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(54) **AEROSOL DELIVERY DEVICE**

(57) The present disclosure relates to an aerosol delivery device and system e.g. a smoking substitute device and system. In particular, the present disclosure relates to an aerosol delivery device comprising a power source a user feedback element and a controller. The controller is configured to control the user feedback element to provide a first feedback when the charge status of the power source drops below a first threshold, and provide a second feedback when the charge status of the power source drops below a second threshold lower than the first threshold. The first feedback is different from the second feedback.

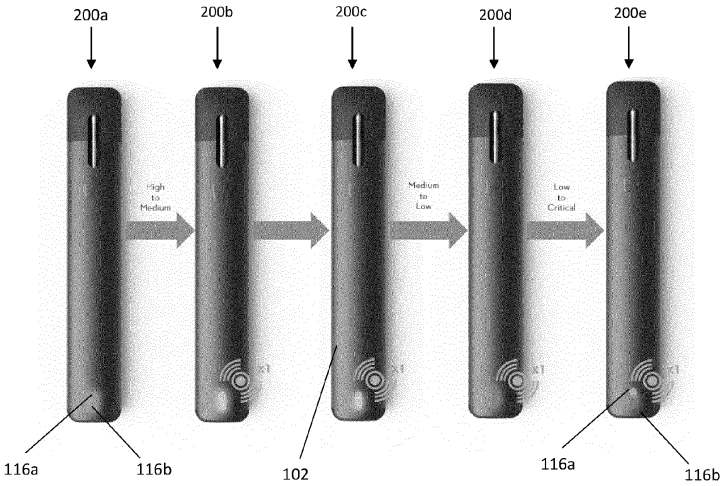

FIG 4

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Description

Technical field

[0001] The present disclosure relates to an aerosol delivery device and an aerosol delivery system such as a smoking substitute device/system.

Background

[0002] The smoking of tobacco is generally considered to expose a smoker to potentially harmful substances. It is generally thought that a significant amount of the potentially harmful substances are generated through the heat caused by the burning and/or combustion of the tobacco and the constituents of the burnt tobacco in the tobacco smoke itself.

[0003] Combustion of organic material such as tobacco is known to produce tar and other potentially harmful by-products. There have been proposed various smoking substitute systems in order to avoid the smoking of tobacco.

[0004] Such smoking substitute systems can form part of nicotine replacement therapies aimed at people who wish to stop smoking and overcome a dependence on nicotine.

[0005] Smoking substitute systems, which may also be known as electronic nicotine delivery systems, may comprise electronic systems that permit a user to simulate the act of smoking by producing an aerosol, also referred to as a "vapour", which is drawn into the lungs through the mouth (inhaled) and then exhaled. The inhaled aerosol typically bears nicotine and/or flavourings without, or with fewer of, the odour and health risks associated with traditional smoking.

[0006] In general, smoking substitute systems are intended to provide a substitute for the rituals of smoking, whilst providing the user with a similar experience and satisfaction to those experienced with traditional smoking and tobacco products.

[0007] The popularity and use of smoking substitute systems has grown rapidly in the past few years. Although originally marketed as an aid to assist habitual smokers wishing to quit tobacco smoking, consumers are increasingly viewing smoking substitute systems as desirable lifestyle accessories. Some smoking substitute systems are designed to resemble a traditional cigarette and are cylindrical in form with a mouthpiece at one end. Other smoking substitute systems do not generally resemble a cigarette (for example, the smoking substitute device may have a generally box-like form).

[0008] There are a number of different categories of smoking substitute systems, each utilising a different smoking substitute approach. A smoking substitute approach corresponds to the manner in which the substitute system operates for a user.

[0009] One approach for a smoking substitute system is the so-called "vaping" approach, in which a vaporisable liquid, typically referred to (and referred to herein) as "e-liquid", is heated by a heater to produce an aerosol vapour which is inhaled by a user. An e-liquid typically includes a base liquid as well as nicotine and/or flavourings. The resulting vapour therefore typically contains nicotine and/or flavourings. The base liquid may include propylene glycol and/or vegetable glycerine.

[0010] A typical vaping smoking substitute system includes a mouthpiece, a power source (typically a battery), a tank or liquid reservoir for containing e-liquid, as well as a heater. In use, electrical energy is supplied from the power source to the heater, which heats the e-liquid to produce an aerosol (or "vapour") which is inhaled by a user through the mouthpiece.

[0011] Vaping smoking substitute systems can be configured in a variety of ways. For example, there are "closed system" vaping smoking substitute systems which typically have a heater and a sealed tank which is pre-filled with e-liquid and is not intended to be refilled by an end user. One subset of closed system vaping smoking substitute systems include a device which includes the power source, wherein the device is configured to be physically and electrically coupled to a component including the tank and the heater. In this way, when the tank of a component has been emptied, the device can be reused by connecting it to a new component. Another subset of closed system vaping smoking substitute systems are completely disposable and intended for one-use only.

[0012] There are also "open system" vaping smoking substitute systems which typically have a tank that is configured to be refilled by a user, so the system can be used multiple times.

[0013] An example vaping smoking substitute system is the myblu™ e-cigarette. The myblu™ e cigarette is a closed system which includes a device and a consumable component. The device and consumable component are physically and electrically coupled together by pushing the consumable component into the device. The device includes a rechargeable battery. The consumable component includes a mouthpiece, a sealed tank which contains e-liquid, as well as a vaporiser, which for this system is a heating filament coiled around a portion of a wick which is partially immersed in the e-liquid. The system is activated when a microprocessor on board the device detects a user inhaling through the mouthpiece. When the system is activated, electrical energy is supplied from the power source to the vaporiser, which heats e-liquid from the tank to produce a vapour which is inhaled by a user through the mouthpiece.

[0014] Another example vaping smoking substitute system is the blu PRO™ e-cigarette. The blu PRO™ e cigarette is an open system which includes a device, a (refillable) tank, and a mouthpiece. The device and tank are physically and electrically coupled together by screwing one to the other. The mouthpiece and refillable tank are physically coupled together by screwing one into the other, and detaching the mouthpiece from the refillable

tank allows the tank to be refilled with e-liquid. The system is activated by a button on the device. When the system is activated, electrical energy is supplied from the power source to a vaporiser, which heats e-liquid from the tank to produce a vapour which is inhaled by a user through the mouthpiece.

[0015] An alternative to the "vaping" approach is the so-called Heated Tobacco ("HT") approach in which tobacco (rather than an e-liquid) is heated or warmed to release vapour. HT is also known as "heat not burn" ("HNB"). The tobacco may be leaf tobacco or reconstituted tobacco. In the HT approach the intention is that the tobacco is heated but not burned, i.e. the tobacco does not undergo combustion.

[0016] The heating, as opposed to burning, of the tobacco material is believed to cause fewer, or smaller quantities, of the more harmful compounds ordinarily produced during smoking. Consequently, the HT approach may reduce the odour and/or health risks that can arise through the burning, combustion and pyrolytic degradation of tobacco.

[0017] A typical HT smoking substitute system may include a device and a consumable component. The consumable component may include the tobacco material. The device and consumable component may be configured to be physically coupled together. In use, heat may be imparted to the tobacco material by a heating element of the device, wherein airflow through the tobacco material causes components in the tobacco material to be released as vapour. A vapour may also be formed from a carrier in the tobacco material (this carrier may for example include propylene glycol and/or vegetable glycerine) and additionally volatile compounds released from the tobacco. The released vapour may be entrained in the airflow drawn through the tobacco.

[0018] As the vapour passes through the consumable component (entrained in the airflow) from the location of vaporization to an outlet of the component (e.g. a mouthpiece), the vapour cools and condenses to form an aerosol for inhalation by the user. The aerosol may contain nicotine and/or flavour compounds.

[0019] Some aerosol delivery devices/systems are able to provide feedback to the user about the state of the aerosol delivery device/system. This may be visual feedback, or haptic feedback, for example. This feedback may be of limited use to the user, e.g. if the information provided by the feedback is not detailed enough, or does not include the information that the user wants.

[0020] Accordingly, there is a need for an improved aerosol delivery device/system which addresses at least some of the problems of the known devices and systems.

Summary

[0021] According to a first aspect, there is provided an aerosol delivery device (e.g. a smoking substitute device) comprising:

a power source;

a user feedback element; and

a controller, wherein the controller is configured to control the user feedback element to:

provide a first feedback when the charge status of the power source drops below a first threshold; and

provide a second feedback when the charge status of the power source drops below a second threshold lower than the first threshold, wherein the first feedback is different from the second feedback.

[0022] In this way, a charge status of the power source may be provided to the user as the charge status drops below different predefined thresholds. The user can be made aware of the charge status of the power source as it drops below such predefined thresholds. The user is therefore able to keep up to date with the charge status of their aerosol delivery device. This may help to avoid situations in which the aerosol delivery device runs out of power without sufficient warning to the user.

[0023] Optional features will now be set out. These are applicable singly or in any combination with any aspect.

[0024] The user feedback element may comprise at least one visual user feedback element. As such, the first feedback may be a first visual feedback, and the second feedback may be a second visual feedback, wherein the first visual feedback is different from the second visual feedback.

[0025] The visual user feedback element may comprise one or more lights, e.g. one or more LEDs, for example.

