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(54) **AEROSOL DELIVERY SYSTEM**

(57) The present disclosure provides an aerosol generating system (100) comprising: aerosol generating means (132) configured to generate an aerosol for delivery to a user during inhalation; a mouthpiece for exhalation of air into the system; a filter configured to filter exhaled air entering the system through the mouthpiece during a user exhalation, wherein a bypass channel (221, 221') is configured to direct exhaled air to the filter whilst bypassing the aerosol generating means (132); one or more exhalation airflow sensors configured to detect an airflow property of exhaled air passing through the filter; and a controller (12) configured to determine a state of the filter based on the detected airflow property of exhaled air.

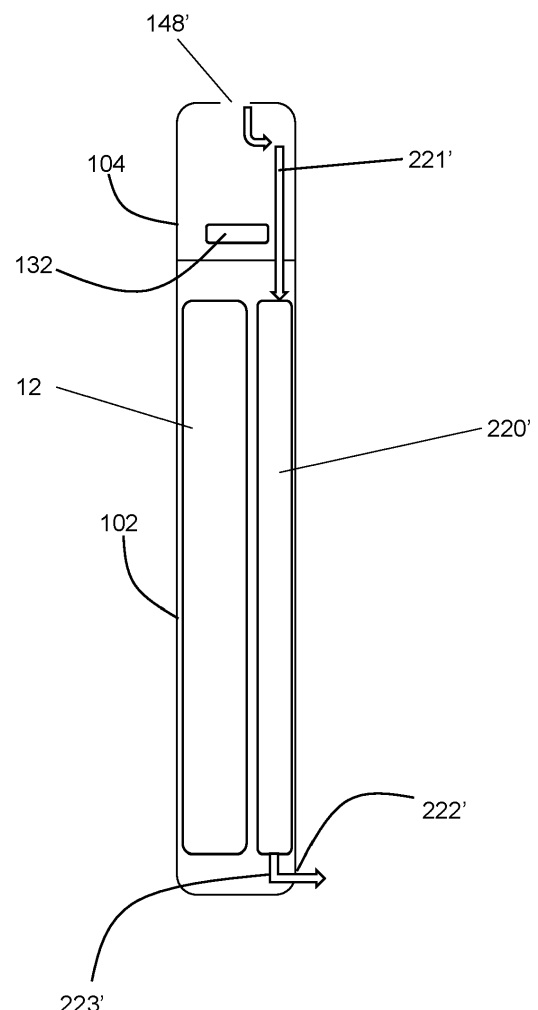


FIG 4

Description

Technical field

[0001] The present disclosure relates to an aerosol delivery system such as a smoking substitute 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] Upon exhalation, nicotine, flavor components and other components that have not been deposited in the lungs or lost in the respiratory tract leave the body and enter the ambient air. This is undesirable for the several reasons. For example, it poses the risk of passive 'smoking' to others. Specifically, it risks the inhalation of the second-hand vapour by others, thus risking the intake of nicotine or other potentially harmful substances by those who do not specifically intend or wish to intake them. This is especially problematic in confined spaces and/or around children or those with a health condition, for which the nicotine or other components may be particularly harmful. However, passive 'smoking' is considered undesirable by many non-users of cigarettes or smoking substitute devices, regardless of their age or health status. The exhalation of vapour from smoking substitute systems can therefore cause social difficulty for the user.

[0020] Moreover, there are rules and laws in many jurisdictions that include public bans on smoking, which extend to a ban on vaping and the use of smoking substitutes in some jurisdictions. The rationale behind such rules and laws is typically based on the potential risk that smoking and vaping pose to others via passive smoking.

[0021] 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

[0022] According to a first aspect, there is provided an aerosol generating system comprising:

aerosol generating means configured to generate an aerosol for delivery to a user during inhalation;
a mouthpiece for exhalation of air into the system;
a filter configured to filter exhaled air entering the system through the mouthpiece during a user exhalation, wherein a bypass channel is configured to direct exhaled air to the filter whilst bypassing the aerosol generating means;
one or more exhalation airflow sensors configured to detect an airflow property of exhaled air passing through the filter; and
a controller configured to determine a state of the filter based on the detected airflow property of exhaled air.

[0023] By monitoring a property of the exhaled air passing through the filter, the aerosol generating system is configured to monitor (i.e., sense, detect, or measure) a property that provides an accurate indicator of the instantaneous state of the filter. One or more exhalation airflow sensors such as conventional airflow sensors may be employed for this purpose, such that the monitoring does not require costly, complex or bulky component parts to be incorporated into the aerosol generating system. However, the present inventors have recognised that, by intelligently locating the one or more sensors so that they can detect an airflow rate of exhaled air passing through the filter, those sensors can provide highly useful information regarding the state of the filter and therefore can provide the user with accurate and dynamic information to ensure that the filtration of exhaled air that the system is providing is always sufficiently high standard. As a result, the user can ensure but they are using a suitable filter at all times, which will enable the system to clean and purify the exhaled air as it passes through the system, before it is exhaled into the surrounding environment. Therefore, the user can ensure that the system is not outputting any remnant vapour or other contaminants that could adversely affect other people in the vicinity, should those other people inhale the airstream that the aerosol generating system outputs. Therefore, the overall safety, reliability, and social acceptability of using an aerosol generating system such as a smoking substitute

system is improved.

