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(54) **AEROSOL-DELIVERY DEVICE/SYSTEM AND METHOD**

(57) The present disclosure relates to an aerosol-delivery device (102) and system (100) e.g. a smoking substitute device (102) and system (100). In particular an aerosol-delivery device (102) comprising: a user feedback element; and a controller (120). The controller (120) is coupled, or couplable, to: an airflow sensor configured to detect a user inhalation pattern when a user draws air through the device (102) and communicate said user inhalation pattern to the controller (120); and a vaporiser configured to produce an aerosol for user inhalation. The controller (120) is configured to: determine whether the user inhalation pattern corresponds to a predefined inhalation pattern; switch the device (102) from a locked mode, in which power cannot be provided to the vaporiser, to an unlocked mode, in which power can be provided to the vaporiser, only if the user inhalation pattern corresponds to the predefined inhalation pattern; provide user feedback to the user via the user feedback element when the user inhalation pattern corresponds to the predefined inhalation pattern; and switch the device (102) from the unlocked mode to the locked mode if a predefined period of time has elapsed since a previous user interaction with the device (102). The present disclosure further relates to a method of unlocking and locking an aerosol-delivery device (102).

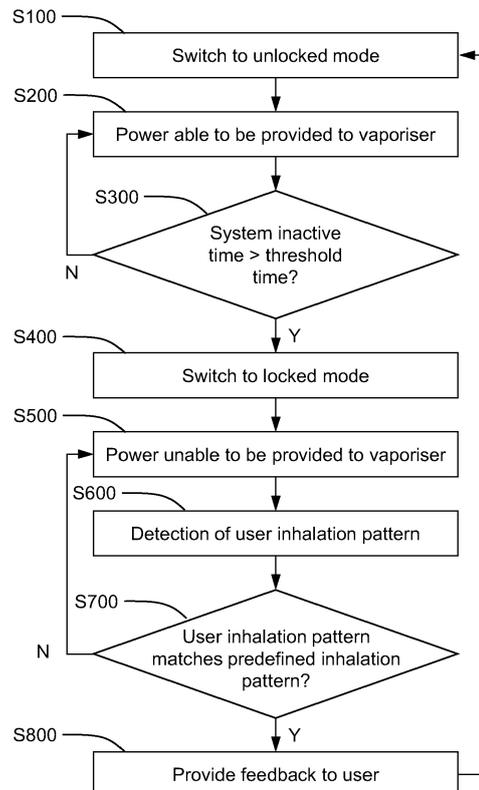


FIG 3

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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. The present disclosure further relates to a method of unlocking and locking an aerosol-delivery device.

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] 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.

[0008] 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.

[0009] A typical vaping smoking substitute system includes a mouthpiece, a power source (typically a bat-

tery), 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.

[0010] 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.

[0011] 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.

[0012] 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.

[0013] 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.

[0014] 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.

[0015] 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.

[0016] 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.

[0017] 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.

[0018] It is desired to prevent the device being used by unwanted users, such that if the device is lost or stolen it cannot be easily used. However, it is also desired that the device can be easily activated and used by the intended user.

[0019] Furthermore, known devices and systems are also prone to accidental activation in certain environmental conditions where it is not appropriate for the devices and systems to activate (e.g. in a pocket of a user, on a plane). Preventing such accidental activation is also desired.

[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 user feedback element; and

a controller, wherein the controller is coupled, or coupleable, to:

an airflow sensor configured to detect a user inhalation pattern when a user draws air through the device and to communicate said user inhalation pattern to the controller; and

a vaporiser configured to produce an aerosol for user inhalation, and

wherein the controller is configured to:

determine whether the user inhalation pattern corresponds to a predefined inhalation pattern;

switch the device from a locked mode, in which power cannot be provided to the vaporiser, to an unlocked mode, in which power can be provided to the vaporiser, only if the user inhalation pattern corresponds to the predefined inhalation pattern;

provide user feedback to the user via the user feedback element when the user inhalation pattern corresponds to the predefined inhalation pattern; and

switch the device from the unlocked mode to the locked mode if a predefined period of time has elapsed since a previous user interaction with the device.

[0022] Advantageously, such an aerosol-delivery device can lock in order to prevent activation by unwanted users and accidental activation, whilst still allowing the intended user to easily unlock the device for use.

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

[0024] The device may comprise the airflow (i.e. puff) sensor. The airflow sensor may be disposed in an airflow path through the aerosol-delivery device.

[0025] Alternatively, the airflow sensor may be disposed in an airflow path through a component (e.g. an aerosol precursor-containing component) that is coupled, or coupleable, to the aerosol-delivery device. Where the component is intended to be disposable and/or has a shorter intended lifetime than the aerosol-delivery device (i.e. the component is a consumable component), disposing the airflow sensor in the aerosol-delivery device is beneficial in avoiding the disposal of the airflow sensor with the component when said airflow sensor is still functional.

[0026] The airflow sensor may, for example, be in the form of a pressure sensor or an acoustic sensor.

[0027] The vaporiser may comprise a heating element e.g. a resistive heating element. The heating element may be a wire (e.g. a resistive wire) or it may be a rod or blade. Alternatively, the vaporiser may comprise an ultrasonic or flow expansion unit, or an induction heating system.

[0028] The aerosol-delivery device may comprise the vaporiser e.g. the device may comprise a heating rod or

heating blade for insertion into an aerosol generating substrate.

[0029] Alternatively, the vaporiser may be in the aerosol precursor-containing component that is coupled, or couplable, to the aerosol-delivery device.

[0030] The device may comprise a 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. The device may comprise a charging connection for connection to an external power supply for recharging of the power source within the device. The device may comprise an electrical connection (e.g. one or more contact pins) for connection of the power source to the vaporiser.

[0031] The coupling of the controller to the airflow sensor and/or the vaporiser may be via a physical electrical connection or via a wireless connection (e.g. via a wireless interface in the device).

[0032] The user feedback element may comprise one or more of: a visual feedback element, a haptic feedback element (e.g. an electric motor and a weight mounted eccentrically on a shaft of the electric motor), and an auditory feedback element. The visual feedback element may comprise a light, such as a light emitting diode. The visual feedback element may be configured to emit different colours.

[0033] The device may comprise a device body for housing the power source and/or other electrical components. The front and/or rear surface of the device body may include at least one visual user feedback element, for example one or more lights e.g. one or more LEDs.

[0034] The device may further comprise a memory. The memory may include non-volatile memory. The memory may be operatively connected to the controller. The memory may store instructions which, when implemented, cause the controller to perform certain tasks or steps of a method. The memory may store the predefined inhalation pattern.

[0035] The controller is configured to determine whether the user inhalation pattern communicated to it from the airflow sensor corresponds to a predefined inhalation pattern.

[0036] The predefined inhalation pattern may be variable i.e. the predefined inhalation pattern may change between successive unlockings of the device. The controller may be configured to select or generate a new predefined inhalation pattern between successive unlockings.

[0037] The memory may be configured to store a plurality of candidate inhalation patterns; and the controller may be configured to select a candidate inhalation pattern from the memory as the predefined inhalation pattern e.g. it may select a candidate inhalation pattern when or after the device is switched to the locked mode. The selection of a candidate inhalation pattern as the predefined inhalation pattern may be a random selection or a sequential selection from the plurality of candidate inhalation patterns.

[0038] The controller may be configured to generate an inhalation pattern as the predefined inhalation pattern e.g. it may generate an inhalation pattern when or after the device is switched from the unlocked mode to the locked mode. The generated inhalation pattern may be a randomly generated inhalation pattern.

[0039] The changing of the predefined inhalation pattern between successive unlockings avoids an unintended user being able to determine how to unlock the device merely by observing the inhalations of the intended user on unlocking the device, since the predefined inhalation pattern will change each time the device enters the locked mode.