[0026] The first visual feedback and the second visual feedback may comprise different colour light. For example, the first visual feedback may comprise amber light, indicating that the charge status of the power source has dropped below a first higher threshold, and the second visual feedback may comprise red light, indicating that the charge status of the power source has dropped below a second lower threshold. The visual user feedback element may be configured to emit the first and second user feedback having different colours.

[0027] Preferably, the first visual feedback is amber light and the second visual feedback is red light.

[0028] In this way, the energy requirements of the visual user feedback element are reduced as the charge status decreases. This is because the visual user feedback element may comprise red, green and blue LEDs (an RGB LED). Amber light may be generated by combining light emitted from the red and green LEDs. Red light may be generated by the light emitted from the red LED only. Therefore, when there the power source has a higher charge status, two LEDs may be switched on to

provide the amber light feedback, whereas when the power source has a lower charge status, only one LED is switched on to provide the red light feedback. Thus, the power requirements of the visual user feedback element are reduced as the charge status of the power source decreases, increasing the timespan of the remaining charge.

[0029] Alternatively/additionally, the first visual feedback and the second visual feedback may comprise light of different intensities. For example, the first visual feedback may comprise light with a first intensity and the second visual feedback may comprise light with a second intensity, the second intensity being greater (or less than) the first intensity.

[0030] The first visual feedback and the second visual feedback may comprise light having different flashing patterns. For example, the first visual feedback may comprise three flashes of light, and the second visual feedback may comprise five flashes of light.

[0031] The user feedback element may comprise a haptic feedback generation unit, e.g. an electric motor and a weight mounted eccentrically on a shaft of the electric motor. The first feedback and second feedback may comprise different vibration patterns and/or vibration intensities.

[0032] The user feedback element may comprise an audible user feedback element. The audible user feedback element may comprise a speaker. The first feedback and second feedback may comprise different sounds, e.g. sound of different pitches, different types of sound, and/or spoken word indicating the charge status of the power source.

[0033] In some examples, the aerosol delivery device may comprise a plurality of user feedback elements.

[0034] For example, the aerosol delivery device may comprise a visual user feedback element configured to provide the first and second feedback, and also a haptic feedback generation unit. The controller may be configured to control the haptic feedback generation unit to provide haptic feedback when the charge status of the power source drops below the first threshold and/or the second threshold.

[0035] In this way, the aerosol delivery device may both vibrate and provide a visual indication of the charge status of the power source when the charge status of the power source drops below predefined thresholds. Also providing haptic feedback provides improved communication with a user, e.g. in case the user misses a change in visual feedback.

[0036] In some examples, the haptic feedback provided when the charge status of the power source drops below the first threshold, may be different from the haptic feedback provided when the charge status of the power source drops below the second threshold. For example, they may have different intensities, or different vibration patterns. Alternatively, the haptic feedback provided when the charge status of the power source drops below the first threshold may be the same as the haptic feedback provided when the charge status of the power source drops below the second threshold.

[0037] In some examples having a plurality of user feedback elements, the first feedback may be provided by a different user feedback element to the second feedback. In particular, the first feedback and the second feedback may be different types of feedback. Types of feedback may include visual feedback, audible feedback and haptic feedback for example. For example, the first feedback may be visual feedback provided by a visual user feedback element, and the second feedback may be haptic feedback provided by a haptic feedback generation unit (or vice versa). In other examples, the first feedback may be haptic feedback provided by a haptic feedback generation unit, and the second feedback may be audible feedback provided by a speaker (or vice versa).

[0038] In some examples, the controller may be configured to control the user feedback element to provide a third feedback when the charge status of the power device drops below a third threshold lower than the second threshold. The third feedback may be different from the first feedback and the second feedback. This further improves the feedback provided to the user.

[0039] The controller may be configured to control the user feedback element to continually provide the first feedback when the charge status of the power source is between the first threshold and the second threshold. The controller may be configured to control the user feedback element to continually provide the second feedback when the charge status of the power source is less than the second threshold. The controller may be configured to control the user feedback element to continually provide the third feedback when the charge status of the power source is less than the third threshold.

[0040] The controller may be configured to control the user feedback element to continually provide a fourth feedback when the charge status of the power source is greater than the first threshold, wherein the fourth feedback is different from the first feedback and the second feedback (and the third feedback).

[0041] For example, a visual user feedback element may continually generate blue light when the charge status of the power source is greater than the first threshold, amber light when the charge status of the power source is between the first and second threshold, and red light when the charge status of the power source is less than the second threshold (or between the second threshold and the third threshold). The visual user feedback element may generate flashing red light when the charge status of the power source is less than the third threshold.

[0042] In this way, the charge status of the power source is communicated to the user at all times, and improved feedback is provided.

[0043] In some examples, the controller may be configured to provide the first feedback and second feedback only for a predefined period of time (e.g. 5 seconds) when the charge status of the power source drops below the

first threshold and the second threshold, respectively. Similarly, the controller may be configured to provide the third feedback only for a predefined period of time (e.g. 5 seconds) when the charge status of the power source drops below the third threshold.

[0044] The thresholds may be predefined, e.g. written into a memory of the aerosol delivery device during manufacture. Alternatively, the thresholds may be user-defined. For example, the aerosol delivery device may comprise a user interface configured to allow a user to set or modify the thresholds.

[0045] As an illustrative example, the first threshold may be a charge status of 50%, and the second threshold may be a charge status of 25%. The third threshold may be a charge status of 10%.

[0046] The device may comprise a charging connection for connection to an external power supply for recharging of the power source. The charging connection may be a charging connection port, such as a USB port. It may be configured to connect to (e.g. receive) a charging cable, for example.

[0047] The controller may be configured to control the user feedback element to, when a charging cable is connected to the charging connection port control the user feedback element to provide a feedback indicating a current charge status of the power source.

[0048] In particular the controller may be configured to, when a charging cable is connected to the charging connection port, control the user feedback element to:

provide the first feedback when a current charge status of the power source is between the first threshold and the second threshold; and
provide the second feedback when a current charge status of the power source is below the second threshold.

[0049] As such, the user can be made aware of the current charge status of the power source of the aerosol delivery device before charging of the power source commences. The user may also be made aware that the charging cable is correctly connected to the charging connection port and/or has been accepted by the aerosol delivery device to charge the power supply, such that the power source is charging.

[0050] The controller may be configured to control the haptic feedback generation unit to provide haptic feedback when a charging cable is connected to the charging connection port. The controller may be configured to control the haptic feedback generation unit to provide haptic feedback when a charging cable is correctly connected to the charging connection port, e.g. such that the power supply is charged by power received via the charging connection port.

[0051] As such, the user is provided with further feedback indicating that the aerosol delivery device has accepted the charging cable, and that charging of the power source within the aerosol delivery device has started.

[0052] For completeness, connection of a charging cable to the charging connection port is to be understood as the transition from a charging cable being unconnected to the charging connection port, to the charging cable being connected to the charging connection port.

[0053] The controller may be configured to control the user feedback element to provide a fifth feedback when the power source reaches full charge. The fifth feedback may be different from the first feedback and the second feedback. It may be different from the third feedback and/or the fourth feedback.

[0054] The fifth feedback may be visual feedback, for example white light.

[0055] The controller may be configured to, when the power source reaches full charge:

control the haptic feedback generation unit to provide haptic feedback; and/or
control the visual user feedback element to provide the visual feedback.

[0056] As such, when the power source reaches full charge, the aerosol delivery device may vibrate, and white light may be emitted from the visual user feedback element. The controller may be configured to control the visual user feedback element to provide the fifth feedback (e.g. white light) for a predefined period, for example 5 minutes.

[0057] The aerosol delivery device may be configured to receive a consumable component for containing an aerosol precursor.

[0058] The controller may be configured to control the user feedback element to, when a consumable component is connected to (e.g. received by) the aerosol delivery device, control the user feedback element to provide a feedback indicating a current charge status of the power source.

[0059] In particular the controller may be configured to, when a consumable component is connected to (e.g. received by) the aerosol delivery device, control the user feedback element to:

provide the first feedback when a current charge status of the power source is between the first threshold and the second threshold; and
provide the second feedback when a current charge status of the power source is below the second threshold.

[0060] As such, the user can be made aware of the charging status of the power supply of the aerosol delivery device, whenever a consumable component is connected to the aerosol delivery device. It may also provide the user with confirmation that the consumable component has been correctly received by the aerosol delivery device.

[0061] For completeness, connection of a consumable component to the aerosol delivery device is to be under-

stood as the transition from a consumable component being unconnected to the aerosol delivery device, to the consumable component being connected to the aerosol delivery device.

[0062] The controller may be configured to control the haptic feedback generation unit to provide haptic feedback when a consumable component is connected to the aerosol delivery device. As such, the user is provided with further feedback indicating that the aerosol delivery device has accepted the consumable component.

[0063] The device comprises the source of power which may be a battery. The source of power may be a capacitor. The power source may be a rechargeable power source.

[0064] The device may comprise a device body for housing the power source and/or other electrical components. The device body may be an elongate body i.e. with a greater length than depth/width. It may have a greater width than depth.

[0065] The device body may have a length of between 5 and 30 cm e.g. between 5 and 10 cm such as between 7 and 9 cm. The maximum depth of the device body may be between 5 and 15 mm e.g. between 9 and 12 mm.