[0024] Optional features will now be set out. These are applicable singly or in any combination with any aspect.

[0025] The aerosol generating means (also referred to herein as the "vaporiser") may be configured to generate the aerosol for delivery to the user via the mouthpiece during the user inhalation i.e. the mouthpiece may be for both inhalation of vapour/aerosol from the system and exhalation of exhaled air into the system.

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

[0027] At least one of the one or more exhalation airflow sensors may be provided in the bypass channel and/or in the filter.

[0028] The system may comprise an exhalation port extending from the filter to the exterior of the system. Accordingly, an exhalation pathway may extend from the mouth piece, through the bypass channel to the filter and from the filter to the exterior of the system via with exhalation port.

[0029] At least one of the one or more exhalation airflow sensors may be provided in the exhalation port.

[0030] The filter may removably connectable within the system. The filter may be provided in a filter chamber or cavity. The filter cavity or chamber may have an opening e.g. a sealable opening through which the filter can be removed and replaced.

[0031] The filter may comprise a porous filter material which may be fibrous material, a meshed material or may be porous network. For example the porous filter material may comprise cellulose acetate tow.

[0032] The system may further comprise a one-way valve that is configured to prevent the flow of exhaled air from the mouthpiece to the aerosol generating means. The one-way valve may be provided in or close to the mouthpiece. The one-way valve may be configured to direct the exhaled air into or through the bypass channel.

[0033] The one or more exhalation airflow sensors may be configured to detect one or more properties of the exhaled air selected from the airflow rate, pressure or volume through the filter.

[0034] Additionally/alternatively, the one or more exhalation airflow sensors may be configured to detect one or more properties selected from a drop in air flow rate, pressure or volume across the filter. For example, a first exhalation airflow sensor may be provided in the bypass channel upstream of the filter and a second exhalation airflow sensor may be provided in the exhalation port downstream of the filter and the controller may be configured to calculate a difference in values between the first and second exhalation airflow sensors to calculate a drop of the airflow rate, pressure or volume of the exhaled air across the filter.

[0035] The controller may be configured to determine a saturation level of the filter based on the detected airflow property. In general terms, a filter that is saturated or approaching saturation may act as a (partial) barrier

to the flow of exhaled air and therefore may decrease the flow rate, pressure or volume of the exhaled air.

[0036] The controller may be configured to determine that the filter should be replaced based on the detected airflow parameter. If the controller determines that the filter is saturated or approaching saturation, based on the detected parameter, it may determine that it is appropriate for the filter to be changed in order to ensure a high level of reliability of the filtration that the aerosol generating system is configured to provide, on an ongoing basis.

[0037] The controller may be configured to determine that the filter should be replaced by comparing the detected exhaled airflow property with a predefined threshold. The predefined, or predetermined, threshold may comprise a minimum acceptable flow rate/pressure/volume of exhaled air across the filter. If the exhaled air is flowing at a flow rate/pressure/volume that is less than the predefined threshold, the controller may determine that the filter is saturated or becoming saturated and therefore presenting an unacceptably significant (or, unacceptably impenetrable) barrier for the exhaled air to pass through, such that the filter should be replaced. In a similar manner, if the controller determines that the drop in rate/pressure/volume of the exhaled air across the filter exceeds a predefined threshold, replacement of the filter may be indicated.

[0038] By determining that the filter should be replaced, the controller is configured to pre-empt and therefore prevent problems that may otherwise occur if a saturated filter was allowed to remain in the system for too long. For example, a saturated filter may allow some or all of the exhalation airflow to pass by the filter without being sufficiently cleaned or purified by the filter.

[0039] The controller may be configured to output an alert based on determined state of the filter e.g. if the filter is deemed to be at or approaching saturation. The alert may be output via a feedback means within the system and/or via a remote device that is communicatively connected to the controller. The alert may be a visual alert and/or an audible alert and/or a haptic alert.

[0040] The system may comprise an aerosol delivery device and a component for containing an aerosol precursor. The filter may be (removably) provided within the device. For example, the device may comprise the filter chamber/cavity for receiving the filter. Accordingly, the exhalation port may be provided in the device.

[0041] The device comprises 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.

[0042] 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.

[0043] 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.

[0044] 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.

[0045] The device body may have a substantially oval transverse cross-sectional shape.

[0046] The device body may have a linear longitudinal axis.

[0047] 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. These may be configured to provide the user alert, based on the determined state of the filter.

[0048] 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.

[0049] The device may comprise a movement detection unit (e.g. an accelerometer) for detecting a movement of the device.

[0050] The device 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 haptic feedback generation unit may be configured to provide the user alert, based on the determined state of the filter.

[0051] The device may include the controller.

[0052] 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.

[0053] 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.