[0040] The device may be configured to communicate the predefined inhalation pattern to the user via the user feedback element. Advantageously, this avoids the user needing to remember the predefined inhalation pattern, since the device is able to provide it to the user via the user feedback element when the device is in the locked mode.

[0041] Where the predefined inhalation pattern is communicated to the user, the controller may be configured such that the user is required to draw air through the device in sequence with each inhalation within the communicated predefined inhalation pattern (i.e. simultaneously with the predefined inhalation pattern being communicated to the user via the user feedback element) or may be configured such that the user is required to puff on the device in a manner corresponding to the communicated predefined inhalation pattern after the conclusion of the communication of the entirety of the predefined inhalation pattern to the user. The first option may make it easier for the user to unlock the device, since they do not need to memorise the predefined inhalation pattern - they can just copy the predefined inhalation pattern as it is being communicated to them via the feedback element. However, the second option may make the device more secure, since the need to memorise the predefined inhalation pattern may make it harder for an unintended user to unlock the device.

[0042] Alternatively, the predefined inhalation pattern may not be communicated to the user via the user feedback element and the user may be required to remember the predefined inhalation pattern provided to them in, for example, documentation provided with the device. This may further improve the security of the device, since it is not possible for an unintended user that expects to be provided with the predefined inhalation pattern via the user feedback element to unlock the device.

[0043] The user inhalation pattern may comprise a pattern of one or more attributes relating to one or more detected user inhalations. Advantageously, the user inhalation pattern comprises a pattern of one or more attributes (preferably a plurality of attributes) relating to two or more detected user inhalations as this may make the device more secure, since the probability of the user inhalation pattern inadvertently corresponding to the predefined inhalation pattern is reduced as the number of

detected user inhalations and/or number of attributes increases. The one or more attributes may include one or more of: the elapsed time between detected user inhalations, the duration of detected user inhalations, and the intensity/strength of detected user inhalations.

[0044] The intensity/strength of a detected user inhalation may be understood as the flowrate or pressure difference from the ambient pressure generated the inhalation, which may correspond to the magnitude of the signal detected by the airflow sensor.

[0045] The predefined inhalation pattern may be defined by point values of one or more predefined inhalation pattern attributes. The one or more predefined inhalation pattern attributes may include one or more of: a number of inhalations, a duration of each inhalation, an elapsed time between each inhalation and an intensity of each inhalation. Using several different attributes to define the predefined inhalation pattern makes the device more secure, since the probability of the user inhalation pattern inadvertently corresponding to the predefined inhalation pattern is reduced as the number of different attributes defining the predefined inhalation pattern increases.

[0046] The determination of whether a user inhalation pattern corresponds to a predefined inhalation pattern may comprise a comparison of the values of one or more attributes defining the user inhalation pattern with the values of one or more respective predefined inhalation pattern attributes defining the predefined inhalation pattern. Each of the comparisons may involve applying a threshold range to the predefined inhalation pattern attributes of the predefined inhalation pattern, wherein if the respective attribute of the user inhalation pattern falls within the threshold range of the predefined inhalation pattern attribute value, the determination for that attribute is positive (i.e. the value of that attribute of the user inhalation pattern is found to correspond to the value of the respective predefined inhalation pattern attribute in the predefined inhalation pattern). Correspondence of the user inhalation pattern to the predefined inhalation pattern may require one or more, or all, of the attributes of the user inhalation pattern to be found to correspond to the respective predefined inhalation pattern attributes.

[0047] The controller is configured to switch the device from the locked mode to the unlocked mode in response to receiving a user inhalation pattern from the airflow sensor only if the user inhalation pattern corresponds to the predefined inhalation pattern. That is, if the controller receives a user inhalation pattern that does not correspond to the predefined inhalation pattern, the controller does not switch the device from the locked mode into the unlocked mode. Nevertheless, alternative methods of switching the device from the locked mode into the unlocked mode may be provided in addition to determining correspondence between the user inhalation pattern and the predefined inhalation pattern

[0048] Once in the unlocked mode, power can be provided (from the power supply) to the vaporiser.

[0049] The airflow sensor may be configured to provide

a signal to the controller that indicates a smoking puff i.e. a user drawing air through device when the device is in the unlocked mode (in addition to communicating the detected user inhalation pattern to the controller when a user draws air through the device when the device is in the locked mode).

[0050] The controller may be configured to control power supplied to the vaporiser in response to the detection of the smoking puff. Accordingly, the device can provide power to the vaporiser only in response to a smoking puff when it is in the unlocked mode (i.e. the device entering the unlocked mode is independent of the device supplying power to the vaporiser).

[0051] If the controller does not switch the device from the locked mode into the unlocked mode in response to receiving a user inhalation pattern from the airflow sensor because the user inhalation pattern does not correspond to the predefined inhalation pattern, the controller may be further configured to provide user feedback via the user feedback element. The user feedback when the user inhalation pattern does not correspond to the predefined inhalation pattern may be different to the user feedback when the user inhalation pattern corresponds to the predefined inhalation pattern. This allows the user to be provided with a prompt in response to failing to unlock the device. This prompt may, for example, be an indication to inhale on the device again to provide another user inhalation pattern and/or information as to what the predefined inhalation pattern is.

[0052] The user feedback when the user inhalation pattern does not correspond to the predefined inhalation pattern will differ from the user feedback when the user inhalation pattern corresponds to the predefined inhalation pattern. This difference may be in the form of the feedback (for example, visual feedback when the user inhalation pattern does not correspond to the predefined inhalation pattern and haptic or auditory feedback when the user inhalation pattern corresponds to the predefined inhalation pattern). Alternatively, where the form of the feedback is the same for correspondence and non-correspondence of the user inhalation pattern (for example, both visual feedback) with the predefined inhalation pattern, the feedback may differ in manners specific to that form of feedback (for example, where user feedback is visual, the feedback for correspondence of the user inhalation pattern with the predefined inhalation pattern may differ in colour from the feedback for non-correspondence of the user inhalation pattern with the predefined inhalation pattern).

[0053] The controller is configured to switch the device from the unlocked mode to the locked mode if a predefined period of time has elapsed since a previous user interaction with the device. The predefined period of time after which the device is switched from the unlocked mode to the locked mode may be specified in firmware of the device or in software of the device. Specifying the predefined period of time in the device software may allow the user to adjust the predefined period of time.

[0054] The previous user interaction with the device may comprise a previous user inhalation. Advantageously, this allows the user interactions with the device to be detected using the airflow sensor. Additionally, or alternatively, where the device comprises a user input interface, e.g. a button and/or an accelerometer, the previous user interaction with the device may comprise a previous user input to the user input interface. Advantageously, this can prevent the device from entering the locked mode when the user is still interacting with the device but is not using the device to smoke (i.e. is not puffing on the device).

[0055] The controller may be configured to provide user feedback via the user feedback element once the device is switched from the unlocked mode to the locked mode. Advantageously, this informs the user that the device is locked and that they will need to provide a user inhalation pattern to unlock the device for use.

[0056] The user feedback provided on the switching of the device from the unlocked mode to the locked mode may differ from the user feedback provided in response to other events in the form of the feedback, for example, the user feedback on switching from the unlocked mode to locked mode may be via a visual feedback element and the user feedback provided in response to other events may be via a haptic feedback element. Alternatively, where the form of the feedback is the same for the switching of the device from the unlocked mode to the locked mode as for other events, the feedback may differ in manners specific to that form of feedback (e.g. where user feedback is visual, the feedback for the device locking may differ in colour from the feedback for correspondence of the user inhalation pattern with the predefined inhalation pattern).

[0057] The controller may be configured to provide user feedback via the user feedback element in response to the airflow sensor detecting a user inhalation when the device is in the locked mode. This allows the device to provide the user with the predefined inhalation pattern in response to detecting that the user wants to use the device (based on them inhaling on the device), allowing the user to then unlock the device for use.

