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

(11) EP 4 529 788 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.04.2025 Bulletin 2025/14

(21) Application number: **23201028.0**

(22) Date of filing: **29.09.2023**

(51) International Patent Classification (IPC):
***A24F 40/50** (2020.01)* ***A24F 40/51** (2020.01)*
A24F 40/20 (2020.01)

(52) Cooperative Patent Classification (CPC):
A24F 40/51; A24F 40/50; A24F 40/20

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

(71) Applicant: **Imperial Tobacco Limited**
Bristol, BS3 2LL (GB)

(72) Inventor: **The designation of the inventor has not yet been filed**

(74) Representative: **Mewburn Ellis LLP**
Aurora Building
Counterslip
Bristol BS1 6BX (GB)

(54) AEROSOL GENERATING APPARATUS AND METHOD

(57) An aerosol generating apparatus (1) comprising: an aerosol generating unit (110) operable to generate aerosol; a controller (100) configured to control energy supplied to the aerosol generating unit (110); and a sensing unit (120) for sensing motion of the aerosol generating apparatus and configured to provide a motion signal indicative of the sensed motion to the controller (100). The controller (100) is configured to determine a lack of motion state of the aerosol generating apparatus (1) based on the motion signal from the sensing unit (120), and to commence a standby period of the aerosol generating unit (110) by reducing energy supplied to the aerosol generating unit (110) from an operating energy supply rate of a usage session of the apparatus to a non-zero standby energy supply rate in response to the determination of the lack of motion state. A method and a computer-readable medium for operating an aerosol generating apparatus are also described.

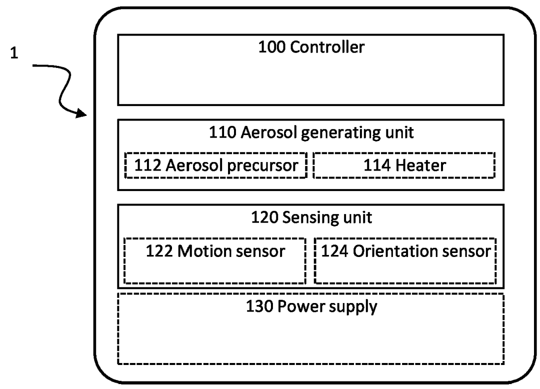

Fig. 6

EP 4 529 788 A1

Description

FIELD

[0001] The present disclosure relates to an aerosol generating apparatus and a method of operating an aerosol generating apparatus.

BACKGROUND

[0002] A typical aerosol generating apparatus may comprise a power supply, an aerosol generating unit that is driven by the power supply, an aerosol precursor, which in use is aerosolised by the aerosol generating unit to generate an aerosol, and a delivery system for delivery of the aerosol to a user.

[0003] A drawback with known aerosol generating apparatuses is controlling energy supplied to the aerosol generating unit to efficiently deliver aerosol to the user. In spite of the effort already invested in the development of aerosol generating apparatuses/systems further improvements are desirable.

SUMMARY

[0004] The present disclosure provides, according to a first aspect, an aerosol generating apparatus that comprises an aerosol generating unit, a controller configured to control energy supplied to the aerosol generating unit, and a sensing unit for sensing motion of the aerosol generating apparatus, the sensing unit being configured to provide a motion signal indicative of the sensed motion to the controller. The controller is configured to determine a lack of motion state of the aerosol generating apparatus based on the motion signal from the sensing unit, and to commence a standby period of the aerosol generating unit by reducing energy supplied to the aerosol generating unit from an operating energy supply rate of a usage session of the apparatus to a non-zero standby energy supply rate in response to the determination of the lack of motion state.

[0005] In some examples, the controller may be configured to determine the lack of motion state based on the aerosol generating apparatus having been sensed to have moved by less than a threshold amount for longer than a threshold time period during the usage session.

[0006] In this way, the device may reduce a usage rate of energy by the aerosol generating apparatus when the device is not in motion. Since a lack of motion is expected to be indicative of a lack of usage by the user (for example because they wish to pause their usage session), controlling the aerosol generating apparatus to operate in this way can reduce energy usage (e.g. energy wastage) during a usage session. This could also improve the safety of the device, by reducing or limiting energy supply to the aerosol generating unit when the user is not actively using the device, for example because they have put it down.

[0007] The aerosol generating unit may be operable to generate aerosol from an aerosol precursor.

[0008] The operating energy supply rate and the standby energy supply rate may be understood as referring to an average energy supply rate over a particular time period, rather than an instantaneous supply rate. The operating energy supply rate may be an energy supply rate sufficient to cause an aerosol to be generated from the aerosol precursor, whereas the standby energy supply rate may be an energy supply rate that is insufficient to cause an aerosol to be generated from the aerosol precursor.

[0009] In some examples, the controller may be further configured to determine a resumption of motion state of the aerosol generating apparatus, and to increase energy supplied to the aerosol generating unit from the standby energy supply rate to the operating energy supply rate following determination of the resumption of motion state.

[0010] For example, the controller may be configured to determine the resumption of motion state based on the aerosol generating apparatus having moved by more than a threshold amount after the lack of motion state has been determined.

[0011] In this way, the device may automatically respond to a movement of the device after a period of inactivity. This may be indicative, for example, of a user wishing to resume a usage session. This may be advantageous over receiving a user input such as a button press and/or detecting a user inhalation because it can reduce or avoid the time lag associated with some aerosol precursors. In more detail, certain aerosol precursors, such as heated tobacco, may have a time lag between resumption of energy supply to the aerosol generating unit and generation of aerosol. Since a movement of the apparatus is likely to occur before the user begins to attempt to inhale aerosol from the apparatus, resuming based on motion may allow time for the aerosol generating unit (and hence aerosol generation) to "ramp up" before aerosol is required or demanded by the user. This can therefore improve the user experience for the apparatus. Viewed differently, basing the reduction and the increase of energy supply rate on detected movement of the apparatus can enable energy and/or aerosol precursor usage or wastage to be reduced without degrading the user experience.

[0012] In some examples, the controller may recommence monitoring for a lack of motion following a determination of a resumption of motion. In other words, a single usage session may include multiple periods of lack of motion, and multiple determinations of resumption of motion. In this way, the control of energy supply to the aerosol generating unit can better match a user's usage pattern.

[0013] In some examples, the controller may be further configured to extend a usage session having a predetermined duration by an extension time period in response to the determination of the resumption of motion state.

[0014] The reduction of energy supplied to the aerosol generating unit following determination of the lack of motion state means that the energy consumption rate is reduced. It may also mean that consumption of an aerosol precursor or aerosol precursor may be reduced. Therefore, at the end of the usage session before extension, there may still be aerosol precursor available in the consumable that has been saved due to the reduction of energy supply rate. This may be particularly relevant for applications such as a heated tobacco apparatus, wherein the consumable is typically entirely consumed during a single usage session. Extending the usage session by an extension time period can enable this saved aerosol precursor to be delivered to the user.