[0054] 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. The memory may store the predefined threshold, to which the airflow property of exhaled air is compared, by the controller, for determining a state of the filter.

[0055] 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 communica-

tion interfaces, e.g. WiFi®, are also possible. The wireless interface may also be configured to communicate wirelessly with a remote server.

[0056] The device may comprise an inhalation airflow (i.e. puff) sensor that is configured to detect a puff (i.e. inhalation from a user). The inhalation 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 inhalation airflow sensor may, for example, be in the form of a pressure sensor or an acoustic sensor.

[0057] The controller may control power supply to the aerosol generating means/vaporiser in response to airflow detection by the inhalation airflow sensor. The control may be in the form of activation of the vaporiser in response to a detected inhalation airflow.

[0058] The device may comprise an electrical connection (e.g. one or more contact pins) for connection of the power source to the vaporiser.

[0059] 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, inhalation airflow sensor, exhalation airflow sensor(s) and/or electrical connection) may be mounted on or affixed to the chassis.

[0060] The component of the system 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.

[0061] 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.

[0062] Thus, the consumable component may comprise one or more engagement portions for engaging with the device.

[0063] 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.

[0064] The consumable component may comprise the aerosol generating means, hereinafter referred to as the vaporiser. The vaporiser may comprise a heating element. Alternatively, the vaporiser may comprise an ultrasonic or flow expansion unit, or an induction heating system.

[0065] 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.

[0066] 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.

[0067] 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. s smoking substitute) system.

[0068] 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).

[0069] The smoking substitute system may comprise an inhalation airflow path therethrough, the inhalation 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 the mouthpiece of the component. In this respect, a user may draw fluid (e.g. air) into and along the inhalation airflow path by inhaling at the outlet (e.g. using the mouthpiece).

[0070] The smoking substitute system may also comprise an exhalation airflow path that extends from the mouthpiece to the filter via the bypass channel. It may then extend from the filter to the exterior of the system via the exhalation port. The bypass channel may separate the inhalation airflow path from the exhalation airflow path.

[0071] The inhalation airflow path passes the vaporiser between the air inlet and the outlet. The vaporiser may be provided in the component. The exhalation airflow path bypasses the vaporiser.

[0072] The inhalation airflow path may comprise a first portion extending from the air inlet towards the vaporiser. A second portion of the inhalation 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.

[0073] References to "downstream" in relation to the inhalation airflow path are intended to refer to the direc-

tion towards the outlet/mouthpiece. Thus the second portion of the inhalation 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 inhalation airflow path (and the air inlet) is upstream of the second portion of the inhalation airflow path (and the outlet/mouthpiece).

[0074] 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.

[0075] 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.

[0076] 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.

[0077] As discussed above, the inhalation airflow 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.

[0078] 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.

[0079] 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.

[0080] 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 inhalation airflow path.

[0081] The heating element may be in the form of a heater track on the wick e.g. on the lower surface of the wick.

[0082] 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.

[0083] 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 inhalation airflow path. This vapour may subsequently cool to form an aerosol e.g. in the conduit.

[0084] In some embodiments, the filter may be provided in the component rather than the device. In these embodiments, the component comprises the filter chamber and the at least one exhalation air flow sensors. The exhalation port may extend from the filter chamber to the exterior of the system entirely through the component or the exhalation port may extend from the component through the device to the exterior of the system.

[0085] In some embodiments, the system further comprises a remote device that is communicatively coupled to the aerosol generating system, wherein the controller of the aerosol generating system is configured to output an alert to the remote device regarding a determined state of the filter.

[0086] For example, the remote device may comprise a mobile device such as a mobile phone. The remote device may be configured to run a software programme or software application that is configured for communication with the controller.

[0087] According to a second aspect, a method is provided of monitoring the state of a filter in an aerosol generating system according to said first aspect. The method comprises detecting an airflow property of exhaled air passing through the filter; and determining a state of the filter based on the detected airflow property of exhaled air. The method may further comprise determining whether the filter should be replaced, based on the detected airflow property. The method may further comprise issuing a user alert if it has been determined that the filter should be replaced.

[0088] The method may be a computer-implemented method.

[0089] According to a third aspect, a computer-readable medium is provided containing instructions configured to, when executed by a processor or by an application installed on a mobile device, cause the processor or application to perform the method of the second aspect.

[0090] In a fourth aspect there is provided a method of using the aerosol-delivery (e.g. smoking substitute) system according to the first 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).

[0091] 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

[0092] 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 having a filter;
- Fig. 4 is schematic of the device having a filter.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0093] 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.

[0094] 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.

[0095] 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.

[0096] 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 be-

tween 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.

[0097] The component 104 includes a mouthpiece at an upper end 109 of the component 104, and one or more air inlets (not shown) in fluid communication with the mouthpiece such that air can be drawn into and through the component 104 along an inhalation pathway when a user inhales through the mouthpiece. The tank 106 containing e-liquid is located at the lower end 111 of the component 104.

[0098] 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.

[0099] 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.

[0100] 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.