[0058] The device may comprise a wireless interface, which may be configured to communicate wirelessly with another device, 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.

[0059] As described above, 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.

[0060] 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, user feedback element, user input interface, controller, memory, wireless interface, airflow sensor and/or electrical connection) may be mounted on or affixed to the chassis.

5 **[0061]** 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.

10 **[0062]** 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.

15 **[0063]** The device body may have a substantially oval transverse cross-sectional shape.

20 **[0064]** The device body may have a linear longitudinal axis.

[0065] The device body may be formed of a metal e.g. of aluminium.

25 **[0066]** In a second aspect there is provided an aerosol-delivery system comprising: a user feedback element; a controller, an airflow sensor configured to detect a user inhalation pattern when a user draws air through the system and communicate said user inhalation pattern to the controller; and a vaporiser configured to produce an aerosol for user inhalation; wherein the controller is configured to: determine whether the user inhalation pattern corresponds to a predefined inhalation pattern; switch the system from a locked mode, in which power cannot be provided to the vaporiser, to an unlocked mode, in which power can be provided to the vaporiser, only if the user inhalation pattern corresponds to the predefined inhalation pattern; provide user feedback via the user feedback element when the user inhalation pattern corresponds to the predefined inhalation pattern; and switch the system from the unlocked mode to the locked mode if a predefined period of time has elapsed since a previous user interaction with the device.

35 **[0067]** The system according to the second aspect may comprise an aerosol-delivery device and a component.

40 **[0068]** The user feedback element, controller and optionally the air flow sensor may be provided in the aerosol-delivery device.

[0069] The component may comprise the vaporiser and an aerosol precursor.

50 **[0070]** In a third aspect, there is provided an aerosol-delivery system comprising a device according to the first aspect and a component coupled, or couplable, to the aerosol-delivery device, the component for containing an aerosol precursor.

55 **[0071]** Within the system, the aerosol-delivery device may comprise the airflow sensor. The airflow sensor may be disposed in an airflow path through the aerosol-delivery device.

[0072] Within the system, the component may comprise the vaporiser and an aerosol precursor.

[0073] The component of the second or third aspect 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. a smoking substitute) system. The component may comprise the vaporiser which may be as described above in relation to the first aspect.

[0074] The device of the second or third aspect may comprise the airflow sensor, which may be as described above in relation to the first aspect.

[0075] 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 body). 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. Thus, the consumable component may comprise one or more engagement portions for engaging with the device.

[0076] 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.

[0077] 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.

[0078] 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.

[0079] 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. a smoking substitute) system.

[0080] 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).

[0081] The aerosol-delivery/smoking substitute system may comprise an airflow path therethrough that includes the airflow path through the device and an airflow path through the consumable, 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), thereby drawing air through the device and consumable. The airflow path passes the vaporiser between the air inlet and the outlet.

[0082] 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.

[0083] 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).

[0084] 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.

[0085] 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.

[0086] 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.

[0087] The tank may be transparent or translucent.

[0088] 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.

[0089] 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.

[0090] 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.

[0091] 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.

[0092] The heating element may be in the form of a heater track on the wick e.g. on the lower surface of the wick. The heating element is 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.

[0093] In a fourth aspect there is provided a method of unlocking and locking an aerosol-delivery device, the aerosol-delivery device comprising a vaporiser, the method comprising the steps of: detecting a user inhalation pattern when a user draws air through the device; determining whether the user inhalation pattern corresponds to a predefined inhalation pattern; switching the device from a locked mode, in which power cannot be provided to the vaporiser, to an unlocked mode, in which power can be provided to the vaporiser; providing user feedback to the user via a user feedback element when the user inhalation pattern corresponds to the predefined inhalation pattern; and switching the device from the unlocked mode to the locked mode if a predefined period of time has elapsed since a previous user interaction with the device; wherein the step of switching the device from a locked mode to an unlocked mode is only conducted if the user inhalation pattern corresponds to the predefined inhalation pattern.

[0094] The method according to the fourth aspect may incorporate any one or more optional feature set out with respect to the first, second and/or third aspects except where such a combination is clearly impermissible or expressly avoided.

[0095] In a fifth aspect there is provided a method of using the aerosol-delivery (e.g. smoking substitute) system according to the second or third 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).

[0096] 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

[0097] 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 flowchart of control logic implemented by the smoking substitute device or system;

Fig. 4 is a modification of the flowchart in Fig. 3; and

Fig. 5 is a flowchart of control logic implemented by the smoking substitute device or system.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0098] 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.

[0099] 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.

[0100] 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.

[0101] 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. In yet further examples, the cavity in the device houses a magnet and the component 104 comprises a metal portion (e.g. a metal base) and the component 104 is coupled to the device by magnetic attraction between the magnet and the metal portion of the component 104.

[0102] 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.

[0103] 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.

[0104] 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.

[0105] 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.

[0106] 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.

[0107] 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.

[0108] 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 may be able to transfer electrical power from the power source 118 to the component 104 (i.e. activation of the smoking substitute system 100).

[0109] 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.

[0110] The additional components 128 of the device 102 may comprise the light 116 discussed above as a user feedback element.

[0111] 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.

[0112] 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).

[0113] The additional components 128 of the device 102 includes an airflow (i.e. puff) sensor for detecting user drawing air through 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 detect a user inhalation pattern and also 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.

[0114] The additional components 128 of the device 102 may include a user input interface, e.g. a button, an accelerometer. The smoking substitute system 100 may be configured to be activated when a user interacts with the user input interface (e.g. presses the button, moves the device in a certain manner).

[0115] This provides an alternative to the airflow sensor as a mechanism for activating the smoking substitute system 100.

[0116] As shown in Fig. 2B, the component 104 includes the tank 106, an electrical interface 130, a vapouriser 132, one or more air inlets 134, a mouthpiece portion 136, and one or more additional components 138.

[0117] 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.

[0118] 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.

[0119] 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.

[0120] In operation and when the system 100 in an unlocked mode in which power can be provided to the vaporiser 132, 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.

[0121] 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.

[0122] 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).

[0123] Figure 3 is a flowchart of control logic that may be implemented by the smoking substitute device 102 or system 100. The control logic may be stored in the memory 122 of the device 102. The control logic is im-

plemented by the controller 120 through its interaction with the other components of the smoking substitute device 102 or system 100. The smoking substitute system 100 (or device 102) has locked and unlocked modes. In the locked mode, electrical energy cannot be provided to the vaporiser 132 from the power source 118 and accordingly a vapour cannot be generated by the system 100. In the unlocked mode, electrical energy can be provided to the vaporiser 132 from the power source 118 and accordingly a vapour can be generated by the system 100. The following description of the control logic in Figure 3 starts at step S100 with the controller 120 switching the system 100 into the unlocked mode; however, it can be appreciated from Figure 3 that the control logic can equally be considered as starting from step S200, where the system 100 is already in the unlocked mode and power is able to be provided to the vaporiser 132, step 400, where the controller 120 switches the system 100 into the locked mode, or step S500, where the system is already in the locked mode and power is unable to be provided to the vaporiser 132.

[0124] At step S100, the system 100 is switched into the unlocked mode by the controller 120. The unlocked mode is activated in response to the user successfully performing an unlock action, which is discussed further below in reference to step S700.

[0125] Having been switched into the unlocked mode, the system 100 is able to provide electrical energy (e.g. in the form of an electrical current) to the vaporiser 132 in the component 104 from the power source 118 in the device 102 via the electrical interfaces 126, 130. 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, with the system 100 in the unlocked mode, the controller 120 supplies electrical energy from the power source 118 to the vaporiser 132, which causes the vaporiser 132 to heat e-liquid drawn from the tank 106 to produce a vapour which can be inhaled by a user through the mouthpiece portion 136.