[0066] The device body may have a front surface that is curved in the transverse dimension. The device body may have a rear surface that is curved in the transverse dimension. The curvatures of the front surface and rear surface may be of the opposite sense to one another. Both front and rear surfaces may be convex in the transverse dimension. They may have an equal radius of curvature.

[0067] The device body may have a substantially oval transverse cross-sectional shape.

[0068] The device body may have a linear longitudinal axis.

[0069] The front and/or rear surface of the device body may include the at least one visual user feedback element, for example one or more lights e.g. one or more LEDs.

[0070] In some embodiments, the device body may include an illumination region configured to allow light provided by the visual user feedback element (e.g. one or more lights/LEDs) within the device body to shine through.

[0071] The device may comprise a movement detection unit (e.g. an accelerometer) for detecting a movement of the device.

[0072] The device may include the controller.

[0073] The controller may be configured to identify an operation of the device; and control the one or more lights contained within the device body, (e.g. to illuminate the illumination region) based on the operation of the device identified.

[0074] The controller may be configured to control the haptic feedback generation unit to generate the haptic feedback in response to the detection of movement of the device by the movement detection unit.

[0075] A memory may be provided and may be operatively connected to the controller. The memory may include non-volatile memory. The memory may include instructions which, when implemented, cause the controller to perform certain tasks or steps of a method.

[0076] The device may comprise a wireless interface, which may be configured to communicate wirelessly with anotherdevice, for example a mobile device, e.g. via Bluetooth®. To this end, the wireless interface could include a Bluetooth® antenna. Other wireless communication interfaces, e.g. WiFi®, are also possible. The wireless interface may also be configured to communicate wirelessly with a remote server.

[0077] The device may comprise an airflow (i.e. puff) sensor that is configured to detect a puff (i.e. inhalation from a user). The airflow sensor may be operatively connected to the controller so as to be able to provide a signal to the controller that is indicative of a puff state (i.e. puffing or not puffing). The airflow sensor may, for example, be in the form of a pressure sensor or an acoustic sensor.

[0078] The controller may control power supply to a vaporiser in response to airflow detection by the sensor. The control may be in the form of activation of the vaporiser in response to a detected airflow.

[0079] The device may comprise an electrical connection (e.g. one or more contact pins) for connection of the power source to the vaporiser.

[0080] The device may comprise a chassis within the device body and one or more of the electrical components of the device (e.g. one or more of the power source, charging connection, visual feedback element, movement detection unit, haptic feedback generation unit, controller, memory, wireless interface, puff sensor and/or electrical connection) may be mounted on or affixed to the chassis.

[0081] In a second aspect, there is provided an aerosol delivery system comprising a device according to the first aspect and a component for containing an aerosol precursor.

[0082] The component may be an aerosol-delivery (e.g. a smoking substitute) consumable i.e. in some embodiments the component may be a consumable component for engagement with the aerosol-delivery (e.g. a smoking substitute) device to form the aerosol-delivery (e.g. smoking substitute) system.

[0083] The device may be configured to receive the consumable component. The device and the consumable component may be configured to be physically coupled together. For example, the consumable component may be at least partially received in a recess of the device (e.g. in a recess defined by the device housing). There may be a snap engagement between the device and the consumable component. Alternatively, the device and the consumable component may be physically coupled together by screwing one onto the other, or through a bayonet fitting.

[0084] Thus, the consumable component may comprise one or more engagement portions for engaging with

the device.

[0085] The device and consumable component may be coupled together by magnetic attraction. For example, the device may comprise at least one magnet whilst the component may comprise a magnet or ferrous plate.

[0086] The consumable component may comprise a vaporiser. The vaporiser may comprise a heating element. Alternatively, the vaporiser may comprise an ultrasonic or flow expansion unit, or an induction heating system.

[0087] The consumable component may comprise an electrical interface for interfacing with a corresponding electrical interface of the device. One or both of the electrical interfaces may include one or more electrical contacts. Thus, when the device is engaged with the consumable component, the electrical interface may be configured to transfer electrical power from the power source to the vaporiser (e.g. heating element) of the consumable component. The electrical interface may also be used to identify the consumable component from a list of known types. The electrical interface may additionally or alternatively be used to identify when the consumable component is connected to the device.

[0088] The device may alternatively or additionally be able to detect information about the consumable component via an RFID reader, a barcode or QR code reader. This interface may be able to identify a characteristic (e.g. a type) of the consumable. In this respect, the consumable component may include any one or more of an RFID chip, a barcode or QR code, or memory within which is an identifier and which can be interrogated via the interface.

[0089] In other embodiments, the component may be integrally formed with the aerosol-delivery (e.g. a smoking substitute) device to form the aerosol-delivery (e.g. smoking substitute) system.

[0090] In such embodiments, the aerosol former (e.g. e-liquid) may be replenished by re-filling a tank that is integral with the device (rather than replacing the consumable). Access to the tank (for re-filling of the e-liquid) may be provided via e.g. an opening to the tank that is sealable with a closure (e.g. a cap).

[0091] The smoking substitute system may comprise an airflow path therethrough, the airflow path extending from an air inlet to an outlet. The air inlet may be provided in the device body. The outlet may be at a mouthpiece portion of the component. In this respect, a user may draw fluid (e.g. air) into and along the airflow path by inhaling at the outlet (i.e. using the mouthpiece portion).

[0092] The airflow path passes the vaporiser between the air inlet and the outlet. The vaporiser may be provided in the component.

[0093] The airflow path may comprise a first portion extending from the air inlet towards the vaporiser. A second portion of the airflow path passes the vaporiser (e.g. over or around the vaporiser) to a conduit that extends to the outlet. The conduit may extend along the axial centre of the component.

[0094] References to "downstream" in relation to the airflow path are intended to refer to the direction towards the outlet/mouthpiece portion. Thus the second portion of the airflow path is downstream of the first portion of the airflow path. Conversely, references to "upstream" are intended to refer to the direction towards the air inlet. Thus the first portion of the airflow path (and the air inlet) is upstream of the second portion of the airflow path (and the outlet/mouthpiece portion).

[0095] References to "upper", "lower", "above" or "below" are intended to refer to the component when in an upright/vertical orientation i.e. with elongate (longitudinal/length) axis of the component vertically aligned and with the mouthpiece vertically uppermost.

[0096] The component may comprise a tank for housing the aerosol precursor (e.g. a liquid aerosol precursor). The aerosol precursor may comprise an e-liquid, for example, comprising a base liquid and e.g. nicotine. The base liquid may include propylene glycol and/or vegetable glycerine.

[0097] The conduit may extend through the tank with the conduit walls defining an inner region of the tank. In this respect, the tank may surround the conduit e.g. the tank may be annular.

[0098] As discussed above, the air flow path passes (e.g. passes over or around) the vaporiser between the air inlet and the outlet. The vaporiser may be within a vaporiser chamber which may form part of the airflow pathway.

[0099] The vaporiser may comprise a wick. The wick may form the base of the tank so that the aerosol precursor may be in contact with the wick. The wick may comprise one or more channels on its upper surface (facing the tank), the channels being in fluid communication with the tank.

[0100] The wick may have a length and width defining its upper surface with a depth aligned with the longitudinal axis of the component. Thus the upper surface and opposing lower surface of the wick may lie in respective planes that are perpendicular to the longitudinal axis of component and longitudinal to the first and third portions of the airflow path.

[0101] The wick may comprise a porous material e.g. a ceramic material. A portion of the wick e.g. at least a portion of the lower surface and/or at least a portion of at least one side wall extending between the upper and lower surface (in a depth direction) may be exposed to airflow in the second portion of the airflow path.

[0102] The heating element may be in the form of a heater track on the wick e.g. on the lower surface of the wick.

[0103] In other embodiments, the wick may be a cylindrical, porous wick e.g. formed of cotton or ceramic. It may be oriented so as to extend in the direction of the width dimension of the component (perpendicular to the longitudinal axis of the component). Thus the wick may extend in a direction perpendicular to the direction of airflow in the airflow path. Opposing ends of the wick may

protrude into the tank and a central portion (between the ends) may extend across the airflow path so as to be exposed to airflow. Thus, fluid may be drawn (e.g. by capillary action) along the wick, from the tank to the exposed portion of the wick. The heating element may be in the form of a filament wound about the wick (e.g. the filament may extend helically about the wick). The filament may be wound about the exposed portion of the wick.

[0104] The heating element may be electrically connected (or connectable) to the power source. Thus, in operation, the power source may supply electricity to (i.e. apply a voltage across) the heating element so as to heat the heating element. This may cause liquid stored in the wick (i.e. drawn from the tank) to be heated so as to form a vapour and become entrained in airflow along the airflow path. This vapour may subsequently cool to form an aerosol e.g. in the conduit.

[0105] In a third aspect there is provided a method of using the aerosol-delivery (e.g. smoking substitute) system according to the second aspect, the method comprising engaging the consumable component with an aerosol-delivery (e.g. smoking substitute) device (as described above) having a power source so as to electrically connect the power source to the consumable component (i.e. to the vaporiser of the consumable component).