[0101] 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.

[0102] 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.

[0103] 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).

[0104] 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 nic-

otine (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.

[0105] The additional components 128 of the device 102 may comprise the light 116 discussed above.

[0106] 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.

[0107] 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).

[0108] The additional components 128 of the device 102 may include an inhalation airflow sensor for detecting airflow in inhalation pathway 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 inhalation airflow sensor. This inhalation airflow sensor could alternatively be included in the component 104. The inhalation 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.

[0109] 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 inhalation airflow sensor as a mechanism for activating the smoking substitute system 100.

[0110] The additional components 128 of the system may additionally include the filter and one or more exhalation airflow sensors as discussed below in relation to Figure 4

[0111] 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 136, and one or more additional components 138.

[0112] 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.

[0113] 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/heater track and a wick. The wick draws e-liquid from the tank 106 and the heating filament heats/heater track the e-liquid to vaporise the e-liquid.

[0114] 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 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.

[0115] 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 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 136.

[0116] 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.

[0117] The additional components 138 of the component may further include the filter and one or more exhalation airflow sensors as discussed below in relation to Figure 3.

[0118] 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).

[0119] 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.

[0120] A component housing 142 defines an outer cas-

ing 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).

[0121] 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.

[0122] 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.

[0123] 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. 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.

[0124] 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.

[0125] 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.

[0126] 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.

[0127] The component housing 142 defines a filter chamber 220 that is in fluid communication with the mouthpiece aperture 148 via a bypass channel 221.

[0128] The component 104 further comprises a bypass valve, such as a one-way valve, (not shown) for directing air into the bypass channel 221 so that exhaled air does not pass the vaporiser 132.

[0129] The valve may be provided in or close to the mouthpiece aperture 148.

[0130] Figure 3 shows the filter chamber 220 in the mouthpiece portion 136 of the component 104 but it may be provided in any location within the component e.g. adjacent the tank 106 or adjacent the vaporiser 132.

[0131] An exhalation port 223 extends from the filter chamber 220 to the exterior of the system through the component housing 142.

[0132] Figure 4 shows an alternative embodiment in which the filter chamber 220' is provided in the device 102 rather than in the component 104. In this embodiment, the bypass channel 221 extends from proximal the mouthpiece aperture 148', through the component 104 (avoiding the vaporiser 132) and into the device.

[0133] When a user exhales, exhaled air is forced into the system via the mouthpiece aperture 148. Therefore, the user does not have to exhale (and therefore does not have to release leftover/remnant vapour that may contain nicotine, contaminants and/or smells/flavours) into their ambient environment.

[0134] The filter chamber 220, 220' contains a filter formed of filter material e.g. a porous filter material which may be fibrous material, a meshed material or may be porous network. For example the porous filter material may comprise cellulose acetate tow.

[0135] The filter is removably located within the filter chamber 220 and can be replaced. For example, the filter chamber 220' may comprise an opening which is in communication with the cavity for receiving the consumable component 104 so that the filter can be replaced by removing the component 104 from the device 102 to reveal the opening.

[0136] In general terms, the filter material is configured to purify the exhaled air and in particular to remove remnants of the vapour that was previously generated by the vaporiser 132.

[0137] As a result, when the exhaled air exits component 104 or device 102 via the exhalation outlet 222, 222', it will comprise substantially clean, purified air, and will comprise little or no remnant of the vapour that the vaporiser 132 previously generated.

[0138] At least one exhalation airflow sensor (not specifically shown) is provided in the system - it may be provided in the component 104 or in the device. The at least one exhalation sensor is configured to detect an airflow rate of exhaled air passing through the filter within the filter chamber 220, 220'. The sensor may therefore be referred to as an "airflow sensor". It may be a pressure sensor.

[0139] The at least one exhalation airflow sensor is provided in, or in communication with the bypass channel 221, 221' and/or filter chamber 220, 220' and/or the exhalation port 223, 223' which leads from the filter chamber 220, 220' to the exhalation outlet 222, 222'.

[0140] The system may comprise a first exhalation airflow sensor upstream of the filter chamber 220, 220' and a second exhalation sensor downstream of the filter chamber 220, 220', for comparison purposes i.e. to detect an airflow rate/pressure/volume drop across the filter/filter chamber 220, 220'.

[0141] The exhalation airflow sensor(s) is/are in communication with a controller 12 in the device 102. The controller is configured to use the data regarding the de-

tected drop in airflow rate/pressure volume of exhaled air through the filter in the filter chamber 220, 220' to determine a saturation state of the filter.

[0142] In general terms, when the filter becomes (or approaches becoming) saturated, the airflow rate of an exhaled airstream passing through the filter will reduce, because it has become more difficult for the airstream to pass through the filter.

[0143] The controller 12 may be configured to compare a detected drop in airflow rate/pressure/volume of exhaled air passing through the filter within the filter chamber 220, 220' to a predetermined thresholds. The controller 12 is configured to provide an output indicating saturation of the filter when the detected drop in airflow rate/pressure/volume exceeds a predetermined threshold.