[0126] The airflow sensor is configured to detect user inhalations on the mouthpiece portion 136 and communicate the detected inhalations to the controller 120. The controller 120 is in turn configured to monitor the time duration between inhalations and monitor the time that the system has been inactive for (i.e. the system inactive time). The system inactive time may solely reflect the time duration since the last inhalation, however the controller 120 may also take user interaction with the user input interface of the device 102 and/or other interactions of the user with the system 100 (e.g. replacement of the component 104, disconnection of a charging source from the charging connection 115, etc.) into consideration in calculating the system inactive time. In other words, the system inactive time may represent the time elapsed since the last user interaction with the system 100, whether that be an inhalation of the user or another form

of interaction that can be detected. At step S300 the controller 120 checks whether the system inactive time exceeds a threshold time. The threshold time may be specified in device firmware or in device software; where the time threshold is specified in the device software, it may be possible for the user to specify the threshold time by interaction with the system 100. If it is determined at step S300 that the system inactive time is less than or equal to the threshold time, the control logic returns to step S200 where the system 100 is in the unlocked mode and electrical energy is able to be provided to the vaporiser 132. If it is determined at step S300 that the system inactive time exceeds the threshold time, the control logic proceeds to step S400.

[0127] At step S400, the system 100 is switched into the locked mode by the controller 120. The locked mode is activated so that if the system 100 has been lost or stolen since the last user interaction, it cannot be easily used by an unintended user and so that if the system 100 is in environmental conditions where accidental activation of the system 100 may otherwise occur, such an accidental activation cannot occur.

[0128] Once the system is switched into the locked mode at step S400, the system 100 enters a state at step S500 in which the system 100 is unable to provide electrical energy (e.g. in the form of an electrical current) to the vaporiser 132 in the component 104 from the power source 118. The locked mode may be activated by the opening of a switch on the electrical connection between the power source 118 and the vaporiser 132, said switch either being located between the power source 118 and the electrical interface 126 of the device 102 or between the electrical interface 130 of the component 104 and the vaporiser 132. In this state, it is therefore not possible for the system 100 to generate a vapour.

[0129] At step S600, the system 100 remains in the locked mode, but detects that a user is inhaling on the mouthpiece portion 136 by means of the airflow sensor. The airflow sensor detects a user inhalation pattern and this user inhalation pattern is communicated from the airflow sensor to the controller 120. The user inhalation pattern is defined by values of one or more attributes derived from the user inhalations, the one or more attributes typically selected from the group including the elapsed time between user inhalations, the duration of user inhalations, and the intensity of user inhalations.

[0130] At step S700, the controller 120 determines whether the user inhalation pattern determined at step S600 corresponds to a predefined (i.e. defined before the user puffs are detected at step S600) inhalation pattern. Similarly to the user inhalation pattern, the predefined inhalation pattern is defined by values of one or more predefined inhalation pattern attributes, the one or more predefined inhalation pattern attributes typically selected from the group including: a number of inhalations, a duration of each inhalation, an elapsed time between each inhalation and an intensity of each inhalation. It can be appreciated that the possible attributes defining

the predefined inhalation pattern correspond to respective attributes defining the user inhalation pattern. The determination of whether the user inhalation pattern corresponds to the predefined inhalation pattern comprises the comparison of the values of one or more attributes defining the user inhalation pattern with the values of one or more respective predefined inhalation pattern attributes defining the predefined inhalation pattern. Where the values of the user inhalation pattern attributes are all within a certain threshold range of the values of the respective predefined inhalation pattern attributes, then the controller 120 determines that the user inhalation pattern corresponds to the predefined inhalation pattern and the method proceeds to step S800. Otherwise, the controller 120 determines that there is not a correspondence between the user inhalation pattern and the predefined inhalation pattern, and the method returns to step S500 where the system 100 remains in the locked mode.

[0131] At step S800, the user is provided with feedback via the light 116 on the device 102, the light 116 being an example of a user feedback element that can be used by the controller 120 to provide feedback to the user. In the case of step S800, the feedback indicates to the user that they have successfully unlocked the system 100 and that it is ready for use. The feedback at step S800 via the light 116 may be, for example, the light 116 flashing a blue colour a certain number of times.

[0132] Following step S800, the method returns to step S100 and the system 100 is switched into the unlocked mode by the controller 120, meaning that power is able to be provided to the vaporiser 132 from the power source 118. Accordingly, upon activation of the system 100, the controller 120 supplies electrical energy from the power source 118 to the vaporiser 132 (via electrical interfaces 126, 130), which causes the vaporiser 132 to heat e-liquid drawn from the tank 106 to produce a vapour which can be inhaled by a user through the mouthpiece portion 136.

[0133] Figure 4 is a flowchart of control logic that may be implemented by the smoking substitute device 102 or system 100. The flowchart in Figure 4 is a modification of the flowchart in Figure 3 and like steps are indicated by like reference numbers. A description of the steps in Figure 4 that are also present in Figure 3 is omitted.

[0134] The control logic in Figure 4 firstly differs from that of Figure 3 in that step S410 is introduced following the switching of the system from the locked mode to the unlocked mode at step S400. At step S410, feedback is provided from the controller 120 to the user via a user feedback element such as the light 116 or a haptic feedback element, thereby informing the user that the device 102 is locked and that they will need to provide a user inhalation pattern to unlock the device 102 for use. The feedback provided at step S410 may be, for example, the light 116 flashing an amber colour a certain number of times.

[0135] An additional difference is that step S420 is also introduced following steps S400 and S410. At step S420, the system 100 enters a sleep state, in which the system

100 remains in the locked mode but additionally the system 100 reduces power provided to components that are not needed (because the system 100 is locked) and places the system 100 into a minimum power consumption state in order to try to maintain as high a state of charge in the power source 118 as possible.

[0136] A further difference from Figure 3 is that the control logic of Figure 4 relates to a system wherein the predefined inhalation pattern is changed each time the system 100 is switched into the locked mode. Accordingly, additional steps S510 - S530 are present in Figure 4.

[0137] At step S510, user interaction with the device 102 or system 100 is detected, user interaction can be understood to encompass a range of actions, which may include: a user input to user input interface within the system 100, e.g. a button on the device 102 and/or movement of the device 102 detected by an accelerometer; and/or detection of a user inhalation on the mouthpiece portion 136.

[0138] At step S520, the predefined inhalation pattern to be compared to the user inhalation pattern at step S700 is defined by the controller 120. In Figure 4, step S520 is shown as being conducted subsequently to detection of user interaction with the device at step S510. However, it is also possible for step S520 to be executed prior to, or in parallel to, step S510. The predefined inhalation pattern may be defined by the controller 120 in several manners. Where the device 102 comprises memory 122, one option is for the memory 122 to store multiple candidate inhalation patterns and for the predefined inhalation pattern to be randomly chosen from the candidate inhalation patterns stored in the memory 122 by the controller 120. Another option is for the controller 120 to be configured such that it can generate a random inhalation pattern internally.

[0139] Having detected user interaction with the device 102 at step S510 and defined the new predefined inhalation pattern at step S520, the system 100 subsequently communicates that predefined inhalation pattern to the user via a pulse sequence of the user feedback element on the device 102. Since the predefined inhalation pattern that the user needs to provide a corresponding inhalation pattern to is newly defined once the system 100 has been switched into the locked mode, the predefined inhalation pattern should be communicated to the intended user in a manner that they can understand. However, it is also desirable that the predefined inhalation pattern is communicated in a manner such that it is not immediately apparent to an unintended user that this is what is being communicated. The pulse sequence may be, for example, the flashing of the light 116 on the device or the pulsed vibration of the device by the haptic feedback element.