[0106] The invention includes the combination of the aspects and preferred features described except where such a combination is clearly impermissible or expressly avoided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0107] So that further aspects and features thereof may be appreciated, embodiments will now be discussed in further detail with reference to the accompanying figures, in which:

- Fig. 1A is a front schematic view of a smoking substitute system;
- Fig. 1B is a front schematic view of a device of the system;
- Fig. 1C is a front schematic view of a component of the system;
- Fig. 2A is a schematic of the electrical components of the device;
- Fig. 2B is a schematic of the parts of the component;
- FIG. 3 is a further schematic of the component;
- Fig. 4 is a schematic illustrating feedback provided by the device for indicating a charge level of a power source of the device;
- Fig. 5 is a schematic illustrating further feedback provided by the device when a charging cable is inserted; and
- Fig. 6 is a schematic illustrating further feedback provided by the device when a component is inserted.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0108] Aspects and embodiments will now be discussed with reference to the accompanying figures. Further aspects and embodiments will be apparent to those skilled in the art.

[0109] Fig. 1A shows a first embodiment of a smoking substitute system 100. In this example, the smoking substitute system 100 includes a device 102 and a component 104. The component 104 may alternatively be referred to as a "pod", "cartridge" or "cartomizer". It should be appreciated that in other examples (i.e. open systems), the device may be integral with the component. In such systems, a tank of the aerosol delivery system may be accessible for refilling the device.

[0110] In this example, the smoking substitute system 100 is a closed system vaping system, wherein the component 104 includes a sealed tank 106 and is intended for single-use only. The component 104 is removably engageable with the device 102 (i.e. for removal and replacement). Fig. 1A shows the smoking substitute system 100 with the device 102 physically coupled to the component 104, Fig. 1B shows the device 102 of the smoking substitute system 100 without the component 104, and Fig. 1C shows the component 104 of the smoking substitute system 100 without the device 102.

[0111] The device 102 and the component 104 are configured to be physically coupled together by pushing the component 104 into a cavity at an upper end 108 of the device 102, such that there is an interference fit between the device 102 and the component 104. In other examples, the device 102 and the component may be coupled by screwing one onto the other, or through a bayonet fitting.

[0112] The component 104 includes a mouthpiece portion at an upper end 109 of the component 104, and one or more air inlets (not shown) in fluid communication with the mouthpiece portion such that air can be drawn into and through the component 104 when a user inhales through the mouthpiece portion. The tank 106 containing e-liquid is located at the lower end 111 of the component 104.

[0113] The lower end 110 of the device 102 also includes a light 116 (e.g. an LED) located behind a small translucent cover. The light 116 may be configured to illuminate when the smoking substitute system 100 is activated and/or when charging. Whilst not shown, the component 104 may identify itself to the device 102, via an electrical interface, RFID chip, or barcode.

[0114] The lower end 110 of the device 102 also includes a charging connection 115, which is usable to charge a battery within the device 102. The charging connection 115 can also be used to transfer data to and from the device, for example to update firmware thereon.

[0115] Figs. 2A and 2B are schematic drawings of the device 102 and component 104. As is apparent from Fig. 2A, the device 102 includes a power source 118, a controller 120, a memory 122, a wireless interface 124, an

electrical interface 126, and, optionally, one or more additional components 128.

[0116] The power source 118 is preferably a battery, more preferably a rechargeable battery. The controller 120 may include a microprocessor, for example. The memory 122 preferably includes non-volatile memory. The memory may include instructions which, when implemented, cause the controller 120 to perform certain tasks or steps of a method.

[0117] The wireless interface 124 is preferably configured to communicate wirelessly with another device, for example a mobile device, e.g. via Bluetooth®. To this end, the wireless interface 124 could include a Bluetooth® antenna. Other wireless communication interfaces, e.g. WiFi®, are also possible. The wireless interface 124 may also be configured to communicate wirelessly with a remote server.

[0118] The electrical interface 126 of the device 102 may include one or more electrical contacts. The electrical interface 126 may be located in a base of the aperture in the upper end 108 of the device 102. When the device 102 is physically coupled to the component 104, the electrical interface 126 is configured to transfer electrical power from the power source 118 to the component 104 (i.e. upon activation of the smoking substitute system 100).

[0119] The electrical interface 126 may also be used to identify the component 104 from a list of known components. For example, the component 104 may be a particular flavour and/or have a certain concentration of nicotine (which may be identified by the electrical interface 126). This can be indicated to the controller 120 of the device 102 when the component 104 is connected to the device 102. Additionally, or alternatively, there may be a separate communication interface provided in the device 102 and a corresponding communication interface in the component 104 such that, when connected, the component 104 can identify itself to the device 102.

[0120] The additional components 128 of the device 102 may comprise the light 116 discussed above.

[0121] The additional components 128 of the device 102 also comprises the charging connection 115 configured to receive power from the charging station (i.e. when the power source 118 is a rechargeable battery). This may be located at the lower end 110 of the device 102.

[0122] The additional components 128 of the device 102 may, if the power source 118 is a rechargeable battery, include a battery charging control circuit, for controlling the charging of the rechargeable battery. However, a battery charging control circuit could equally be located in a charging station (if present).

[0123] The additional components 128 of the device 102 may include a sensor, such as an airflow (i.e. puff) sensor for detecting airflow in the smoking substitute system 100, e.g. caused by a user inhaling through a mouthpiece portion 136 of the component 104. The smoking substitute system 100 may be configured to be activated when airflow is detected by the airflow sensor. This sensor could alternatively be included in the component 104. The airflow sensor can be used to determine, for example, how heavily a user draws on the mouthpiece or how many times a user draws on the mouthpiece in a particular time period.

[0124] The additional components 128 of the device 102 may include a user input, e.g. a button. The smoking substitute system 100 may be configured to be activated when a user interacts with the user input (e.g. presses the button). This provides an alternative to the airflow sensor as a mechanism for activating the smoking substitute system 100.

[0125] As shown in Fig. 2B, the component 104 includes the tank 106, an electrical interface 130, a vaporiser 132, one or more air inlets 134, a mouthpiece portion 136, and one or more additional components 138.

[0126] The electrical interface 130 of the component 104 may include one or more electrical contacts. The electrical interface 126 of the device 102 and an electrical interface 130 of the component 104 are configured to contact each other and thereby electrically couple the device 102 to the component 104 when the lower end 111 of the component 104 is inserted into the upper end 108 of the device 102 (as shown in Fig. 1A). In this way, electrical energy (e.g. in the form of an electrical current) is able to be supplied from the power source 118 in the device 102 to the vaporiser 132 in the component 104.

[0127] The vaporiser 132 is configured to heat and vaporise e-liquid contained in the tank 106 using electrical energy supplied from the power source 118. As will be described further below, the vaporiser 132 includes a heating filament and a wick. The wick draws e-liquid from the tank 106 and the heating filament heats the e-liquid to vaporise the e-liquid.

[0128] The one or more air inlets 134 are preferably configured to allow air to be drawn into the smoking substitute system 100, when a user inhales through the mouthpiece portion 136. When the component 104 is physically coupled to the device 102, the air inlets 134 receive air, which flows to the air inlets 134 along a gap between the device 102 and the lower end 111 of the component 104.

[0129] In operation, a user activates the smoking substitute system 100, e.g. through interaction with a user input forming part of the device 102 or by inhaling through the mouthpiece portion 136 as described above. Upon activation, the controller 120 may supply electrical energy from the power source 118 to the vaporiser 132 (via electrical interfaces 126, 130), which may cause the vaporiser 132 to heat e-liquid drawn from the tank 106 to produce a vapour which is inhaled by a user through the mouthpiece portion 136.

[0130] An example of one of the one or more additional components 138 of the component 104 is an interface for obtaining an identifier of the component 104. As discussed above, this interface may be, for example, an RFID reader, a barcode, a QR code reader, or an electronic interface which is able to identify the component.

The component 104 may, therefore include any one or more of an RFID chip, a barcode or QR code, or memory within which is an identifier and which can be interrogated via the electronic interface in the device 102.

[0131] It should be appreciated that the smoking substitute system 100 shown in figures 1A to 2B is just one exemplary implementation of a smoking substitute system. For example, the system could otherwise be in the form of an entirely disposable (single-use) system or an open system in which the tank is refillable (rather than replaceable).

[0132] Fig. 3 is a schematic view of an example of the component 104 described above. The component 104 comprises a tank 106 for storing e-liquid, a mouthpiece portion 136 and a conduit 140 extending along a longitudinal axis of the component 104. In the illustrated embodiment the conduit 140 is in the form of a tube having a substantially circular transverse cross-section (i.e. transverse to the longitudinal axis). The tank 106 surrounds the conduit 140, such that the conduit 140 extends centrally through the tank 106.

[0133] A component housing 142 defines an outer casing of the component 104. The component housing 142 extends from a lower shell 158 at the lower end 111 of the component 104 to the mouthpiece portion 136 at the upper end 109 of the component 104. The component housing may define a lip or shoulder which acts as a stop feature when the component 104 is inserted into the device 102 (i.e. by contact with an upper edge of the device 102).

[0134] The tank 106, the conduit 140 and the mouthpiece portion 136 are integrally formed with each other so as to form a single unitary component and may e.g. be formed by way of an injection moulding process. Such a component may be formed of a thermoplastic material.