[0015] The extension time period may be a fixed period added to the session time for each determination of the resumption of motion state. Alternatively, the extension time period may be based on the standby time period between the determination of the lack of motion state and the determination of the resumption of motion state. For example, the extension time period may be a particular percentage of the pause time period. The proportion may be based, for example, on the ratio between the operating energy supply rate and the standby energy supply rate, such that the total energy usage for a usage session remains the same whether or not a lack of motion state is detected. Additionally or alternatively, the proportion may be based on parameters of the aerosol precursor. For example, it may be based on the rate of consumption of the aerosol precursor at the the operating energy supply rate and the non-zero standby energy supply rate. For example, some aerosol precursors may be consumed or exhausted by the supply of energy to the aerosol generating unit even at the standby energy supply rate when compared to a non-usage condition, and the proportion may be set to account for this.

[0016] In some examples, an extended usage session duration may be equal to the sum of the predetermined usage session duration plus the duration of the standby period.

[0017] In some examples, the aerosol generating unit may comprise a heater. The controller may be configured to cause the heater to operate at a setpoint temperature. Reducing energy supplied to the aerosol generating unit may comprise reducing the setpoint temperature of the aerosol generating unit from a first setpoint temperature to a second setpoint temperature lower than the first setpoint temperature. For example, the first setpoint temperature may be a temperature at which an aerosol is generated from the aerosol precursor, while the second setpoint temperature is a temperature at which an aerosol is not generated from the aerosol precursor. Each of the first setpoint temperature and the second setpoint temperature may be an elevated temperature (i.e. a temperature greater than room temperature). Having the second setpoint temperature set as a temperature at which an aerosol is not generated can reduce aerosol precursor usage or wastage.

[0018] Controlling the heater in this way can enable control over the aerosol generation rates at the operating energy supply rate and the standby energy supply rate. For example, it may enable the standby energy supply rate to be selected such that the aerosol precursor is held close to (but not at) a temperature at which an aerosol can be generated, further reducing any "ramp up" lag when returning to the operating energy supply rate following a determination of resumption of motion.

[0019] In some examples, the heater, when at the second setpoint temperature, may be operable to return to the first setpoint temperature in less than 8 seconds, optionally in less than 5 seconds, or less than 3 seconds, or less than 1 second.

[0020] In some examples, the controller may comprise a proportional-integral-derivative (PID) controller for controlling the aerosol generating unit to operate at the setpoint temperature. A PID controller is a particular control scheme by which an operating parameter (such as a set temperature) may be maintained.

[0021] In some examples, the energy may be supplied to the aerosol generating unit via a pulsed waveform. The operating energy supply rate may therefore be provided via a first duty cycle, and the standby energy supply rate may be provided via a second duty cycle. A duty cycle may be understood as referring to a ratio of the sum of the pulse durations (i.e. the "ON" period) to the period of the waveform (i.e. the cycle rate). A lower duty cycle therefore corresponds to a lower average energy supply rate. In some examples, the pulsed waveform may be a pulse width modulation, PWM, waveform.

[0022] Provision of energy via a pulsed waveform rather than via varying, for example, supplied voltage to an aerosol generating unit can enable simpler implementation of energy supply. The energy supply can be controlled via a switch, rather than requiring components to effect a continuous variation in energy supply rate.

[0023] In some examples, the sensing unit may comprise any one, any two, or all three of a tilt switch, an accelerometer, and a gyroscope. These represent different examples for means by which motion and/or orientation of the apparatus can be detected, and can be selected as needed according to the particular requirements of the apparatus and the motion that is to be sensed or detected.

[0024] In some examples the sensing unit may be configured to sense a rotational movement and/or a translational movement of the aerosol generating apparatus. The lack of motion state and the resumption of motion state may be determined by comparing the motion to a threshold. For example, the threshold may be one or more of a threshold orientation change, a threshold duration of rotation, a threshold rotation rate, a threshold translation distance, a threshold duration of translation, and a threshold rate of translation. The threshold orientation change may be a change of orientation about any one, any two or all three of the orthogonal rotation axes of the apparatus (e.g. yaw, pitch and roll). Similarly, the threshold translation distance may be a translation along about any one, any two or all three of the orthogonal translation axes of the apparatus (e.g. x, y, z). The threshold may thereby be set based on the expected motion of the apparatus. The thresholds may differ for determining a lack of motion state and determining a resumption of motion state.

[0025] In some examples, the aerosol generating apparatus may be a heat-not-burn, HNB, aerosol generating apparatus.

[0026] In some examples, the device may provide a notification to a user following determination of the lack of motion state. The notification may comprise any one, any two, or all three of a haptic notification, a visual notification, and an audible notification. The notification may be a one-off notification (e.g. a single audible, visible, or haptic output), or may continue while the lack of motion state persists (e.g. an intermittent or pulsed sequence of audible, visible, or haptic outputs). Such a notification may therefore serve to inform a user that energy is being supplied at the reduced energy supply rate, and/or to prompt the user to move the apparatus to resume energy supply at the higher operating energy supply rate.

[0027] In some examples, the sensing unit is for sensing orientation and motion of the aerosol generating apparatus and is configured to provide a motion signal indicative of the sensed motion and an orientation signal indicative of the sensed orientation to the controller. The controller is configured to determine a lack of motion state of the aerosol generating apparatus based on the orientation signal from the sensing unit and the motion signal from the sensing unit, and to commence a standby period of the aerosol generating unit by reducing energy supplied to the aerosol generating unit from an operating energy supply rate to a non-zero standby energy supply rate in response to the determination of the lack of motion state. For example, the controller may be configured to determine the lack of motion state based on the aerosol generating apparatus having been sensed to have been within a predetermined orientation range by the sensing unit and to have moved by less than a threshold amount for longer than a threshold time period during the usage session.

[0028] In this example, the lack of motion state can therefore be limited to being determined only if the aerosol generating device is at a particular orientation, or within a particular orientation range. Such an orientation range may be selected, for example, as positions where it is unlikely that the user is holding the aerosol generating device in a position for usage. Monitoring the orientation in this way may prevent, for example, a determination of lack of motion occurring during usage if a user does not move the device while inhaling aerosol. In other words, this provides an improved determination of when to reduce the energy supply rate by accounting for the device position and the device movement. For example, it may allow for a shorter monitoring time period, or quicker response, to lack of motion by reducing the chance for false positive detection of lack of motion.

[0029] There is also provided, according to a second aspect, a method of operating an aerosol generating apparatus comprising an aerosol generating unit for generating aerosol, and a sensing unit for sensing motion of the aerosol generating apparatus. The method comprises the steps of providing energy to the aerosol generating unit, determining a lack of motion state of the aerosol generating apparatus based on the motion signal from the sensing unit, and commencing a standby period of the aerosol generating unit by reducing energy supplied to the aerosol generating unit from an operating energy supply rate of a usage session of the apparatus to a non-zero standby energy supply rate in response to the determination of the lack of motion state.

[0030] In some examples, the method may further comprise the steps of determining a resumption of motion state of the aerosol generating apparatus based on the motion signal from the sensing unit; and ending the standby period of the aerosol generating unit by increasing energy supplied to the aerosol generating unit from the standby energy supply rate to the operating energy supply rate following the determination of the resumption of motion state.