[0140] A further modification of the control logic in Figure 4 is that when it is determined at step S700 that the inhalation pattern of the user does not correspond to the predefined inhalation pattern defined by the controller

120, the logic proceeds to step S900, where feedback is provided to the user via user feedback element. This feedback differs to that provided at step S800 (where it is determined at step S700 that the inhalation pattern of the user does correspond to the predefined inhalation pattern). At step S900 the user feedback is intended to inform the user that they have failed to unlock the system 100 for use, for example, the light 116 on the device may flash red several times. In Figure 4 the control logic then returns to step S500 following step S900, meaning that once the user inhalation pattern is found not to correspond to the predefined inhalation pattern, a new predefined inhalation pattern will be defined (step S520) that the user then needs to match to unlock the device 102. Another option that is not illustrated in Figure 4 is for the control logic to return to step S530 following step S900, in which case a new predefined inhalation pattern is not defined in response to the user inhalation pattern not corresponding to the predefined inhalation pattern. In this case, the previous predefined inhalation pattern is communicated to the user again for them to try and provide a corresponding inhalation pattern to. Another possibility is for step S900 to be omitted and for the control logic to proceed directly to step S530 following a negative determination at step S700 i.e. the predefined inhalation pattern is re-communicated to the user in place of providing separate feedback to the user indicating that the user inhalation pattern did not correspond to the predefined inhalation pattern.

[0141] Figure 5 is a flowchart of control logic that may be implemented by the smoking substitute device 102 or system 100 where the component 104 of the system 100 is removably engageable with the device 102 of the system 100. The control logic of Figure 4 relates to the functioning of the device 102 upon engagement of the device 102 with the component 104, which results in the connection of electrical interfaces 126, 130 of the device 102 and component 104.

[0142] When the device 102 is disengaged from a component 104, the system 100 is in the locked mode and it is not possible to provide power from the power source 118 to the vaporiser 132 (both because the vaporiser 132 is in the component 104 and thus not electrically connected to the power source 118, and because the controller 120 performs control action to prevent power being provided to the electrical interface 126 of the device 102). Typically, the system 104 is shipped to a customer with the component 104 disengaged from the device 102 and the device 102 in the locked mode. However, the device 102 may also be disengaged from a component 104 when a user is switching one component 104 for another (e.g. where the components 104 are consumables).

[0143] When the component 104 is disengaged from the device 102, the control logic of Figure 5 commences from step S400a, where the system 100 is switched into the locked mode. Once locked mode is activated at step S400a, the system 100 enters a state at step S500a in

which the system 100 is unable to provide electrical energy (e.g. in the form of an electrical current) to the vaporiser 132 in the component 104 from the power source 118, as described above in relation to step S500 in Figure 3.

[0144] At step S505, the controller 120 checks whether engagement of a component 104 with the device 102 has been identified. Identification of the connection of a component 104 to the device 102 may be facilitated by the electrical interface 126 of the device 102. If it is determined at step S505 that no component 104 has been engaged with the device 102, the control logic returns to step S500a. However, if at step S505 the controller 120 determines that engagement of a component 104 with the device 102 has been identified, then the control logic proceeds to step S530, where the predefined inhalation pattern is communicated to the user as described in relation to step S530 in Figure 4. The system 100 then proceeds to step S600, in which the system 100 remains in the locked mode but detects that a user is inhaling on the mouthpiece portion 136 by means of the airflow sensor. A user inhalation pattern detected by the airflow sensor is communicated from the airflow sensor to the controller 120 as described above in relation to step S600 in Figure 3.

[0145] Having detected the user inhalation pattern at step S600, the control logic in Figure 5 proceeds to step S700. At step S700, the controller 120 determines whether the user inhalation pattern corresponds to a predefined inhalation pattern, as described in relation to step S700 in Figure 3.

[0146] If the determination at step S700 is negative, the control logic proceeds to step S500 in the control logic of Figure 3 or Figure 4 and the control of the system 100 continues from there. If the determination at step S700 is positive, the logic proceeds to step S800, where the system 100 provides feedback to the user indicating that they have provided a user inhalation pattern that matches the predefined inhalation pattern, the device 102 is switched to the unlocked mode (step S100). The control logic then proceeds to step S200 of Figure 3 or Figure 4 and the control of the system 100 continues from there.

[0147] 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.

[0148] 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.

[0149] 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%.

[0150] 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 (102) comprising:

a user feedback element; and
a controller (120), wherein the controller (120) is coupled, or couplable, to:

an airflow sensor configured to detect a user inhalation pattern when a user draws air through the device (102) and communicate said user inhalation pattern to the controller (120); and
a vaporiser configured to produce an aerosol for user inhalation; and

wherein the controller (120) is configured to:

determine whether the user inhalation pattern corresponds to a predefined inhalation pattern;
switch the device (102) from a locked mode, in which power cannot be provided to the vaporiser, to an unlocked mode, in which power can be provided to the vaporiser, only if the user inhalation pattern corresponds to the predefined inhalation pattern;
provide user feedback to the user via the user feedback element when the user inhalation pattern corresponds to the predefined inhalation pattern; and
switch the device (102) from the unlocked mode to the locked mode if a predefined period of time has elapsed since a previous user interaction with the device (102).

2. The aerosol-delivery device (102) according to claim 1, wherein the previous user interaction with the device (102) comprises a previous user inhalation.
3. The aerosol-delivery device (102) according to any preceding claim, wherein:
- the controller (120) is further configured to provide user feedback to the user via the user feedback element when the user inhalation pattern does not correspond to the predefined inhalation pattern; and
- the user feedback when the user inhalation pattern does not correspond to the predefined inhalation pattern is different to the user feedback when the user inhalation pattern corresponds to the predefined inhalation pattern.
4. The aerosol-delivery device (102) according to any preceding claim, wherein the device (102) is configured to communicate the predefined inhalation pattern to the user via the user feedback element.
5. The aerosol-delivery device (102) according to claim 4, wherein the predefined inhalation pattern is communicated to the user via a pulse sequence of the user feedback element.
6. The aerosol-delivery device (102) according to claim 4 or 5, wherein:
- the device (102) further comprises memory (122) containing a plurality of candidate inhalation patterns; and
- the controller (102) is configured to select a candidate inhalation pattern from the memory (122) as the predefined inhalation pattern once the device (102) is switched to the locked mode.
7. The aerosol-delivery device (102) according to claim 4 or 5, wherein the controller (120) is configured to generate a candidate inhalation pattern as the predefined inhalation pattern once the device (102) is switched from the unlocked mode to the locked mode.
8. The aerosol-delivery device (102) according to any preceding claim, wherein the controller (120) is configured to provide user feedback via the user feedback element once the device (102) is switched from the unlocked mode to the locked mode.
9. The aerosol-delivery device (102) according to any preceding claim, wherein the controller (120) is configured to provide user feedback to the user via the user feedback element in response to the airflow sensor detecting a user inhalation when the device (102) is in the locked mode.
10. The aerosol-delivery device (102) according to any preceding claim, wherein the user feedback element comprises one or more of: a visual feedback element, a haptic feedback element, and an auditory feedback element.
11. An aerosol-delivery system comprising:
- an aerosol-delivery device (102) according to any preceding claim; and
- a component (104) coupled, or couplable, to the aerosol-delivery device (102).
12. An aerosol-delivery system according to claim 11, wherein the aerosol-delivery device (102) comprises the airflow sensor.
13. An aerosol-delivery system according to claim 11 or 12, wherein the component (104) comprises the vaporiser and an aerosol precursor.
14. An aerosol-delivery system (100) comprising:
- a user feedback element;
- a controller (120),
- an airflow sensor configured to detect a user inhalation pattern when a user draws air through the system and communicate said user inhalation pattern to the controller (120); and
- a vaporiser configured to produce an aerosol for user inhalation;
- wherein the controller (120) is configured to:
- determine whether the user inhalation pattern corresponds to a predefined inhalation pattern;
- switch the system (100) from a locked mode, in which power cannot be provided to the vaporiser, to an unlocked mode, in which power can be provided to the vaporiser, only if the user inhalation pattern corresponds to the predefined inhalation pattern;
- provide user feedback to the user via the user feedback element when the detected user inhalation pattern corresponds to the predefined inhalation pattern; and
- switch the system (100) from the unlocked mode to the locked mode if a predefined period of time has elapsed since a previous user interaction with the system (100).
15. A method of unlocking and locking an aerosol-delivery device (102), the aerosol-delivery device (102) comprising a vaporiser, the method comprising the steps of:
- detecting a user inhalation pattern when a user draws air through the device (102);

determining whether the user inhalation pattern corresponds to a predefined inhalation pattern; switching the device (102) from a locked mode, in which power cannot be provided to the vaporiser, to an unlocked mode, in which power can be provided to the vaporiser; providing user feedback to the user via a user feedback element when the user inhalation pattern corresponds to the predefined inhalation pattern; and switching the device from the unlocked mode to the locked mode if a predefined period of time has elapsed since a previous user interaction with the device;

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wherein the step of switching the device (102) from a locked mode to an unlocked mode is only conducted if the user inhalation pattern corresponds to the predefined inhalation pattern.