[0135] The mouthpiece portion 136 comprises a mouthpiece aperture 148 defining an outlet of the conduit 140. The vaporiser 132 is downstream of the inlet 134 of the component 104 and is fluidly connected to the mouthpiece aperture 148 (i.e. outlet) by the conduit 140.

[0136] In some embodiments, the vaporiser 132 comprises a porous ceramic wick and a heater track (not shown) printed onto the bottom surface (facing the inlet 34) of the ceramic wick.

[0137] The vaporiser 132 forms the base of the tank 106 so that the aerosol precursor is in contact with the wick and liquid aerosol precursor can move axially into the wick.

[0138] In other embodiments, the vaporiser 132 comprises a porous cylindrical wick with a coiled heating filament, the wick extending into an annular portion of the tank surrounding the vaporiser so that liquid aerosol precursor can move radially into the wick.

[0139] The aerosol precursor is heated by the heater track or heating filament (when activated e.g. by detection of inhalation), which causes the aerosol precursor to be vaporised and to be entrained in air flowing past the wick. This vaporised liquid may cool to form an aerosol in the conduit 140, which may then be inhaled by a user.

[0140] The lower shell 158 of the component housing 142 has an opening that accommodates the electrical interface 119 of the consumable component 102 comprising two electrical contacts 136a, 136b that are electrically connected to the heater track. In this way, when the consumable component 104 is engaged with the device 102, power can be supplied from the power source 118 of the device to the heater track/heating filament.

[0141] Fig. 4 is a schematic illustrating feedback provided by the device 102 to the user, for indicating a charge level of the power source 118. The device 102 may comprise two LEDs 116a, 116b, and a haptic feedback generation unit. The LEDs 116a, 116b may be RGB LEDs.

[0142] A plurality of predefined charge status thresholds may be stored in memory 122. The example shown in Fig. 4 includes 4 thresholds; e.g. 75%, 50%, 25% and 10% charge status.

[0143] Each time the current charge status of the power source 118 falls below a predefined threshold, the controller may control the haptic feedback generation unit to provide haptic feedback (e.g. to vibrate).

[0144] The controller may also be configured to control the LEDs 116a, 116b to provide visual feedback indicating a current charge status of the power source. When the current charge status is above the first, highest predefined threshold (e.g. above 75%) the two LEDs 116a, 116b may be configured to emit blue light (see e.g. state 200a of Fig. 3). When the current charge status is between the first and second predefined thresholds (e.g. between 75% and 50%), the two LEDs 116a, 116b may be configured to emit amber light (see e.g. state 200b of Fig. 3). When the current charge status is between the second and third predefined thresholds (e.g. between 50% and 25%), one of the LEDs 116a may be configured to turn off, and the other LED 116b may be configured to emit amber light (see e.g. state 200c of Fig. 3). When the current charge status is between the third and fourth predefined thresholds (e.g. between 25% and 10%) the two LEDs 116a, 116b may be configured to emit red light (see e.g. state 200d of Fig. 3). When the current charge status is below the fourth predefined threshold (e.g. less than 10%), one of the LEDs 116a may be configured to turn off, and the other LED 116b may be configured to emit red light (see e.g. state 200e of Fig. 3).

[0145] The state of the LEDs 116a, 116b may change as the current charge status of the power source 118 falls below each predefined threshold.

[0146] Accordingly, the user is continually/frequently provided with feedback of the current charge status of the power source 118, and the haptic feedback provides additional feedback to the user when each predefined threshold is passed. The user is also made aware each time that the charge status drops below a predefined threshold. As such, the user is provided with advance warning of when the device will run out of power.

[0147] As mentioned above, the device 102 comprises

a charging connection 115 such as a USB port. Fig. 5 is a schematic illustrating feedback provided by the device 102 when a charging cable connected to an external power source is connected to the charging connection 115 such that the power source 118 is charged.

[0148] State 210a illustrates the device when a charging cable 215 is not connected to the charging connection 115. The LEDs 116a, 116b (described above with reference to Fig. 4) may not emit light in this state.

[0149] For completeness, in some examples, the device may comprise only a single LED 116, rather than two LEDs.

[0150] When the charging cable 215 is first attached to the charging connection 115 (e.g. state 210b), the controller may be configured to control the haptic feedback generation unit to provide haptic feedback (e.g. a vibration) to indicate that the charging cable 215 is correctly inserted such that the power supply 188 is charging. The haptic feedback generation unit may also provide haptic feedback (e.g. a vibration) when the power supply 118 is fully charged.

[0151] The one or more LEDs may also provide feedback indicating a current charge level of the power supply 118 when the charging cable is first attached to the charging connection 115 and also whilst the charging cable remains attached to the charging connection 115 (see e. g. state 210b-210e). In the example shown in Fig. 5, the one or more LEDs emit red light if the current charge status of the power supply is below a lower predefined threshold (e.g. below 25%), see e.g. state 210b of Fig. 5. The one or more LEDs emit amber light if the current charge status of the power supply is between the lower predefined threshold and a higher predefined threshold (e.g. between 25% and 50%), see e.g. state 210c of Fig. 5. The one or more LEDs emit blue light if the current charge status of the power supply is above the higher predefined threshold (e.g. above 50%), see e.g. state 210d of Fig. 5.

[0152] When the current charge level of the power supply reaches full charge (e.g. 100%) the one or more LEDs may emit white light, see e.g. state 210e of Fig. 5. As mentioned above, the haptic feedback generation unit may also provide haptic feedback too. The one or more LEDs may emit the white light for a predefined period, e. g. 5 minutes. Once the predefined period has passed since the power supply has reached full charge, the one or more LEDs may switch off, see e.g. state 210f of Fig. 5. If the charging cable is detached and reattached to the charging connection 115, the LEDs may be configured to switch back on to indicate the current charge status (e.g. to emit white light if the power supply 118 is fully charged).

[0153] The device 102 may also provide feedback when a component 104 is inserted into the device 102. This feedback is illustrated in a schematic shown in FIG. 6.

[0154] State 220a illustrates the system in the state where a consumable component 104 is not received in the device 102. The one or more LEDs 116a, 116b (described above with reference to Fig. 4) may not emit light in this state.

[0155] When the consumable component 104 is first received in the device 102 (e.g. inserted), the controller may be configured to control the haptic feedback generation unit to provide haptic feedback (e.g. a vibration) to indicate that the consumable component is correctly inserted.

[0156] The one or more LEDs may also provide feedback indicating a current charge level of the power supply 118 when the consumable component 104 is inserted (see e.g. states 220b-220d). For example, when the consumable component 104 is inserted when the current charge status of the power supply 118 is above a higher predefined threshold, the one or more LEDs may be configured to emit blue light (see e.g. state 220b of Fig. 6). When the consumable component is inserted when the current charge status of the power supply 118 is between the higher predefined threshold and a lower predefined threshold, the one or more LEDs may be configured to emit amber light (see e.g. state 220c of Fig. 6). When the consumable component is inserted when the current charge status of the power supply is below the lower predefined threshold, the one or more LEDs may be configured to emit red light (see e.g. state 220d of Fig. 6).

[0157] Accordingly, the user is frequently provided with feedback indicating the charge status of the power source 118 during use. For example, feedback indicating the charge status is provided (i) when a consumable component is inserted, (ii) when a charging cable is inserted; and/or (iii) when the power source charge level falls below predefined thresholds. As such, improved communication of the power source charge status to the user is provided.

[0158] For completeness, the colours of light set out above are an example; other colours may be used to indicate the different charge statuses of the device. Furthermore, in some examples, the different charge statuses of the power supply may be indicated by different light intensities and/or different flashing patterns, instead or in addition to different colours.

[0159] While exemplary embodiments have been described above, many equivalent modifications and variations will be apparent to those skilled in the art when given this disclosure. Accordingly, the exemplary embodiments set forth above are considered to be illustrative and not limiting.

[0160] Throughout this specification, including the claims which follow, unless the context requires otherwise, the words "have", "comprise", and "include", and variations such as "having", "comprises", "comprising", and "including" will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

[0161] It must be noted that, as used in the specification and the appended claims, the singular forms "a," "an,"

and "the" include plural referents unless the context clearly dictates otherwise. Ranges may be expressed herein as from "about" one particular value, and/or to "about" another particular value. When such a range is expressed, another embodiment includes from the one particular value and/or to the other particular value. Similarly, when values are expressed as approximations, by the use of the antecedent "about," it will be understood that the particular value forms another embodiment. The term "about" in relation to a numerical value is optional and means, for example, +/- 10%.

[0162] The words "preferred" and "preferably" are used herein refer to embodiments of the invention that may provide certain benefits under some circumstances. It is to be appreciated, however, that other embodiments may also be preferred under the same or different circumstances. The recitation of one or more preferred embodiments therefore does not mean or imply that other embodiments are not useful, and is not intended to exclude other embodiments from the scope of the disclosure, or from the scope of the claims.

Claims

1. An aerosol delivery device, comprising:

a power source;
a user feedback element; and
a controller, wherein the controller is configured to control the user feedback element to:

provide a first feedback when the charge status of the power source drops below a first threshold; and
provide a second feedback when the charge status of the power source drops below a second threshold lower than the first threshold, wherein the first feedback is different from the second feedback.

2. An aerosol delivery device according to claim 1, wherein the user feedback element comprises a visual user feedback element.