[0031] In some examples, the method may further comprise the step of extending a usage session having a predetermined duration by an extension time period in response to the determination of the resumption of motion state.

[0032] More generally, features of the first aspect pertain, except where incompatible, to the method of the second aspect. Indeed, the method of the second aspect can be performed using the aerosol generating apparatus of the first aspect.

[0033] There is also provided, according to a third aspect, electrical circuitry and/or a computer program configured to cause an aerosol generating apparatus/-system to perform the method of the second aspect. A computer readable medium comprising the computer program is also disclosed.

[0034] The preceding summary is provided for purposes of summarizing some examples to provide a basic understanding of aspects of the subject matter described herein. Accordingly, the above-described features should not be construed to narrow the scope or spirit of the subject matter described herein in any way. Moreover, the above and/or proceeding examples may be combined in any suitable combination to provide further examples, except where such a combination is clearly impermissible or expressly avoided. Other features, aspects, and advantages of the subject matter described herein will become apparent from the following text and the accompanying drawings.

BRIEF DESCRIPTION OF THE FIGURES

[0035] Aspects, features and advantages of the present disclosure will become apparent from the following description of examples in reference to the appended drawings in which like numerals denote like elements.

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

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

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

Fig. 4 is a block system diagram showing an example implementation of the apparatus of Fig. 1, where the aerosol generating apparatus is configured to generate aerosol from a solid precursor.

Fig. 5 is a schematic diagram showing an example implementation of the apparatus of Fig. 4.

Fig. 6 is a block system diagram showing an example implementation of the apparatus of Fig. 1.

Fig. 7A is a flow diagram for a control method executed by the controller of an aerosol generating device.

Fig. 7B is a flow diagram for a subsequent part of the control method of Fig. 7A.

Fig. 7C is a flow diagram for a subsequent part of the control method of Fig. 7B.

Fig. 8 is a diagram illustrating exemplary usage sessions for an aerosol generating device.

Fig. 9 is a flow diagram for an alternative part of the control method to that of Fig. 7A.

DETAILED DESCRIPTION OF EMBODIMENTS

[0036] Before describing several examples implementing the present disclosure, it is to be understood that the present disclosure is not limited by specific construction details or process steps set forth in the following description and accompanying drawings. Rather, it will be apparent to those skilled in the art having the benefit of the present disclosure that the systems, apparatuses and/or methods described herein could be embodied differently and/or be practiced or carried out in various alternative ways.

[0037] Unless otherwise defined herein, scientific and technical terms used in connection with the presently disclosed inventive concept(s) shall have the meanings that are commonly understood by those of ordinary skill in the art, and known techniques and procedures may be performed according to conventional methods well known in the art and as described in various general and more specific references that may be cited and discussed in the present specification.

[0038] Any patents, published patent applications, and non-patent publications mentioned in the specification are hereby incorporated by reference in their entirety.

[0039] All examples implementing the present disclosure can be made and executed without undue experimentation in light of the present disclosure. While particular examples have been described, it will be apparent to those of skill in the art that variations may be applied to the systems, apparatus, and/or methods and in the steps or in the sequence of steps of the methods described herein without departing from the concept, spirit, and scope of the inventive concept(s). All such similar substitutions and modifications apparent to those skilled in the art are deemed to be within the spirit, scope, and concept of the inventive concept(s) as defined by the appended claims.

[0040] The use of the term "a" or "an" in the claims and/or the specification may mean "one," as well as "one or more," "at least one," and "one or more than one." As such, the terms "a," "an," and "the," as well as all singular terms, include plural referents unless the context clearly indicates otherwise. Likewise, plural terms shall include the singular unless otherwise required by context.

[0041] The use of the term "or" in the present disclosure (including the claims) is used to mean an inclusive "and/or" unless explicitly indicated to refer to alternatives only or unless the alternatives are mutually exclusive. For example, a condition "A or B" is satisfied by any of the following: A is true (or present) and B is false (or not present), A is false (or not present) and B is true (or present), and both A and B are true (or present).

[0042] As used in this specification and claim(s), the words "comprising, "having," "including," or "containing" (and any forms thereof, such as "comprise" and "comprises," "have" and "has," "includes" and "include," or "contains" and "contain," respectively) are inclusive or open-ended and do not exclude additional, unrecited elements or method steps.

[0043] Unless otherwise explicitly stated as incompatible, or the physics or otherwise of the embodiments, examples, or claims prevent such a combination, the features of examples disclosed herein, and of the claims, may be integrated together in any suitable arrangement, especially ones where there is a beneficial effect in doing so. This is not limited to only any specified benefit, and instead may arise from an "ex post facto" benefit. This is to say that the combination of features is not limited by the described forms, particularly the form (e.g. numbering) of example(s), embodiment(s), or dependency of claim(s). Moreover, this also applies to the phrase "in one embodiment," "according to an embodiment," and the like, which are merely a stylistic form of wording and are not to be construed as limiting the following features to a separate embodiment to all other instances of the same or similar wording. This is to say, a reference to 'an,' 'one,' or 'some' embodiment(s) may be a reference to any one or more, and/or all embodiments, or combination(s) thereof, disclosed. Also, similarly, the reference to "the" embodiment may not be limited to the immediately preceding embodiment. Further, all references to one or more embodiments or examples are to be construed as non-limiting to the claims.

[0044] The present disclosure may be better understood in view of the following explanations, wherein the terms used that are separated by "or" may be used interchangeably:

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

[0045] Each occurrence of the aerosol generating apparatus being caused to generate aerosol for a period of time (which may be variable) may be referred to as an **"activation"** of the aerosol generating apparatus. The aerosol generating apparatus may be arranged to allow an amount of aerosol delivered to a user to be varied per activation (as opposed to delivering a fixed dose of aerosol), e.g. by activating an aerosol generating unit of the apparatus for a variable amount of time, e.g. based on the strength/duration of a draw of a user through a flow path of the apparatus (to replicate an effect of smoking a conventional combustible smoking article).

[0046] The aerosol generating apparatus may be portable. As used herein, the term **"portable"** may refer to the apparatus being for use when held by a user.

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

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

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

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

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

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

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

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

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

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

[0057] As used herein **"heat-not-burn"** (or **"HNB"** or **"heated precursor"**) may refer to the heating of a precursor, typically tobacco, without combustion, or without substantial combustion (i.e. localised combustion may be experienced of limited portions of the precursor, including of less than 5% of the total volume).

[0058] As used herein, **"electrical circuitry"** may refer to one or more electrical components, examples of which may include: an Application Specific Integrated Circuit (ASIC); electronic/electrical componentry (which may include combinations of transistors, resistors, capacitors, inductors etc); one or more processors; a non-transitory memory (e.g. implemented by one or more memory devices), that may store one or more software or firmware programs; a combinational logic circuit; interconnection of the aforesaid.