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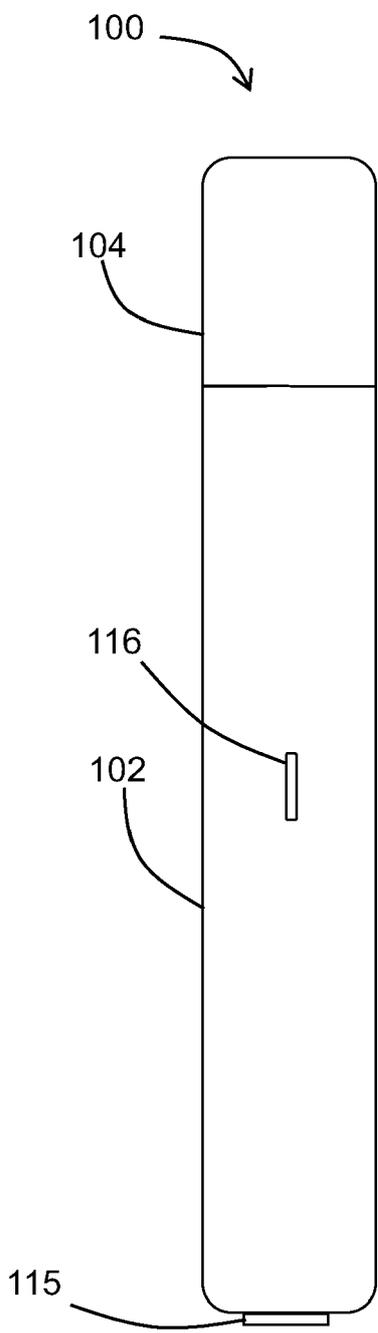