3. An aerosol delivery device according to claim 2, wherein the first feedback and second feedback comprise different colour light.

4. An aerosol delivery device according to claim 3, wherein the first feedback is amber light and the second feedback is red light.

5. An aerosol delivery device according to any of claims 2-4, wherein the first feedback and second feedback comprise light of different intensities.

6. An aerosol delivery device according to any of claims 2-5, further comprising a haptic feedback generation unit, wherein the controller is configured to control the haptic feedback generation unit to provide haptic feedback when the charge status of the power source drops below the first threshold and/or the second threshold.

7. An aerosol delivery device according to any preceding claim, wherein the controller is configured to control the user feedback element to provide a third feedback when the charge status of the power device drops below a third threshold lower than the second threshold, wherein the third feedback is different from the first feedback and the second feedback.

8. An aerosol delivery device according to any preceding claim, wherein the controller is configured to control the user feedback element to:

continually provide the first feedback when the charge status of the power source is between the first and second threshold; and
continually provide the second feedback when the charge status of the power source is lower than the second threshold.

9. An aerosol delivery device according to any preceding claim, wherein the controller is configured to control the user feedback element to continually provide a fourth feedback when the charge status of the power source is greater than the first threshold, wherein the fourth feedback is different from the first feedback and the second feedback.

10. An aerosol delivery device according to any preceding claim, further comprising a charging connection port for connection to an external power supply for recharging of the power source, wherein the controller is configured to, when a charging cable is connected to the charging connection port, control the user feedback element to:

provide the first feedback when a current charge status of the power source is between the first threshold and the second threshold; and
provide the second feedback when a current charge status of the power source is below the second threshold.

11. An aerosol delivery device according to any preceding claim, further comprising:

a charging connection port for connection to an external power supply for recharging of the power source; and
a haptic feedback generation unit, wherein the controller is configured to control the haptic feedback generation unit to provide haptic feedback

when a charging cable is connected to the charging connection port.

12. An aerosol delivery device according to any preceding claim, wherein the controller is configured to, when the power source reaches full charge, control the user feedback element to provide a fifth feedback.

13. An aerosol delivery device according to any preceding claim, wherein the aerosol delivery device is configured to receive a consumable component for containing an aerosol precursor, wherein the controller is configured to, when a consumable component is received by the aerosol delivery device, control the user feedback element to:

provide the first feedback when a current charge status of the power source is between the first threshold and the second threshold; and
provide the second feedback when a current charge status of the power source is below the second threshold.

14. An aerosol delivery device according to any preceding claim, comprising a haptic feedback generation unit, wherein:

the aerosol delivery device is configured to receive a consumable component for containing an aerosol precursor; and
the controller is configured to control the haptic feedback generation unit to provide haptic feedback when a consumable component is received by the aerosol delivery device.

15. An aerosol delivery system comprising a device according to any one of the preceding claims and a component comprising an aerosol precursor.

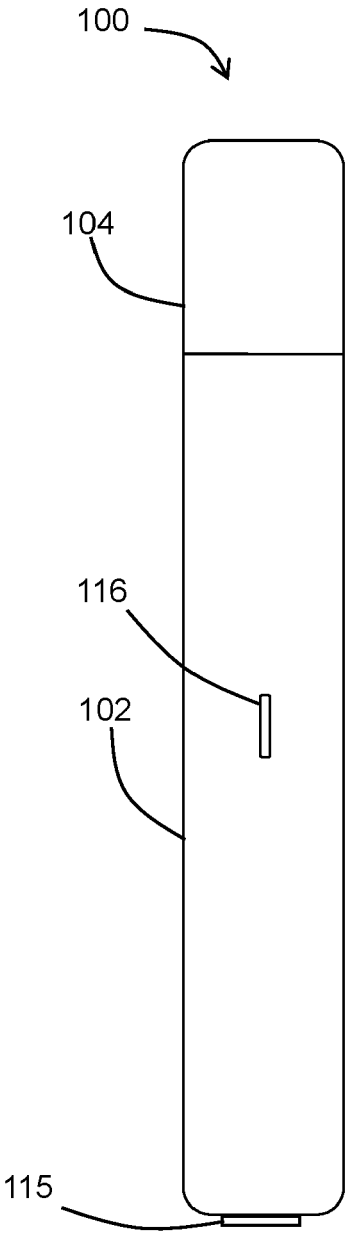

FIG 1A

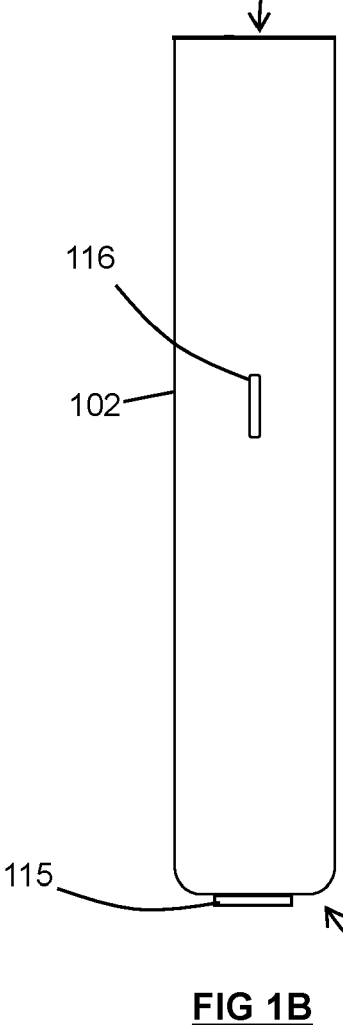

FIG 1B

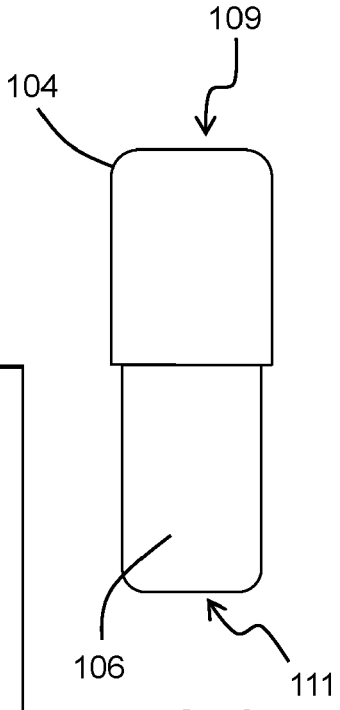

FIG 1C

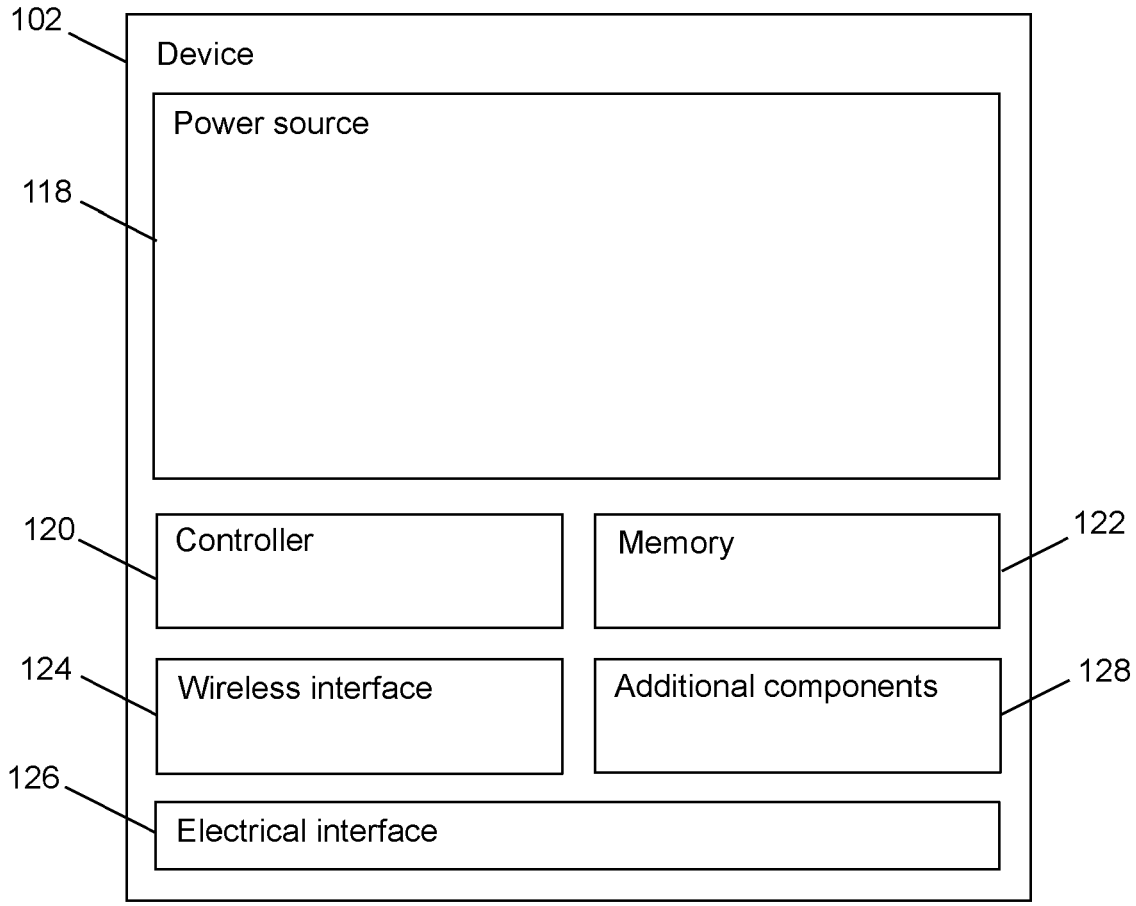
102
Device
Power source
118
120
Controller
Memory
122
124
Wireless interface
Additional components
128
126
Electrical interface