[0059] As used herein, a **"processing resource"** (or **"processor"** or **"controller"**) may refer to one or more units for processing data, examples of which may include an ASIC, microcontroller, FPGA, microprocessor, digital signal processor (DSP) capability, state machine or other suitable component. A processing resource may be configured to execute a computer program, e.g. which may take the form of machine-readable instructions, which may be stored on a non-transitory memory and/or programmable logic. The processing resource may have various arrangements corresponding to those discussed for the circuitry, e.g. on-board and/or off board the apparatus as part of the system. As used herein, any machine executable instructions, or computer readable media, may be configured to cause a disclosed method to be carried out, e.g. by an aerosol generating apparatus or system as disclosed herein, and may therefore be used synonymously with the term method.

[0060] As used herein, a **"computer readable medium/media"** (or **"memory"** or **"data storage"**) may include any medium capable of storing a computer program, and may take the form of any conventional non-transitory memory, for example one or more of: random access memory (RAM); a CD; a hard drive; a solid-state drive; a memory card; a DVD. The memory may have various arrangements corresponding to those discussed for the circuitry /processor. The present disclosure includes a computer readable medium configured to cause an apparatus or system disclosed herein to perform a method as disclosed herein.

[0061] Referring to Fig. 1, an example aerosol generating apparatus 1 includes a power supply 2, for supply of electrical energy. The apparatus 1 includes an aerosol generating unit 4 that is driven by the power supply 2. The power supply 2 may include an electric power supply in the form of a battery and/or an electrical connection to an external power source. The apparatus 1 includes a precursor 6, which in use is aerosolised by the aerosol generating unit 4 to generate an aerosol. The apparatus 2 includes a delivery system 8 for delivery of the aerosol to a user.

[0062] Electrical circuitry (not shown in figure 1) may be implemented to control the interoperability of the power supply 4 and aerosol generating unit 6.

[0063] In variant examples, which are not illustrated, the power supply 2 may be omitted since, e.g. an aerosol generating unit implemented as an atomiser with flow expansion may not require a power supply.

[0064] Fig. 2 shows an implementation of the apparatus 1 of Fig. 1, where the aerosol generating apparatus 1 is configured to generate aerosol from a liquid precursor.

[0065] In this example, the apparatus 1 includes a device body 10 and a consumable 30.

[0066] In this example, the body 10 includes the power supply 4. The body may additionally include any one or more of electrical circuitry 12, a memory 14, a wireless interface 16, one or more other components 18.

[0067] The electrical circuitry 12 may include a processing resource for controlling one or more operations of the body 10 and consumable 30, e.g. based on instructions stored in the memory 14.

[0068] The wireless interface 16 may be configured to communicate wirelessly with an external (e.g. mobile) device, e.g. via Bluetooth.

[0069] The other component(s) 18 may include one or more user interface devices configured to convey information to a user and/or a charging port, for example (see e.g. Fig. 3).

[0070] The consumable 30 includes a storage portion implemented here as a tank 32 which stores the liquid precursor 6 (e.g. e-liquid). The consumable 30 also includes a heating system 34, one or more air inlets 36, and a mouthpiece 38. The consumable 30 may include one or more other components 40.

[0071] The body 10 and consumable 30 may each include a respective electrical interface (not shown) to provide an electrical connection between one or more components of the body 10 with one or more components of the consumable 30. In this way, electrical power can be supplied to components (e.g. the heating system 34) of the consumable 30, without the consumable 30 needing to have its own power supply.

[0072] In use, a user may activate the aerosol generating apparatus 1 when inhaling through the mouthpiece 38, i.e. when performing a puff. The puff, performed by the user, may initiate a flow through a flow path in the consumable 30 which extends from the air inlet(s) 34 to the mouthpiece 38 via a region in proximity to the heating system 34.

[0073] Activation of the aerosol generating apparatus 1 may be initiated, for example, by an airflow sensor in the body 10 which detects airflow in the aerosol generating apparatus 1 (e.g. caused by a user inhaling through the mouthpiece), or by actuation of an actuator included in the body 10. Upon activation, the electrical circuitry 12 (e.g. under control of the processing resource) may supply electrical energy from the power supply 2 to the heating system 34 which may cause the heating system 32 to heat liquid precursor 6 drawn from the tank to produce an aerosol which is carried by the flow out of the mouthpiece 38.

[0074] In some examples, the heating system 34 may include a heating filament and a wick, wherein a first portion of the wick extends into the tank 32 in order to draw liquid precursor 6 out from the tank 32, wherein the heating filament coils around a second portion of the wick located outside the tank 32. The heating filament may be configured to heat up liquid precursor 6 drawn out of the tank 32 by the wick to produce the aerosol.

[0075] In this example, the aerosol generating unit 4 is provided by the above-described heating system 34 and the delivery system 8 is provided by the above-described flow path and mouthpiece 38.

[0076] In variant embodiments (not shown), any one or more of the precursor 6, heating system 34, air inlet(s) 36 and mouthpiece 38, may be included in the body 10. For example, the mouthpiece 36 may be included in the body 10 with the precursor 6 and heating system 32 arranged as a separable cartomizer.

[0077] Figs. 3a and 3b show an example implementation of the aerosol generating device 1 of Fig. 2. In this example, the consumable 30 is implemented as a capsule/pod, which is shown in Fig. 3a as being physically coupled to the body 10, and is shown in Fig. 3b as being decoupled from the body 10.

[0078] In this example, the body 10 and the consumable 30 are configured to be physically coupled together by pushing the consumable 30 into an aperture in a top end 11 the body 10, with the consumable 30 being retained in the aperture via an interference fit.

[0079] In other examples (not shown), the body 10 and the consumable 30 could be physically coupled together in other ways, e.g. by screwing one onto the other, through a bayonet fitting, or through a snap engagement mechanism, for example.

[0080] The body 10 also includes a charging port (not shown) at a bottom end 13 of the body 10.

[0081] The body 10 also includes a user interface device configured to convey information to a user. Here, the user interface device is implemented as a light 15, which may e.g. be configured to illuminate when the apparatus 1 is activated. Other user interface devices are possible, e.g. to convey information haptically or audibly to a user.

[0082] In this example, the consumable 30 has an opaque cap 31, a translucent tank 32 and a translucent window 33. When the consumable 30 is physically coupled to the body 10 as shown in Fig. 3a, only the cap 31 and window 33 can be seen, with the tank 32 being obscured from view by the body 10. The body 10 includes a slot 15 to accommodate the window 33. The window 33 is configured to allow the amount of liquid precursor 6 in the tank 32 to be visually assessed, even when the consumable 30 is physically coupled to the body 10.

[0083] Fig. 4 shows an implementation of the apparatus 1 of Fig. 1, where the aerosol generating apparatus 1 is configured to generate aerosol by a-heat not-burn process.

[0084] In this example, the apparatus 1 includes a device body 50 and a consumable 70.

[0085] In this example, the body 50 includes the power supply 4 and a heating system 52. The heating system 54 includes at least one heating element 54. The body may additionally include any one or more of electrical circuitry 56, a memory 58, a wireless interface 60, one or more other components 62.