FIG 1A

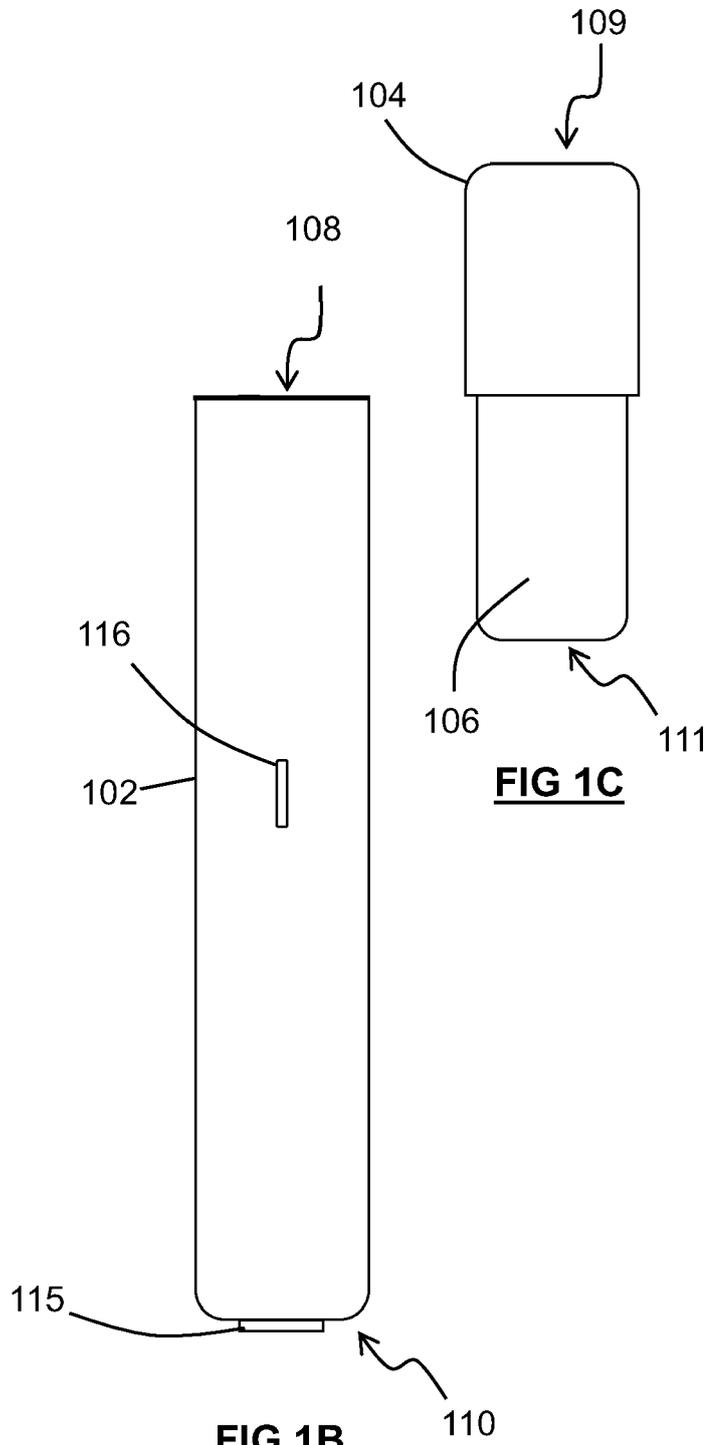


FIG 1C

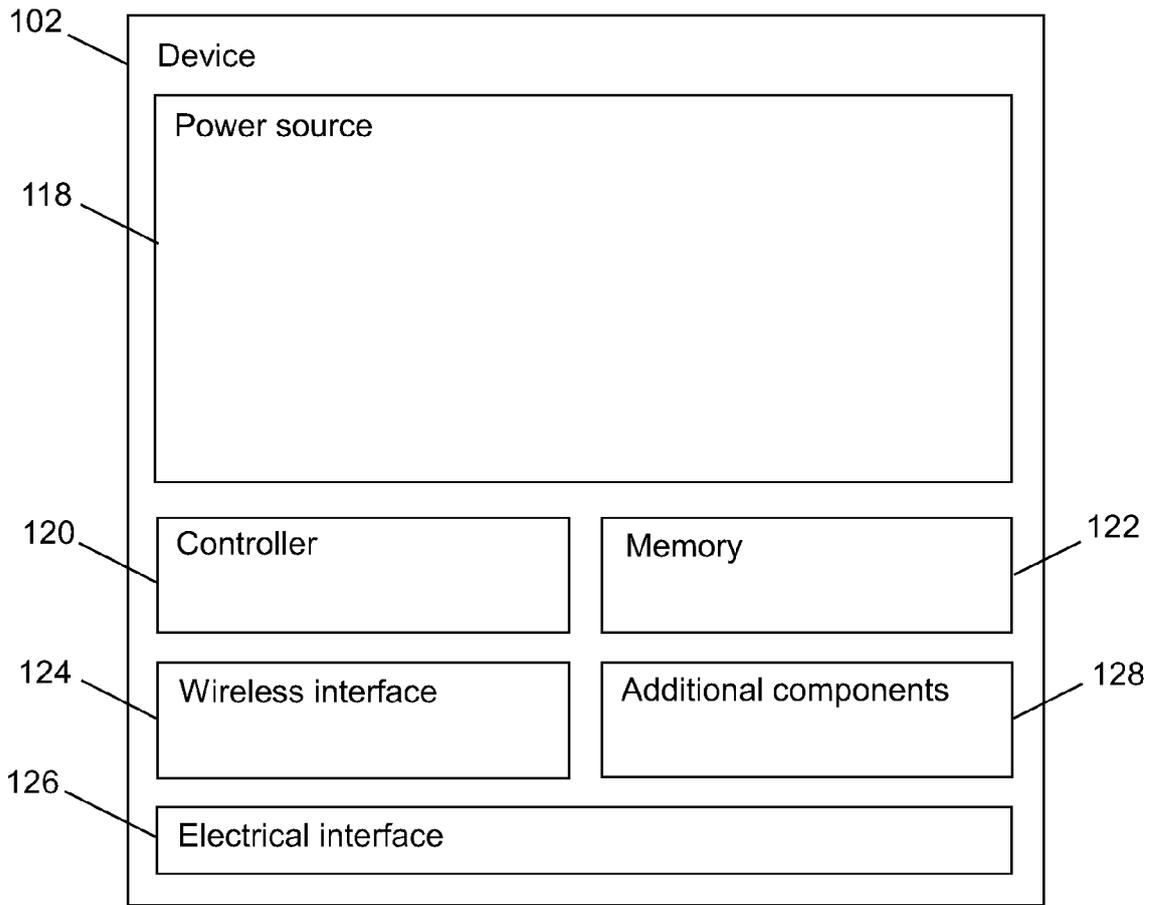


FIG 2A

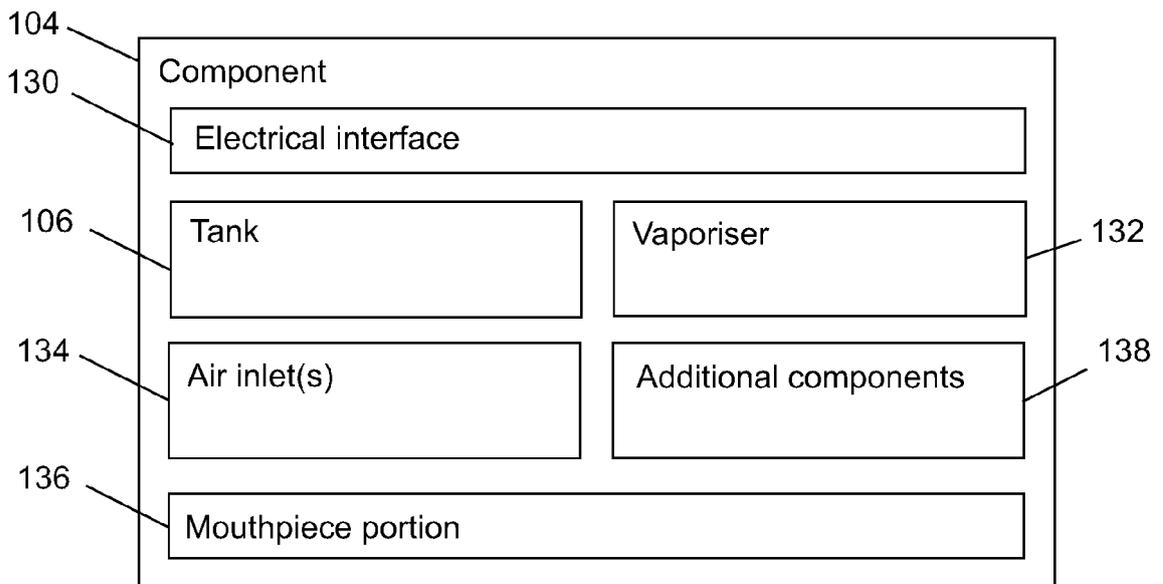


FIG 2B

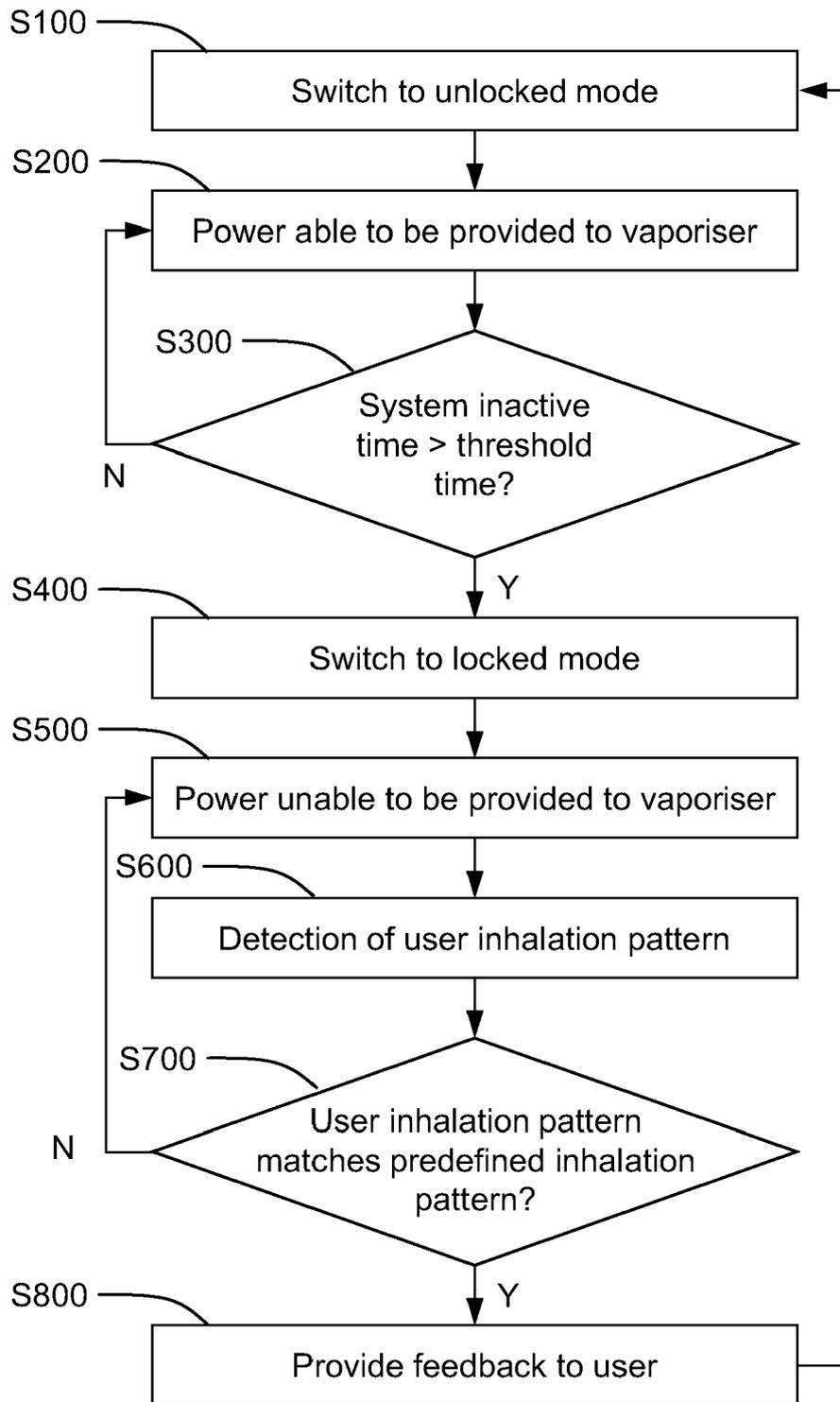