[0144] The output may provide an indication to the user via feedback means, for example comprising the LED 116 on the device when the filter is at or approaching saturation.

[0145] 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.

[0146] 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.

[0147] 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%.

[0148] 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 generating system comprising:

aerosol generating means configured to generate an aerosol for delivery to a user during inhalation;
 a mouthpiece for exhalation of air into the system;
 a filter configured to filter exhaled air entering the system through the mouthpiece during a user exhalation, wherein a bypass channel is configured to direct exhaled air to the filter whilst bypassing the aerosol generating means;
 one or more exhalation airflow sensors configured to detect an airflow property of exhaled air passing through the filter; and
 a controller configured to determine a state of the filter based on the detected airflow property of exhaled air.

2. A system according to claim 1 wherein the aerosol generating means is configured to generate the aerosol for delivery to the user via the mouthpiece during the user inhalation.**3.** A system according to claim 1 or 2 further comprising an exhalation port extending from the filter to an exterior of the system.**4.** A system according to any one of the preceding claims wherein at least one of the one or more exhalation airflow sensors is provided in the bypass channel and/or in the filter and/or in the exhalation port.**5.** A system according to any one of the preceding claims wherein the filter is removably connectable within the system.**6.** A system according to claim 5 wherein the system comprises a filter chamber or cavity, the filter cavity or chamber having an opening through which the filter can be removed and replaced.**7.** A system according to any one of the preceding claims further comprising a one-way valve configured to prevent the flow of exhaled air from the mouthpiece to the aerosol generating means.**8.** A system according to any one of the preceding claims wherein the one or more exhalation airflow sensors is configured to detect one or more properties of the exhaled air selected from the airflow rate, pressure or volume through the filter.**9.** A system according to any one of the preceding claims wherein the one or more exhalation airflow

sensors is configured to detect one or more properties selected from a drop in air flow rate, pressure or volume across the filter.

10. A system according to any one of the preceding claims wherein the controller is configured to determine that the filter should be replaced by comparing the detected exhaled airflow property with a predefined threshold.**11.** A system according to claim 10 wherein the controller is configured to output an alert via a feedback means within the system and/or via a remote device that is communicatively connected to the controller when the controller determines that the filter should be replaced.**12.** A system according to any one of the preceding claims wherein the system comprises an aerosol delivery device and a component for containing an aerosol precursor, and wherein the filter is provided within the device.**13.** A method of monitoring the state of a filter in an aerosol generating system according to any one of claims 1 to 12, the method comprising detecting an airflow property of exhaled air passing through the filter; and determining a state of the filter based on the detected airflow property of exhaled air.**14.** A computer-implemented method comprising the method of any claim 13.**15.** A computer-readable medium containing instructions configured to, when executed by a processor or by an application installed on a mobile device, cause the processor or application to perform the method of claim 14.