[0086] The electrical circuitry 56 may include a processing resource for controlling one or more operations of the body 50, e.g. based on instructions stored in the memory 58.

[0087] The wireless interface 60 may be configured to communicate wirelessly with an external (e.g. mobile) device, e.g. via Bluetooth.

[0088] The other component(s) 62 may include an actuator, one or more user interface devices configured to convey information to a user and/or a charging port, for example (see e.g. Fig. 5).

[0089] The body 50 is configured to engage with the consumable 70 such that the at least one heating element 54 of the heating system 52 penetrates into the solid precursor 6 of the consumable. In use, a user may activate the aerosol generating apparatus 1 to cause the heating system 52 of the body 50 to cause the at least one heating element 54 to heat the solid precursor 6 of the consumable (without combusting it) by conductive heat transfer, to generate an aerosol which is inhaled by the user.

[0090] Fig. 5 shows an example implementation of the aerosol generating device 1 of Fig. 4.

[0091] As depicted in Fig. 5, the consumable 70 is implemented as a stick, which is engaged with the body 50 by inserting the stick into an aperture at a top end 53 of the body 50, which causes the at least one heating element 54 of the heating system 52 to penetrate into the solid precursor 6.

[0092] The consumable 70 includes the solid precursor 6 proximal to the body 50, and a filter distal to the body 50. The filter serves as the mouthpiece of the consumable 70 and thus the apparatus 1 as a whole. The solid precursor 6 may be a reconstituted tobacco formulation.

[0093] In this example, the at least one heating element 54 is a rod-shaped element with a circular transverse profile. Other heating element shapes are possible, e.g. the at least one heating element may be blade-shaped (with a rectangular transverse profile) or tube-shaped (e.g. with a hollow transverse profile).

[0094] In this example, the body 50 includes a cap 51. In use the cap 51 is engaged at a top end 53 of the body 50. Although not apparent from Fig. 5, the cap 51 is moveable relative to the body 50. In particular, the cap 51 is slidable and can slide along a longitudinal axis of the body 50.

[0095] The body 50 also includes an actuator 55 on an outer surface of the body 50. In this example, the actuator 55 has the form of a button.

[0096] The body 50 also includes a user interface device configured to convey information to a user. Here, the user interface device is implemented as a plurality of lights 57, which may e.g. be configured to illuminate when the apparatus 1 is activated and/or to indicate a charging state of the power supply 4. Other user interface devices are possible, e.g. to convey information haptically or audibly to a user.

[0097] The body may also include an airflow sensor which detects airflow in the aerosol generating apparatus 1 (e.g. caused by a user inhaling through the consumable 70). This may be used to count puffs, for example.

[0098] In this example, the consumable 70 includes a flow path which transmits aerosol generated by the at least one heating element 54 to the mouthpiece of the consumable.

[0099] In this example, the aerosol generating unit 4 is provided by the above-described heating system 52 and the delivery system 8 is provided by the above-described flow path and mouthpiece of the consumable 70.

[0100] Referring to Fig. 6, an aerosol generating apparatus 1, which may be implemented in any of the preceding examples, comprises a controller 100, an aerosol generating unit 110 for generating aerosol from an aerosol precursor 112, a sensing unit 120, and a power supply 130. In this example, the sensing unit 120 includes at least one sensor for sensing motion of the aerosol generating apparatus 1, and at least one sensor for sensing orientation of the aerosol generating apparatus 1. The sensor for sensing motion and/or orientation may be any one, any two, or all three of a tilt switch, an accelerometer, and a gyro sensor. The same sensor may sense both motion and orientation of the aerosol generating apparatus 1.

[0101] Energy may be supplied to the aerosol generating unit 110 via a continuously variable supply (e.g. a variable voltage), or via a pulsed signal such as a pulse width modulation (PWM) signal. Energy may be supplied at a fixed rate, or may be supplied based on a feedback loop such as a proportional-integral-derivative control scheme to maintain a particular parameter of the aerosol generating unit 110. In this example, the aerosol generating unit 110 includes a heater 114, with energy being supplied to maintain a particular setpoint temperature of the heater 114.

[0102] The controller 100 receives a motion signal and an orientation signal from the sensing unit 120. The motion signal is indicative of the sensed motion of the aerosol generating apparatus 1, and the orientation signal is indicative of the sensed orientation of the aerosol generating apparatus 1. The controller 100 may process the motion and orientation signals to infer the motion and orientation of the aerosol generating apparatus 1. The controller is configured to control the supply of energy to the aerosol generating unit based on the received motion and orientation signals by switching between two different energy supply rates. These may be, for example, two setpoint temperatures for the heater 114.

[0103] A control method that may be implemented by the controller 100 is illustrated in Fig. 7A, 7B, 7C.

[0104] A first stage of the control method is illustrated in Fig. 7A. The first stage involves determining and acting upon a lack of motion state of the aerosol generating device.

[0105] A usage session is commenced (S1010) following, for example, a user input, and energy is supplied to the aerosol generating unit 110 at the operating energy supply rate (S1020) of the usage session. During the usage session, the controller 100 receives a motion signal input from the sensing unit 120 (S1030) and determines whether the sensed motion within a preceding time period exceeds a predetermined threshold amount (S1040). The threshold amount may be, for example, a rate, duration, or magnitude of change of position and/or orientation.

[0106] If the sensed motion does exceed the threshold amount (Yes, S1050a), the controller 100 continues to receive and monitor the motion signal from the sensing unit 120. If the sensed motion does not exceed the threshold amount (No, S1050b), the controller determines a lack of motion state (S1060). Optionally, a notification may be provided to the user (S1070) of this determination. This may be a visual, audible, or haptic notification.

[0107] Following determination of a lack of motion state, the controller 100 reduces the energy supply rate to the aerosol generating unit 110, and supplies energy to the aerosol generating unit 110 at a standby energy supply rate (S1080), the standby energy supply rate being a non-zero energy supply rate lower than the operating energy supply rate. For example, the controller may reduce the setpoint temperature for the heater 114 to reduce the energy supply rate.

[0108] A second stage of the control method, which may follow the first stage, is illustrated in Fig. 7B. The second stage involves determining and acting upon a resumption of motion state.

[0109] Following determination of the lack of motion state, the controller 100 receives and monitor the motion signal from the sensing unit 120 (S1090) and determines whether the sensed motion within a preceding time period exceeds a predetermined threshold amount (S1100). If the sensed motion does not exceed the threshold amount (No, S1110a), the controller 100 continues to monitor the motion signal from the sensing unit 120. If the sensed motion does exceed the threshold amount (Yes, S1110b), the controller determines a resumption of motion state (S1120).

[0110] The threshold amount for determining resumption of motion may be different to the threshold amount for determining lack of motion. For example, the threshold amount for determining resumption of motion may be larger than the threshold amount for determining lack of motion, such that a more significant motion is required to cause a determination of resumption of motion than to prevent determination of a lack of motion.

[0111] Optionally, a notification may be provided to the user (S1130) of this determination of resumption of motion. This may be any one, any two or all three of a visual, audible, and haptic notification.