FIG 3

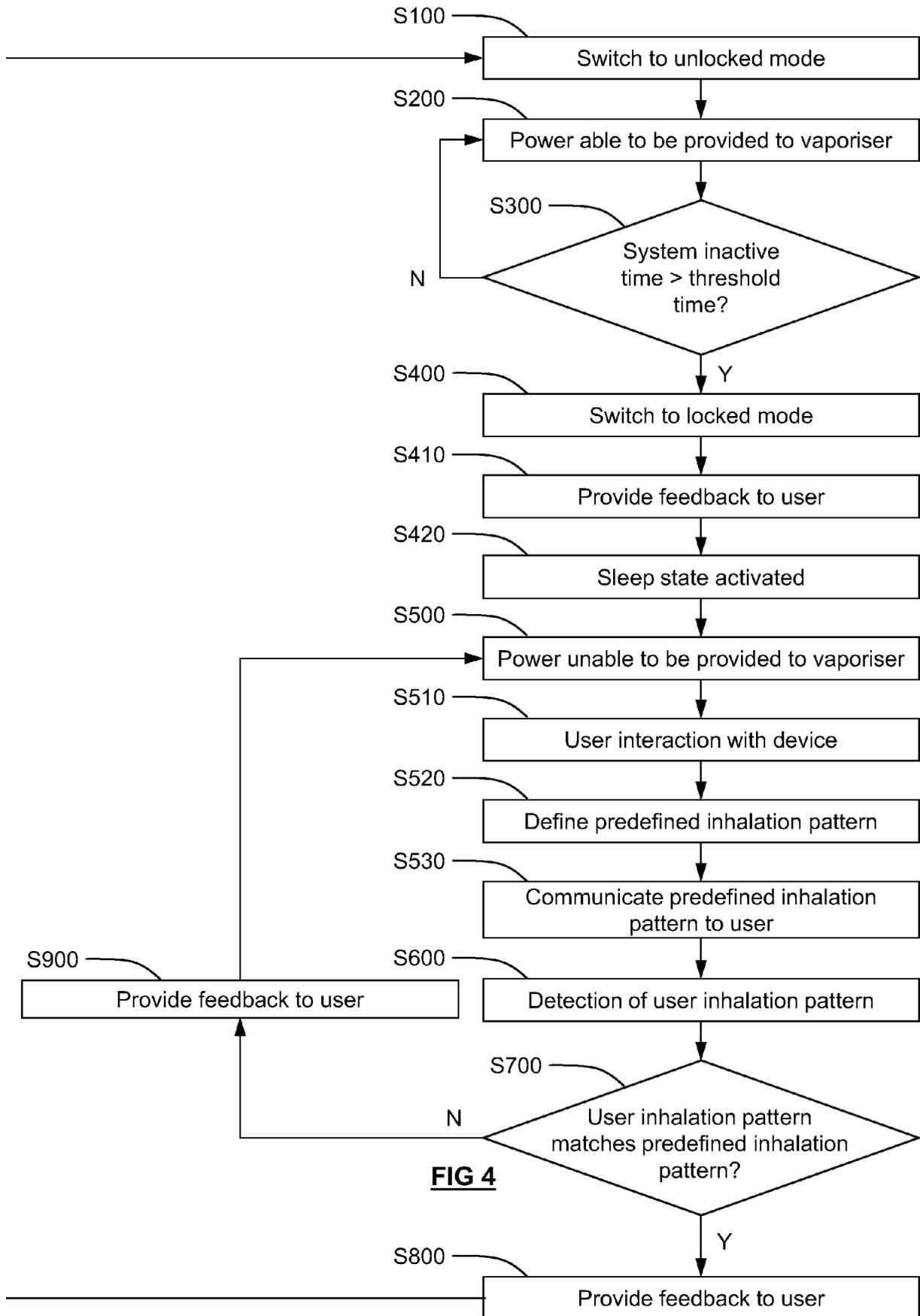


FIG 4

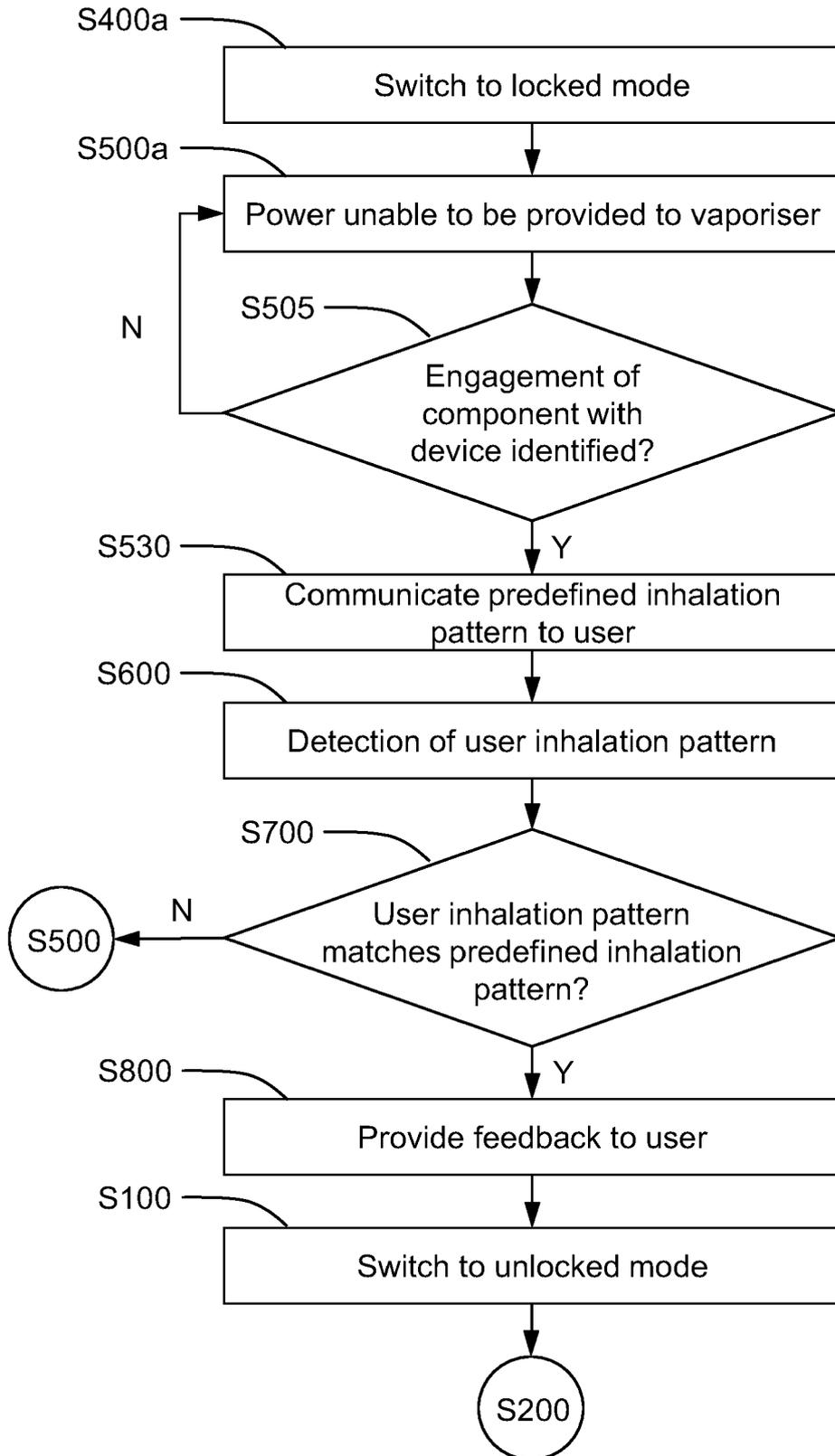


FIG 5



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