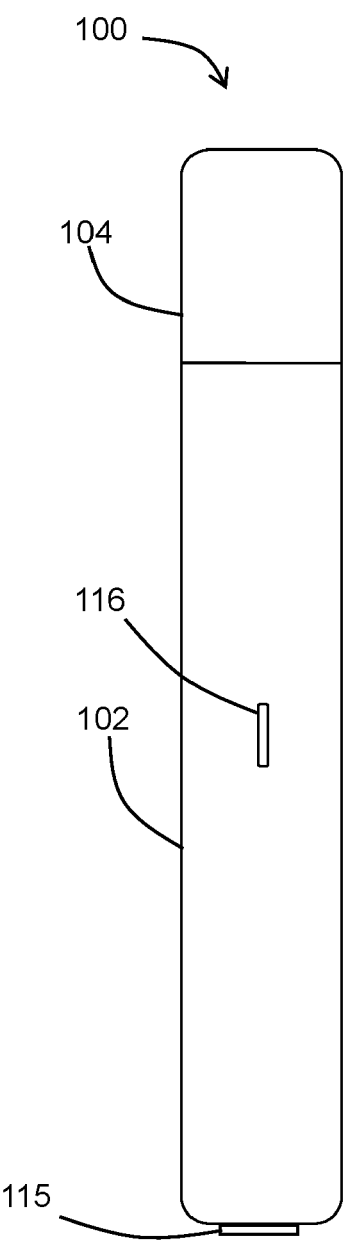


FIG 1A

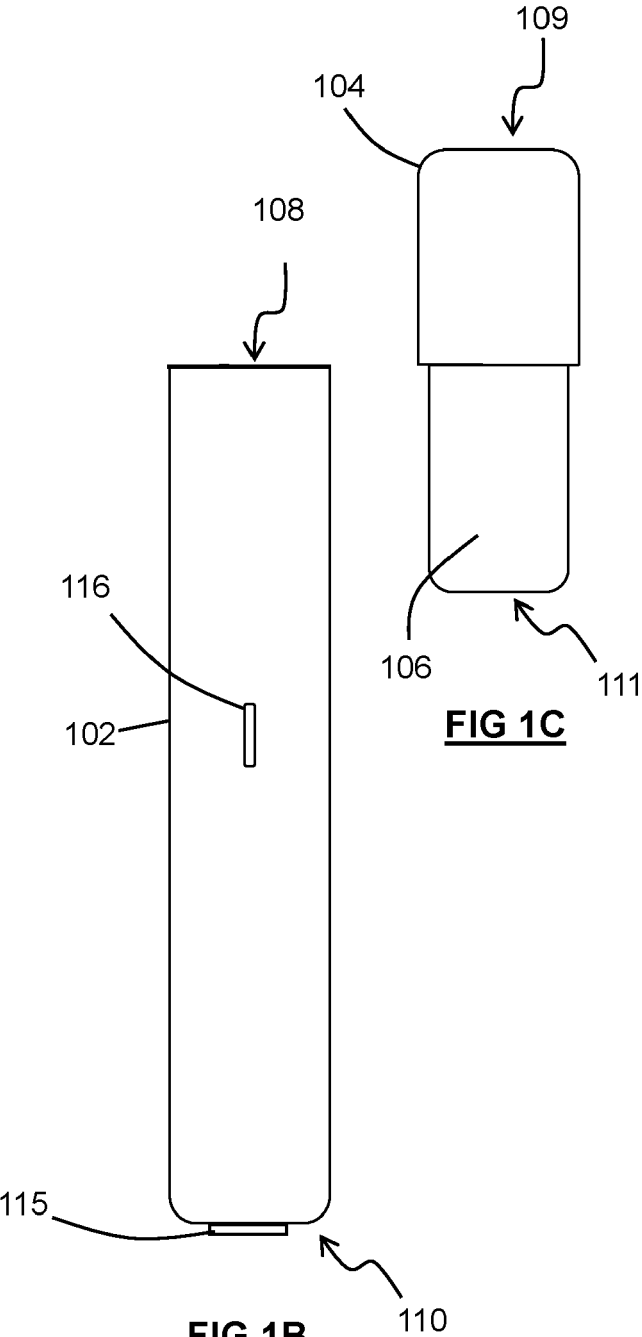


FIG 1C

FIG 1B