[0112] Following determination of a resumption of motion state, the controller 100 increases the energy supply rate to the aerosol generating unit 110, and resumes supplying energy to the aerosol generating unit 110 at the operating energy supply rate (S1140). For example, the controller may increase the setpoint temperature for the heater 114 to increase the energy supply rate. The control method may then return to step S1030 of Fig. 7A, such that there may be multiple determined periods of lack of motion during a single usage session.

[0113] A third stage of the control method is illustrated in Fig. 7C. The third stage involves extending the usage session based on the time between the determination of a lack of motion and determination of a resumption of motion.

[0114] Following a determination of a resumption of motion, the controller 100 records the time elapsed between the determination of a lack of motion and determination of a resumption of motion (S1150). Where there are multiple determinations of lack of motion and determinations of resumption of motion, the total time between each respective determination of a lack of motion and determination of a resumption of motion may be recorded, and the sum of the recorded times may be taken as the time elapsed. The usage session is extended based on this time elapsed (S1160). For example, the usage session may be extended by a proportion of the time elapsed. Following the extended duration of the usage session, the controller ends the usage session (S1170).

[0115] Fig. 8 illustrates different examples of usage sessions and extensions thereof based on determinations of lack of motion and resumption of motion. In each of the following, the usage session includes a standard usage session having a predetermined duration. The predetermined duration is the length of the usage session if there is no determination of a lack of motion (as illustrated in the first example usage session 200). The controller 100 may extend the usage session by a usage session extension, the usage session extension having an extension duration based on the duration of any standby period(s) between a determination of a lack of motion and a determination of a resumption of motion.

[0116] In the first example, usage session 200, there is no determination of a lack of motion. Energy is supplied 202 at the operating energy supply rate for the duration of the standard usage session. In other words, the usage session 200 continues for its predetermined length, and is not extended.

[0117] In the second example, usage session 210, there is a determination of a lack of motion 212 and a determination of a resumption of motion 214. Energy is suppled 211 at the operating energy supply rate until the determination of the lack of motion 212. Energy is then suppled 213 at the standby energy supply rate until the determination of the resumption of motion 214 (the standby period). Energy is then supplied 215 at the operating energy supply rate until the expected end of the usage session, and continues to be supplied for an extension period 216, the duration of which is dependent on the duration of the standby period.

[0118] In the third example, usage session 220, there are two determinations of lack of motion 222, 226, and two determinations of resumption of motion 224, 228. Energy is supplied 221, 225, 229 at the operating supply rate from the start of the session until the first determination of lack of motion 222, from the first determination of resumption of motion 224 until the second determination of lack of motion 226, and from the second determination of resumption of motion 228 until the end of the standard usage session. Energy continues to be supplied at the operating supply rate for an extension period 230, the duration of which is dependent on the sum of the standby periods 223, 227 between the determinations of lack of motion 222, 226 and the determinations of resumption of motion 224, 228.

[0119] An alternative stage of the control method is illustrated in Fig. 9. The stage illustrated in Fig. 9 is an alternative to the first stage of the control method illustrated in Fig. 7A, and involves determining an acting upon a lack of motion state when the apparatus is in a particular orientation.

[0120] A usage session is commenced (S2010), and energy is supplied to the aerosol generating unit 110 at the operating supply rate (S2020). During the usage session, the controller 100 receives an orientation signal from the sensing unit 120 (S2030), which indicates the orientation of the aerosol generating device 1. The controller determines whether the orientation of the aerosol generating device 1 is within a particular orientation range (S2040). The orientation range may be a range of orientations or positions where it is unlikely that the user is holding the aerosol generating device in a position for usage.

[0121] If the sensed orientation is not within the predetermined range (No, S2050a), the controller 100 continues to receive and monitor the orientation signal from the sensing unit 120. If the sensed orientation is within the predetermined range (Yes, S2050b), the controller receives a motion signal input from the sensing unit 120 (S2060) and determines whether the sensed motion within a preceding time period exceeds a threshold amount (S2070).

[0122] If the sensed motion does exceed the threshold amount (Yes, S2080a), the controller returns to receiving and monitoring the orientation signal from the sensing unit 120. If the sensed motion does not exceed the threshold amount (No, S2080b), the controller determines a lack of motion state (S2090). Optionally, a notification may be provided to the user (S2100) of this determination. This may be any one, any two or all three of a visual, audible, and haptic notification.

[0123] Following determination of a lack of motion state, the controller 100 reduces the energy supply rate to the aerosol generating unit 110, and supplies energy to the aerosol generating unit 110 at the standby energy supply rate (S2110).

[0124] The control method may then continue to the steps set out in Fig. 7B. It may not be necessary to monitor the orientation when determining a resumption of motion, since it is more likely that this motion, regardless of orientation, is indicative of the user preparing to demand aerosol from the device. However, a determination of orientation may nevertheless be made before step S1090 of Fig. 7B, or after step S1110b of Fig. 7B to determine whether the orientation of the aerosol generating device 1 falls within an expected usage range of orientations when determining a resumption of motion.

Claims

1. An aerosol generating apparatus (1) comprising:

an aerosol generating unit (110) operable to generate aerosol;
a controller (100) configured to control energy supplied to the aerosol generating unit (110); and
a sensing unit (120) for sensing motion of the aerosol generating apparatus, the sensing unit (120) being configured to provide a motion signal indicative of the sensed motion to the controller (100);
wherein the controller (100) is configured:

to determine a lack of motion state of the aerosol generating apparatus (1) based on the motion signal from the sensing unit (120), and
to commence a standby period of the aerosol generating unit (110) by reducing energy supplied to the aerosol generating unit (110) from an operating energy supply rate of a usage session of the apparatus to a non-zero standby energy supply rate in response to the determination of the lack of motion state.

2. An aerosol generating apparatus (1) according to claim 1, wherein the controller (100) is further configured:

to determine a resumption of motion state of the aerosol generating apparatus (1) based on the motion signal from the sensing unit (120); and
to end the standby period of the aerosol generating unit (110) by increasing energy supplied to the aerosol generating unit (110) from the standby energy supply rate to the operating energy supply rate following determination of the resumption of motion state.

3. An aerosol generating apparatus (1) according to claim 2, wherein the controller (100) is further configured:
to extend the usage session having a predetermined duration by an extension time period in response to the determination of the resumption of motion state.

4. An aerosol generating apparatus (1) according to claim 3, wherein the extension time period is based on a duration of the standby period.

5. An aerosol generating apparatus (1) according to claim 4, wherein an extended usage session duration is equal to the sum of the predetermined usage session duration plus the duration of the standby period.

6. An aerosol generating apparatus (1) according to any preceding claim, wherein the aerosol generating unit (110) comprises a heater (114), the controller (100) being configured to cause the heater (114) to operate at a setpoint temperature, and wherein reducing energy supplied to the aerosol generating unit (110) comprises reducing the setpoint temperature of the aerosol generating unit (110) from a first setpoint temperature to a second setpoint temperature lower than the first setpoint temperature.

