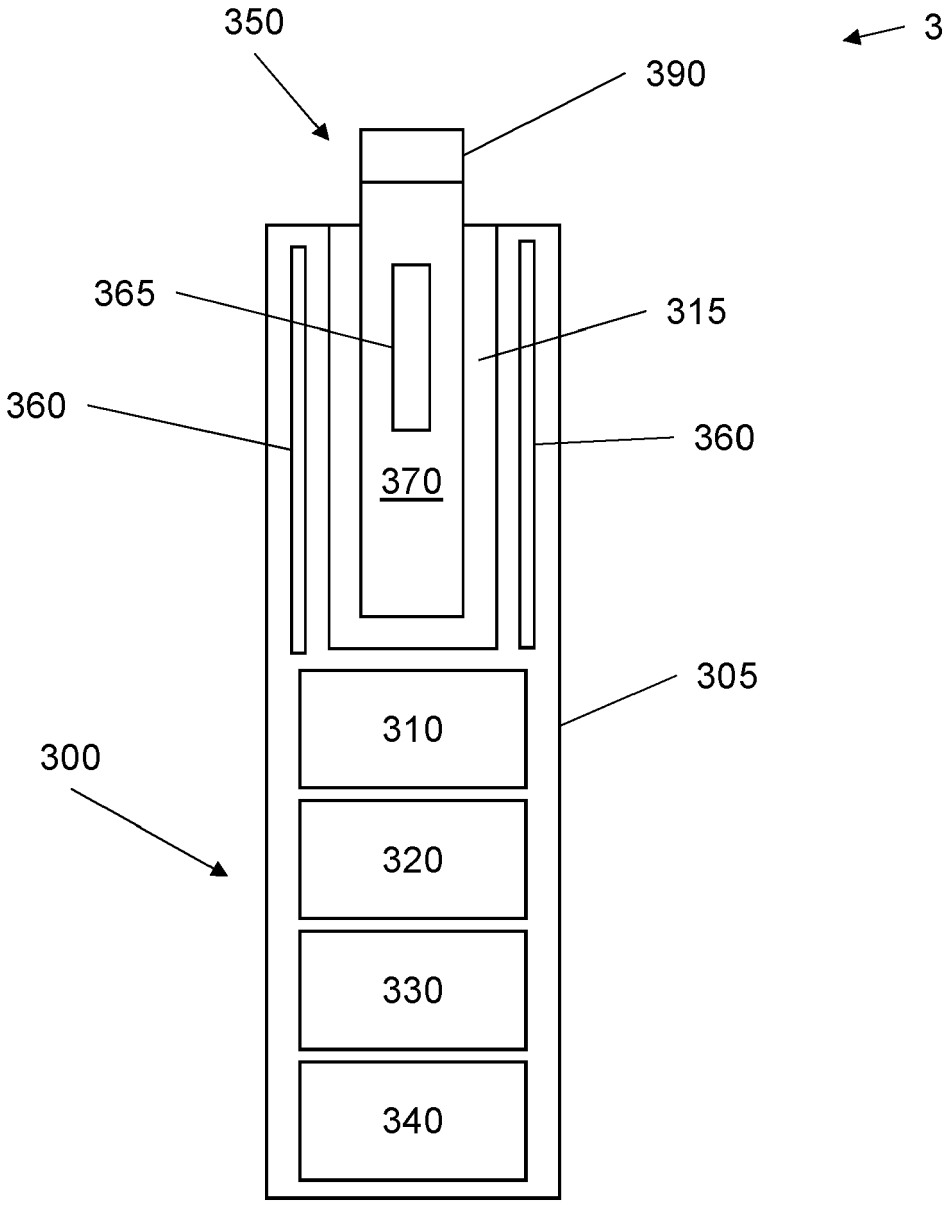

Figure 3

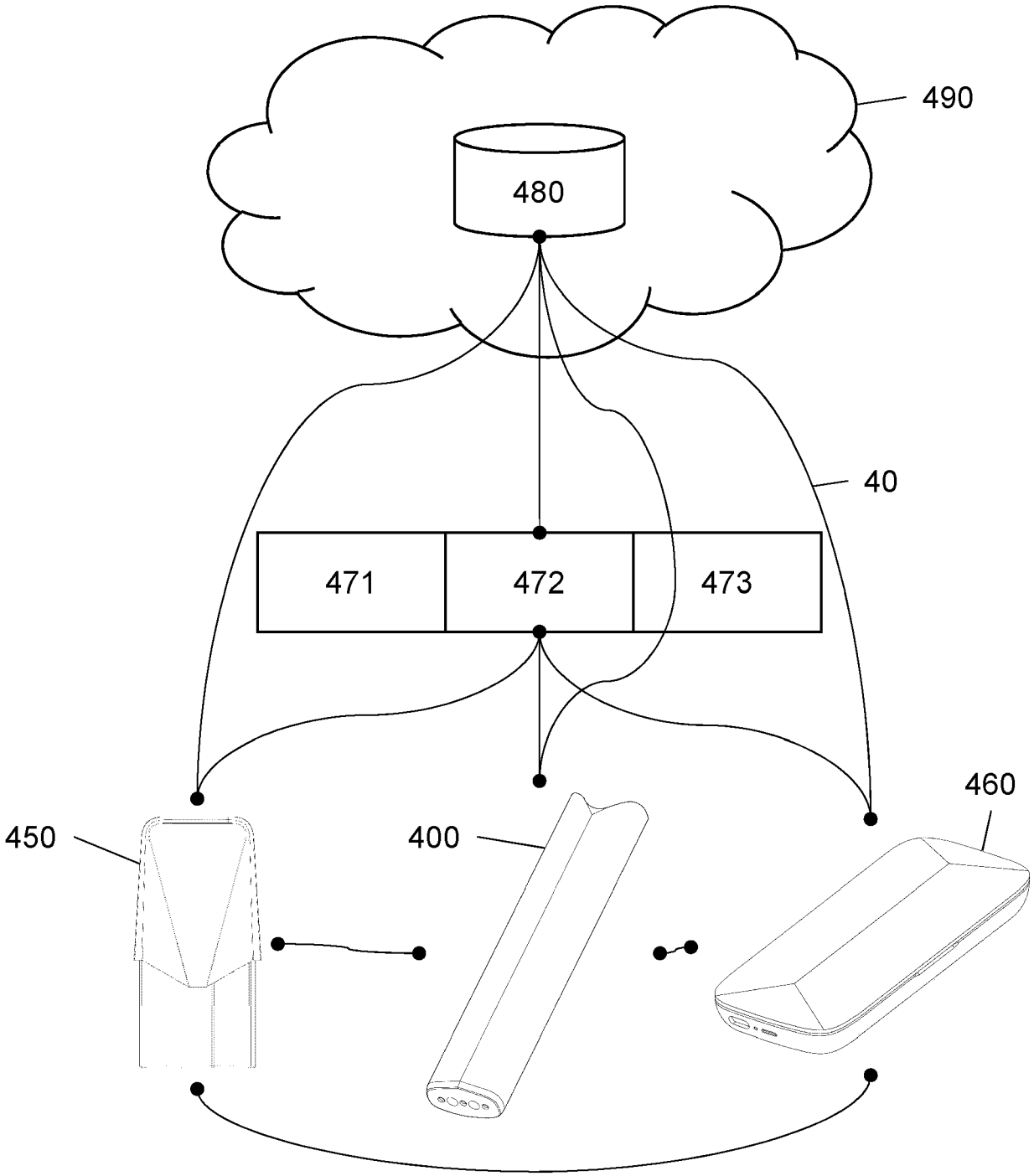

Figure 4

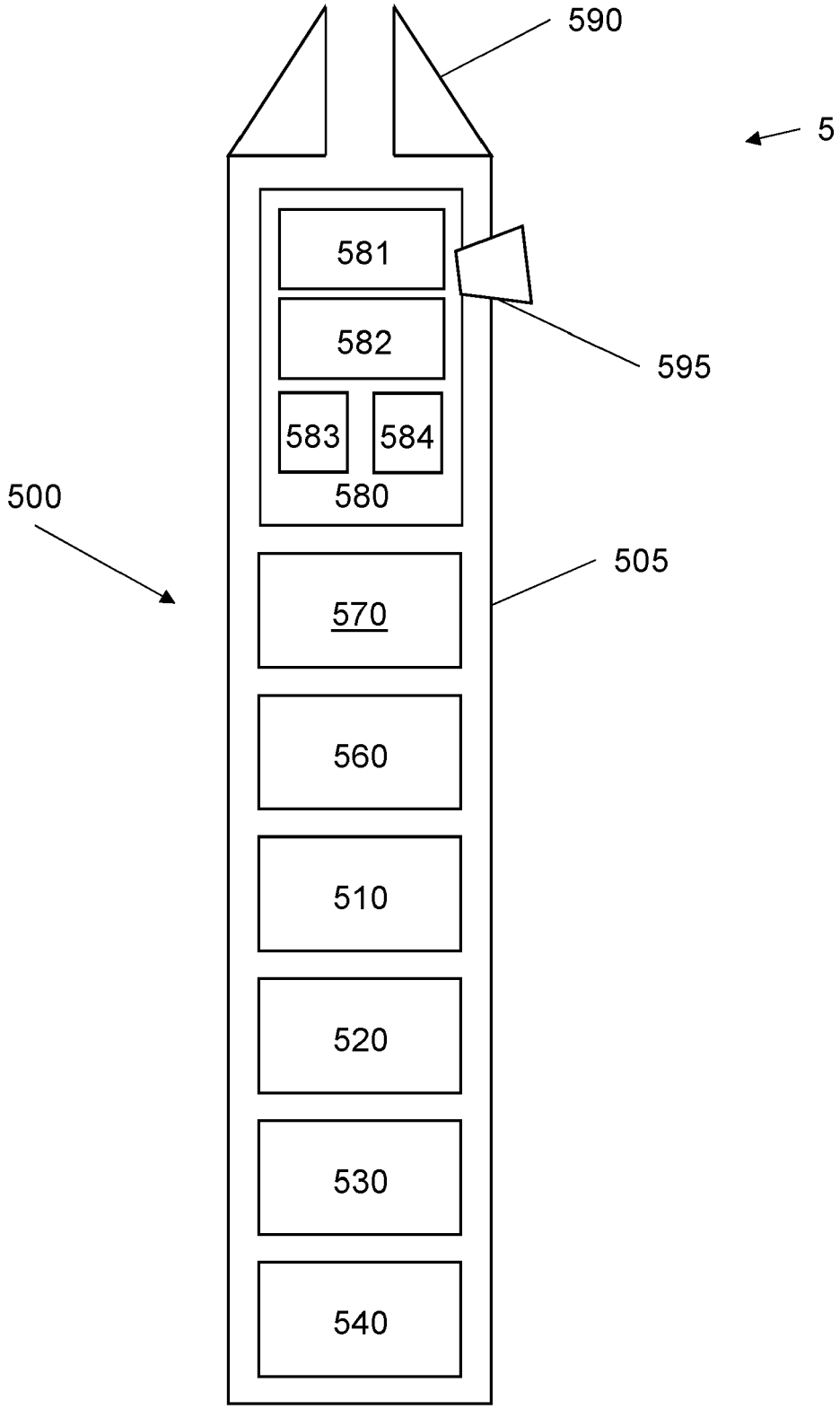

Figure 5

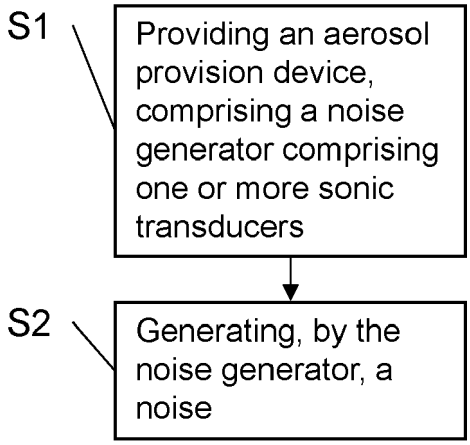
S1
Providing an aerosol provision device, comprising a noise generator comprising one or more sonic transducers
S2
Generating, by the noise generator, a noise

Figure 6

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 24 15 1449

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	EP 3 711 502 A1 (NERUDIA LTD [GB]) 23 September 2020 (2020-09-23)	1,6-15	INV. A24F40/60
A	* paragraph [0086] - paragraph [0136]; figures 1-3 *	2-5	A24F40/53
	-----		ADD. A24F40/49

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	15 July 2024	Klintebäck, Daniel

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
.....
& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 15 1449

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

15-07-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3711502 A1	23-09-2020	EP 3711502 A1	23-09-2020
		EP 3941224 A1	26-01-2022
		EP 4378330 A2	05-06-2024
		WO 2020193213 A1	01-10-2020

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82