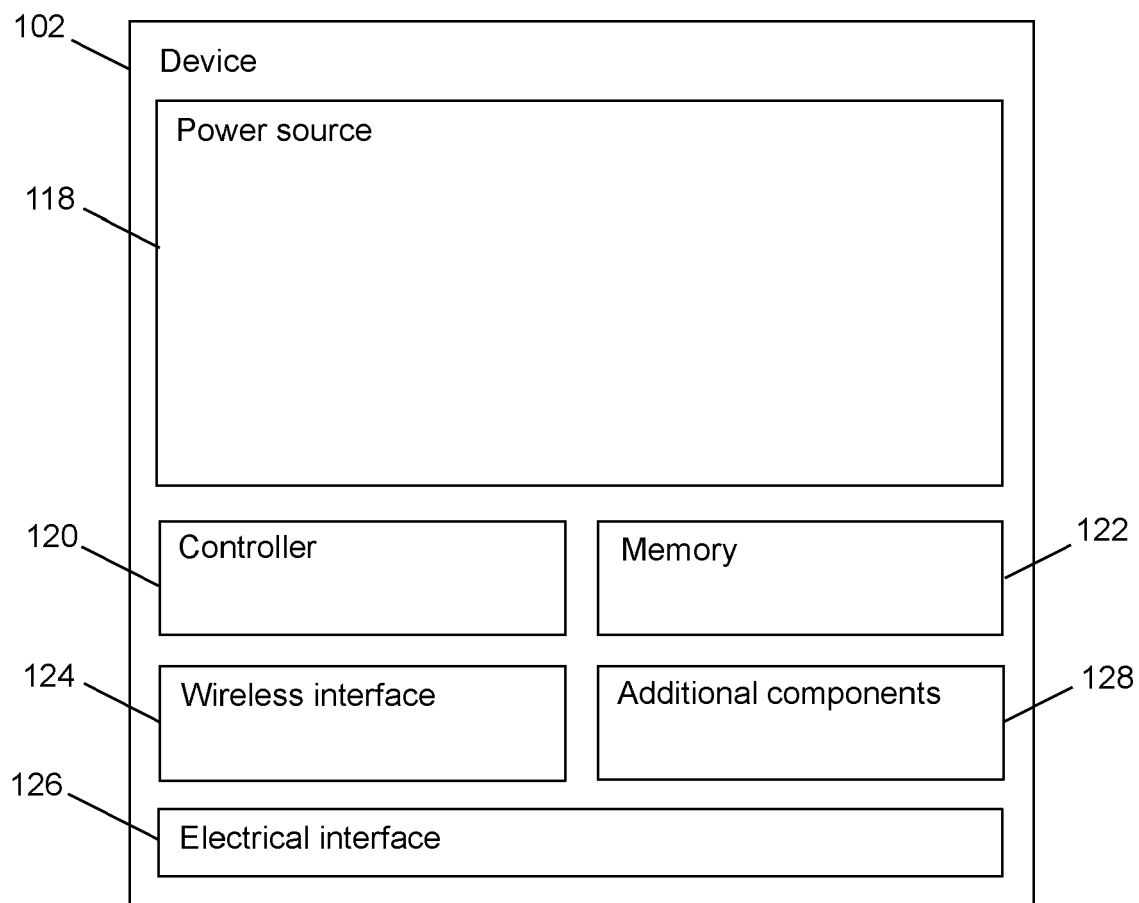


FIG 2A

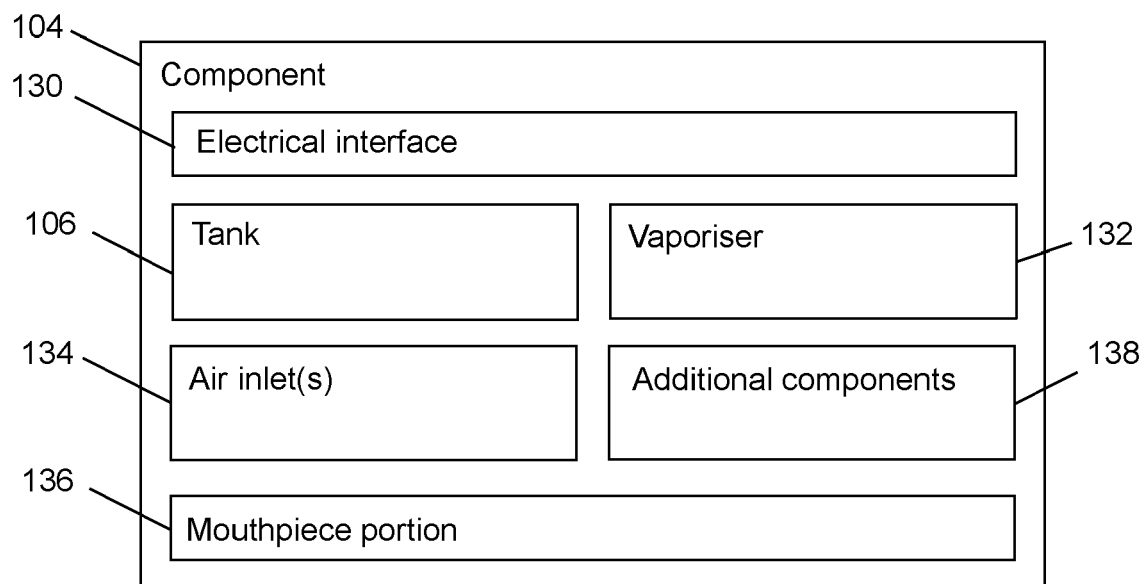
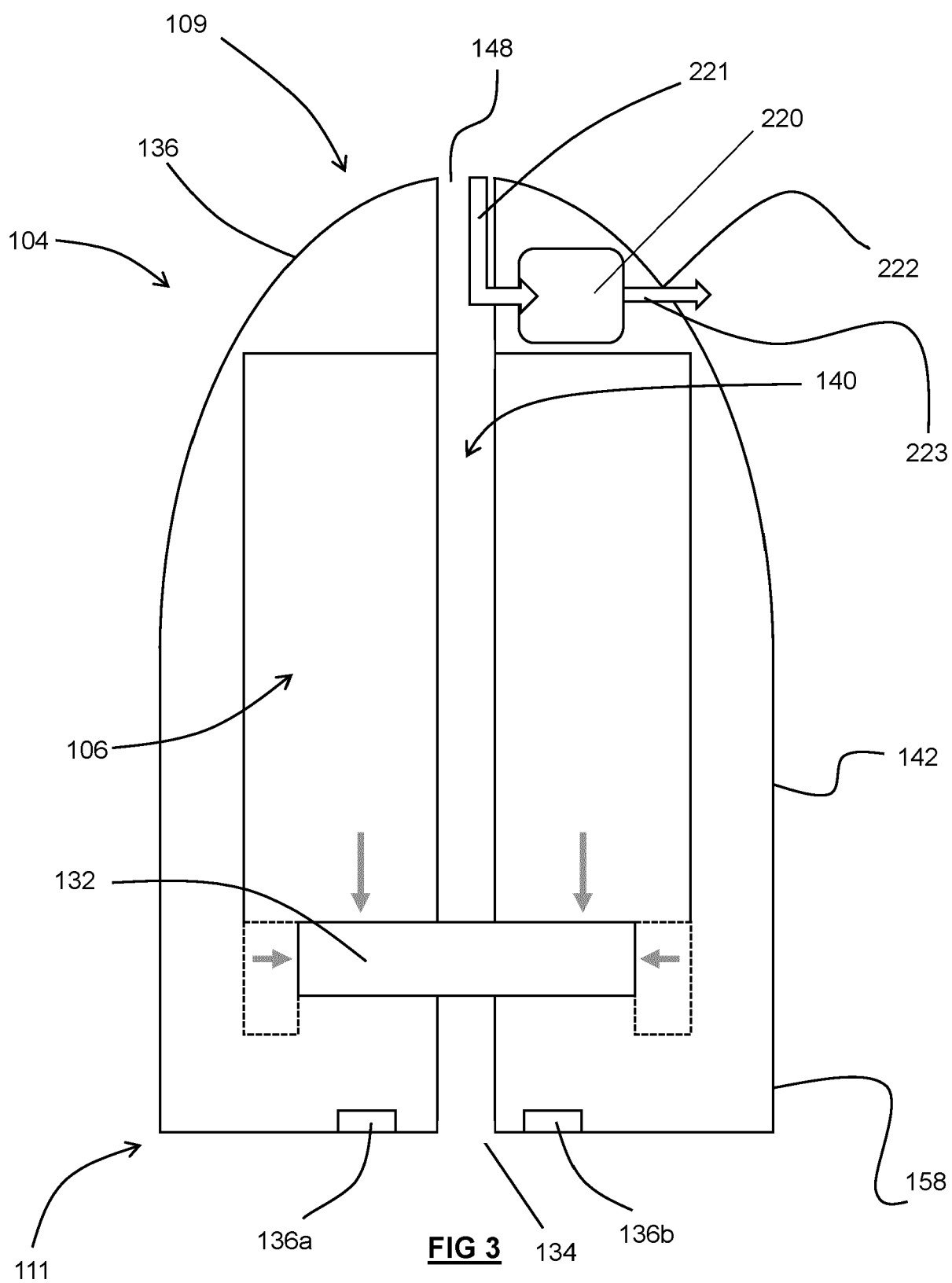