FIG 2A

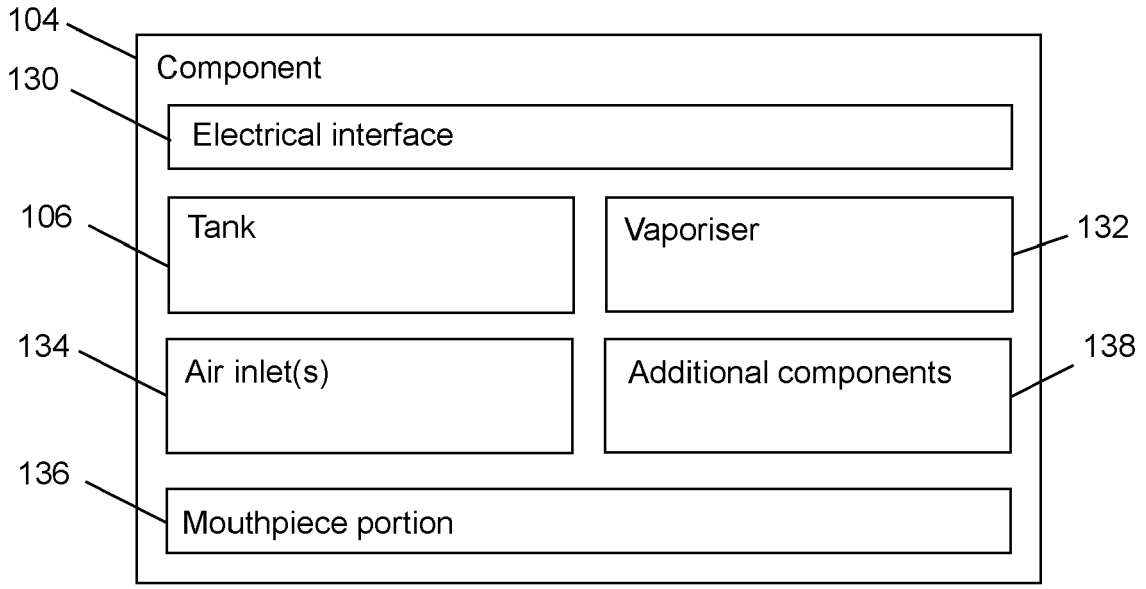
104
Component
130
Electrical interface
106
Tank
Vaporiser
132
134
Air inlet(s)
Additional components
138
136
Mouthpiece portion

FIG 2B

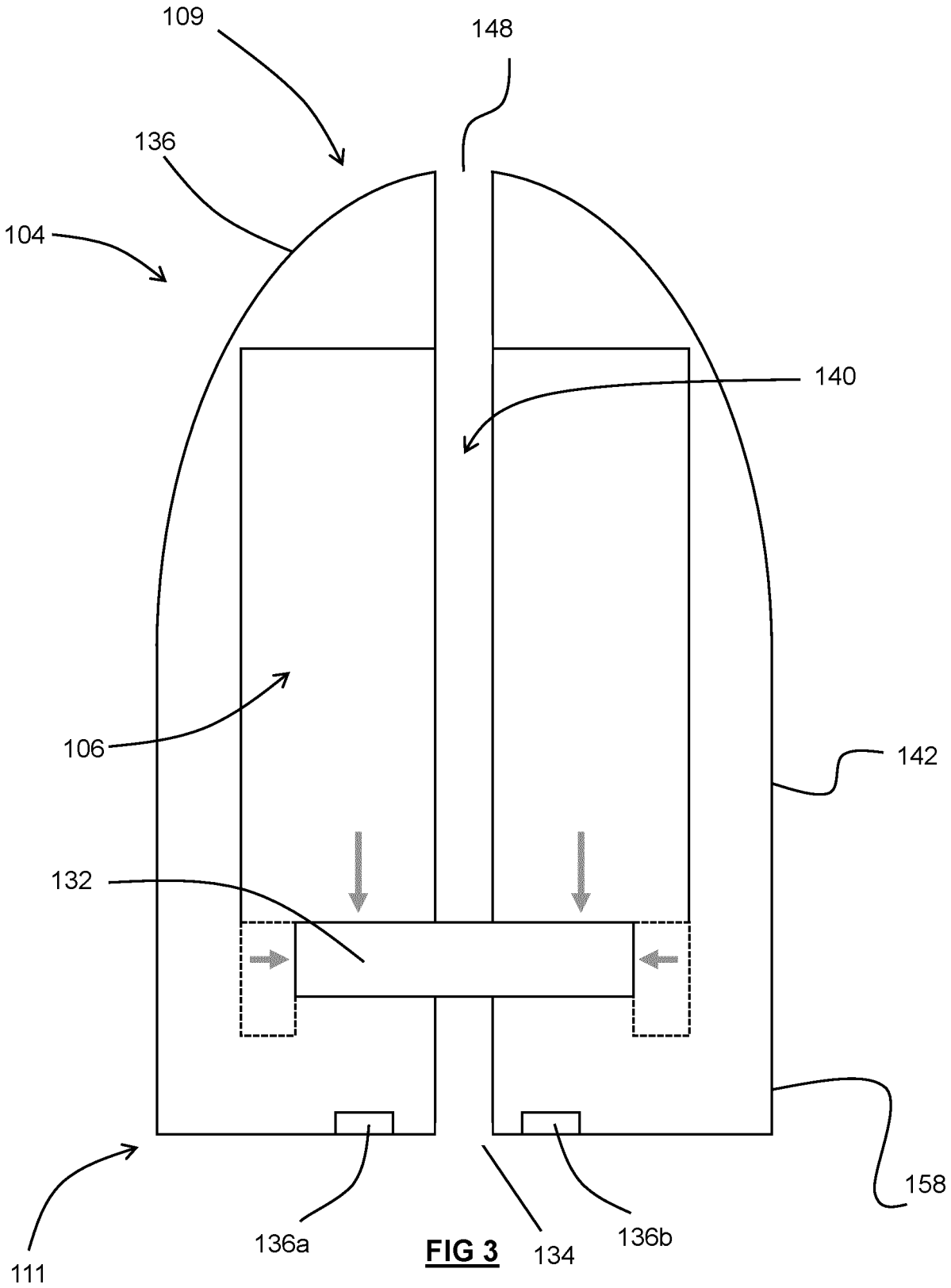

FIG 3

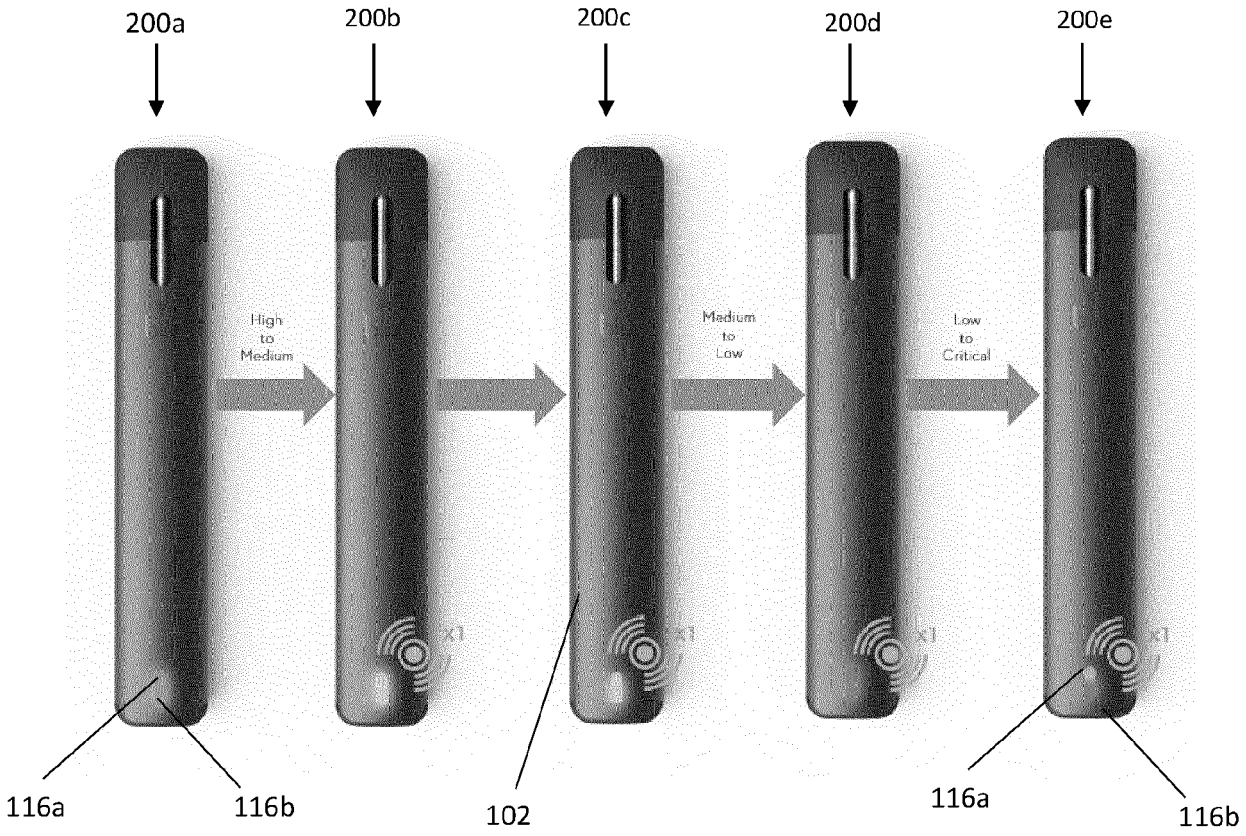
200a
200b
200c
200d
200e
High to Medium
Medium to Low
Low to Critical
116a
116b
102
116a
116b