7. An aerosol generating apparatus (1) according to claim 6, wherein the first setpoint temperature is a temperature at which an aerosol is generated from the aerosol precursor, and wherein the second setpoint temperature is a temperature at which an aerosol is not generated from the aerosol precursor.

8. An aerosol generating apparatus (1) according to claim 6 or claim 7, wherein the heater, when at the second setpoint temperature, is operable to return to the first setpoint temperature in less than 8 seconds, optionally in less than 5 seconds.

9. An aerosol generating apparatus (1) according to any preceding claim, wherein the energy is supplied via a pulsed waveform, and wherein the operating energy supply rate is provided via a first duty cycle of the pulsed waveform and the standby energy supply rate is provided via a second duty cycle of the pulsed waveform; optionally the pulsed waveform is a pulse width modulation, PWM, waveform.

10. An aerosol generating apparatus (1) according to any preceding claim, wherein the sensing unit (120) comprises any one, any two or all three of a tilt switch, an accelerometer, and a gyroscope.

11. An aerosol generating apparatus (1) according to any preceding claim, wherein the device is a heat-not-burn, HNB, aerosol generating apparatus.

12. An aerosol generating apparatus (1) according to any preceding claim, wherein the device provides a notification to a user following determination of the lack of motion state.

13. An aerosol generating apparatus (1) according to claim 12, wherein the notification comprises any one, any two or all three of a haptic notification, a visual notification, and an audible notification.

14. A method of operating an aerosol generating apparatus (1) comprising an aerosol generating unit (110) for generating aerosol, and a sensing unit (120) for sensing motion of the aerosol generating apparatus (1), the method comprising the steps of:

providing energy to the aerosol generating unit (110);
determining a lack of motion state of the aerosol generating apparatus (1) based on the motion signal from the sensing unit (120), and
commencing a standby period of the aerosol generating unit (110) by reducing energy supplied to the aerosol generating unit (110) from an operating energy supply rate of a usage session of the apparatus to a non-zero standby energy supply rate in response to the determination of the lack of motion state.

15. A computer-readable medium that stores program instructions executable by a processor to perform a method of operating an aerosol generating apparatus (1) comprising an aerosol generating unit (110) for generating aerosol, and a sensing unit (120) for sensing motion of the aerosol generating apparatus (1), the method comprising the steps of:

providing energy to the aerosol generating unit (110);
determining a lack of motion state of the aerosol generating apparatus (1) based on the motion signal from the sensing unit (120), and
commencing a standby period of the aerosol generating unit by reducing energy supplied to the aerosol generating unit (110) from an operating energy supply rate of a usage session of the apparatus to a non-zero standby energy supply rate in response to the determination of the lack of motion state.

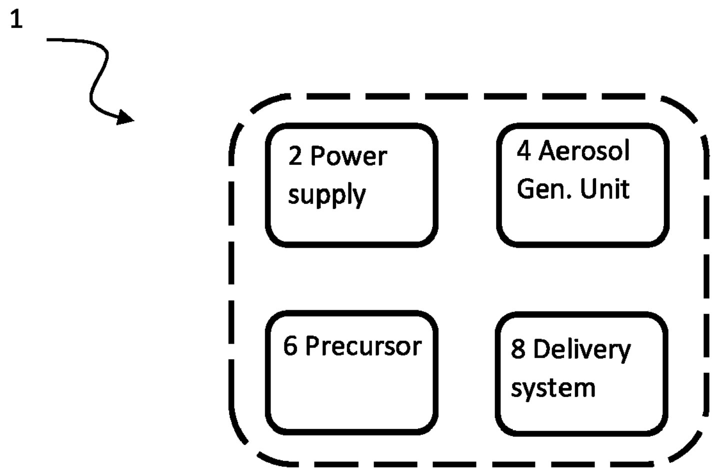
1
2 Power supply
4 Aerosol Gen. Unit
6 Precursor
8 Delivery system