FIG 2B



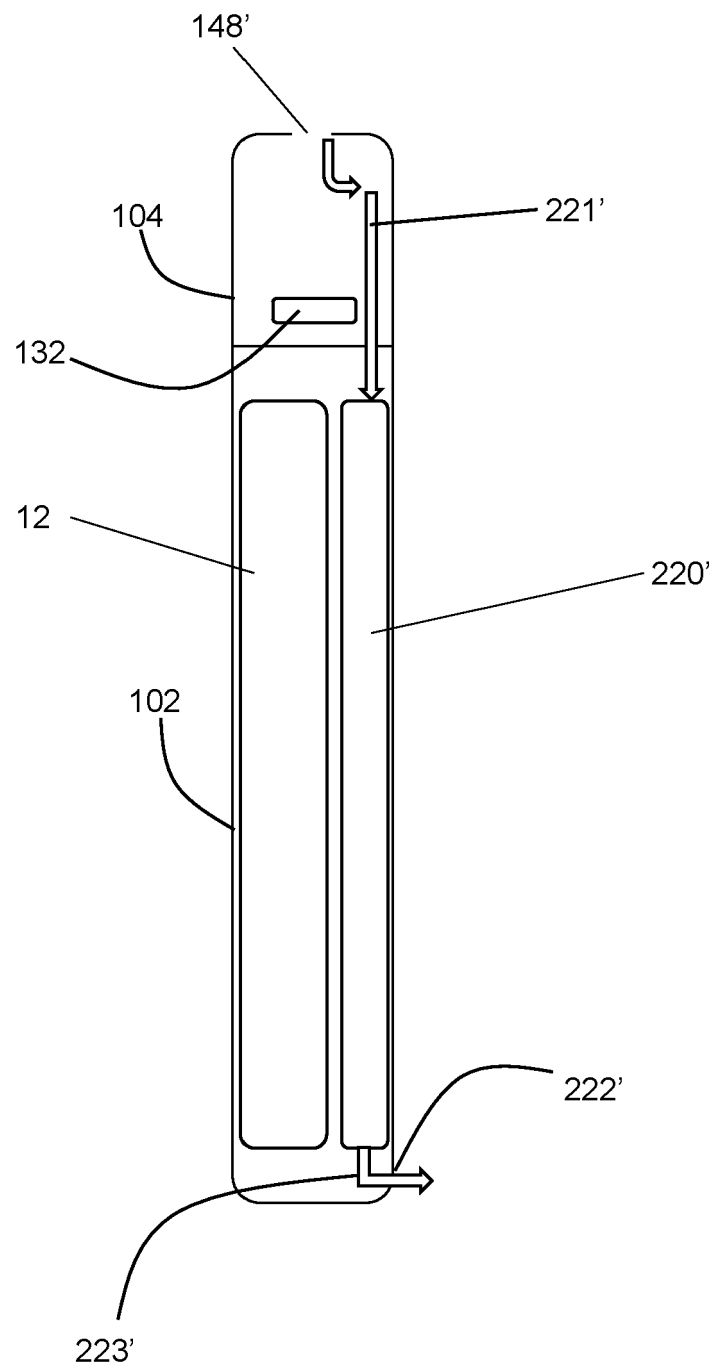


FIG 4



EUROPEAN SEARCH REPORT

Application Number

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Place of search Munich		Date of completion of the search 31 May 2022	Examiner Marzano Monterosso
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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