FIG 4

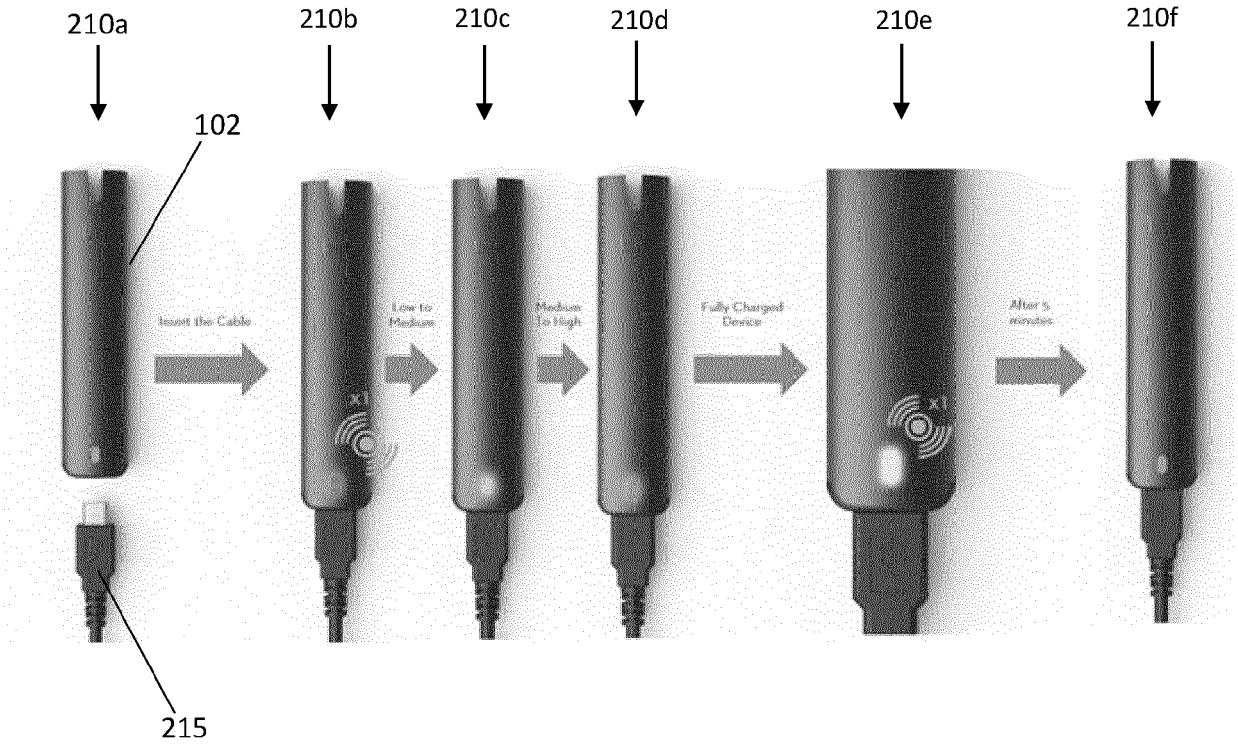
210a
210b
210c
210d
210e
210f
102
Insert the Cable
Low to Medium
Medium to High
Fully Charged Device
After 5 minutes
x1
215

FIG 5

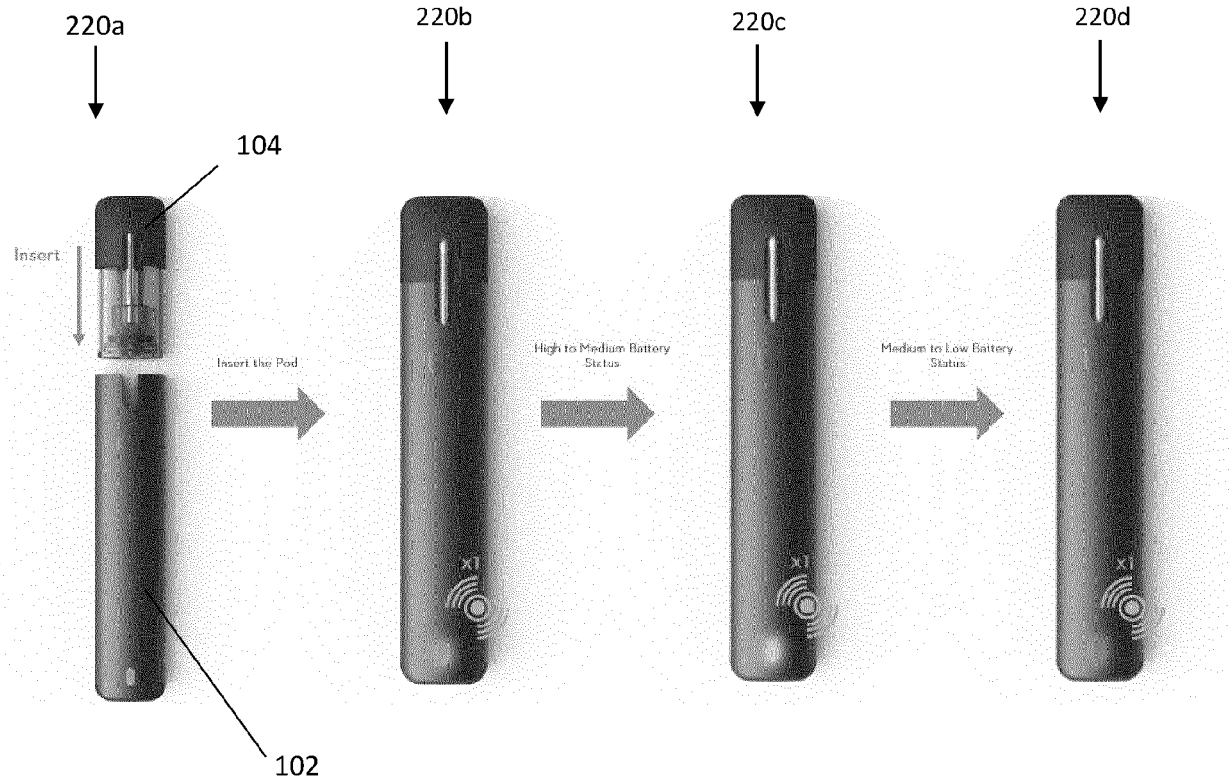
220a
220b
220c
220d
104
Insert
Insert the Pod
High to Medium Battery Status
Medium to Low Battery Status
102

FIG 6

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 21 21 5057

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	US 2015/272223 A1 (WEIGENSBERG AARON ARYE [IL] ET AL) 1 October 2015 (2015-10-01) * abstract * * figures 1-4 * * claims 1-24 * * paragraphs [0046], [0053] - [0073] *	1-4,6-8, 13-15	INV. A24F40/60 A24F40/50 A24F40/53
X	WO 2021/116687 A1 (NICOVENTURES TRADING LTD [GB]) 17 June 2021 (2021-06-17) * abstract * * figures 1-10 * * page 9 - page 18 *	1-5, 7-10, 12-15	
X	EP 3 838 019 A1 (NERUDIA LTD [GB]) 23 June 2021 (2021-06-23) * abstract * * figures 1-9 * * paragraphs [0048] - [0055], [0112], [0113], [0162] - [0170] *	1-6, 11-15	
X	US 2020/245688 A1 (YAMADA MANABU [JP] ET AL) 6 August 2020 (2020-08-06) * abstract * * figures 1-19 * * paragraphs [0072], [0085], [0096] - [0120], [0140], [0156], [0217] - [0227] *	1-3, 5-10, 13-15	TECHNICAL FIELDS SEARCHED (IPC) A24F
X	WO 2017/205838 A1 (PAX LABS INC [US]) 30 November 2017 (2017-11-30) * abstract * * figures 1-16 * * paragraphs [0024], [0125], [0133], [0153] - [0155] *	1-4,6,7, 9,12-15	

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 May 2022	Juvenelle, Cyril

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 21 21 5057

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 May 2022	Juvenelle, Cyril

CATEGORY OF CITED DOCUMENTS

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L : document cited for other reasons

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