Fig. 1

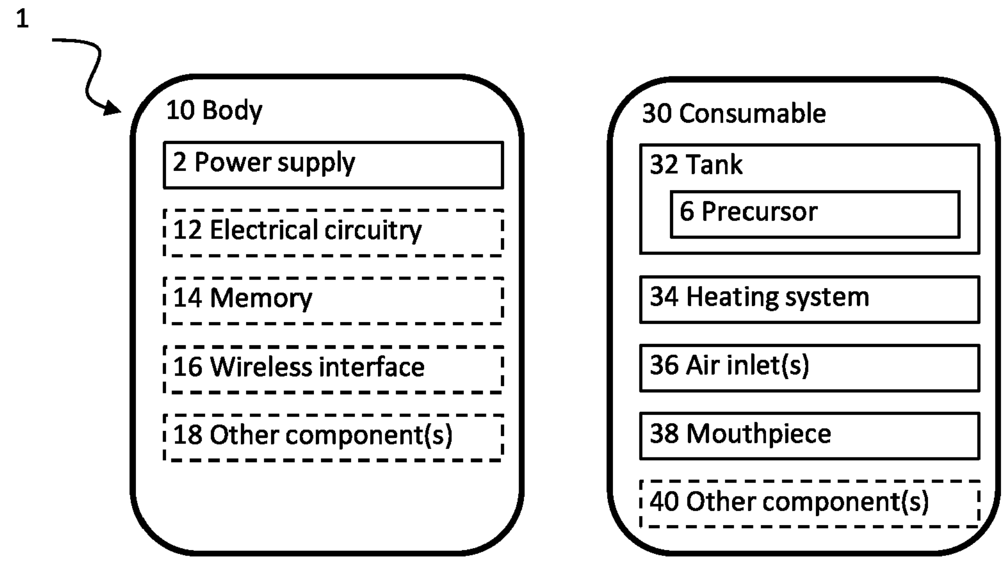

Fig. 2

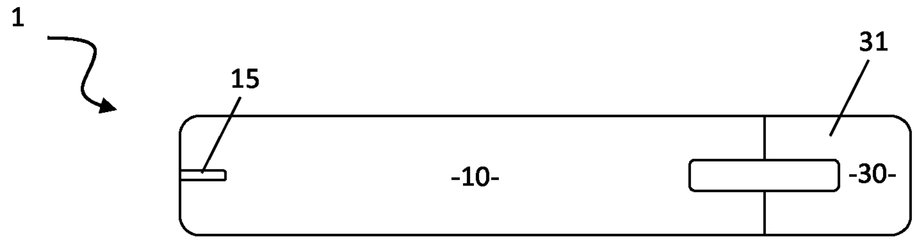

Fig. 3A

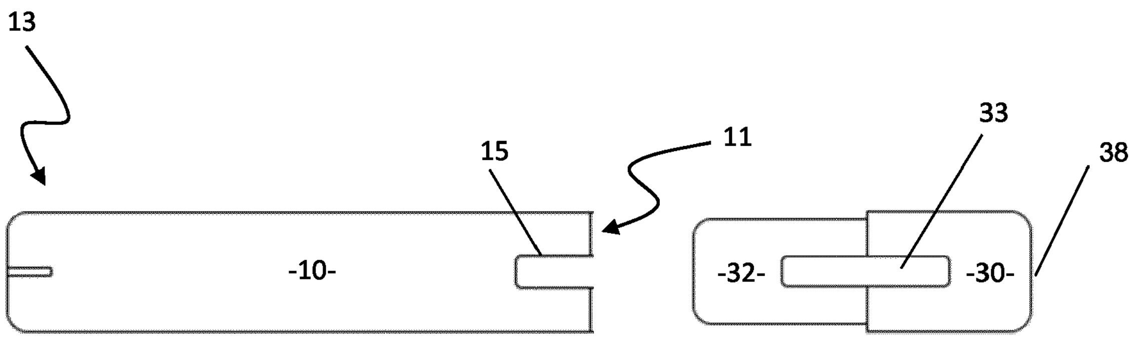

Fig. 3B

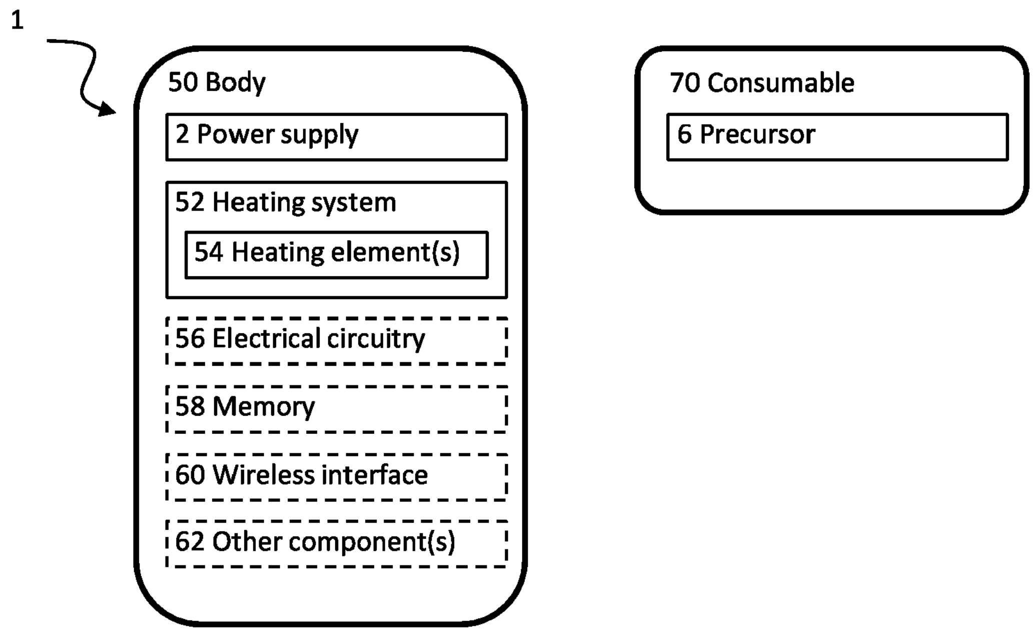
1
50 Body
2 Power supply
52 Heating system
54 Heating element(s)
56 Electrical circuitry
58 Memory
60 Wireless interface
62 Other component(s)
70 Consumable
6 Precursor

Fig. 4

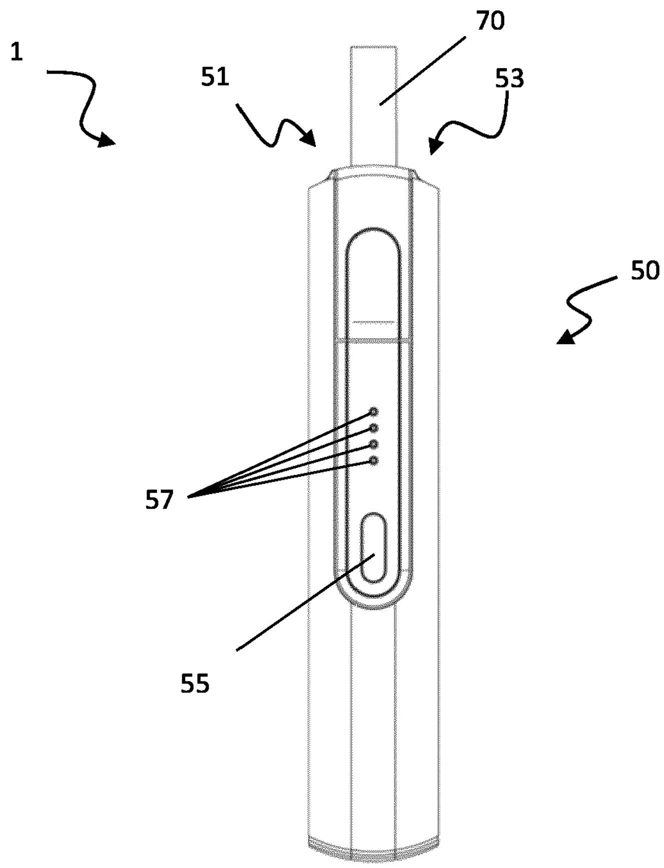
70
1
51
53
50
57
55

Fig. 5

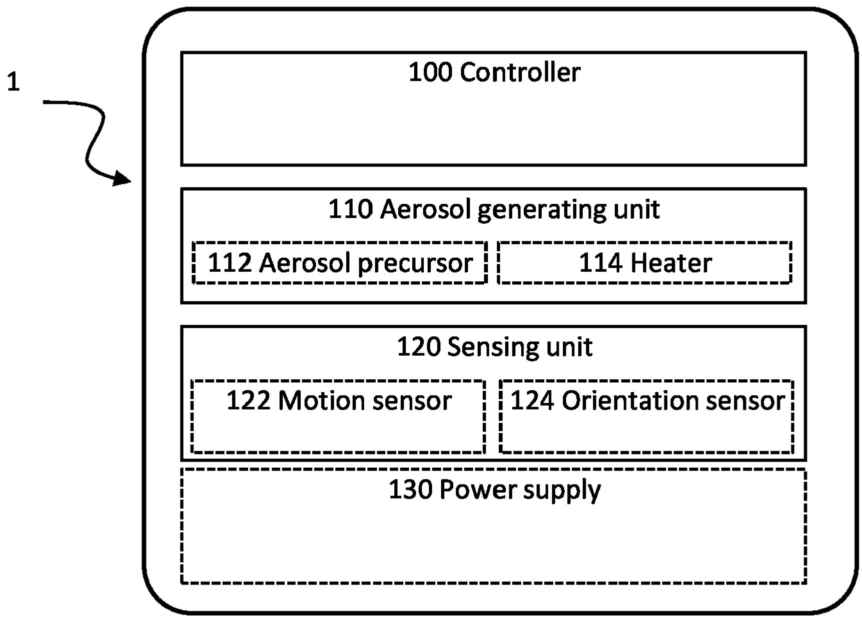
1
100 Controller
110 Aerosol generating unit
112 Aerosol precursor
114 Heater
120 Sensing unit
122 Motion sensor
124 Orientation sensor
130 Power supply

Fig. 6

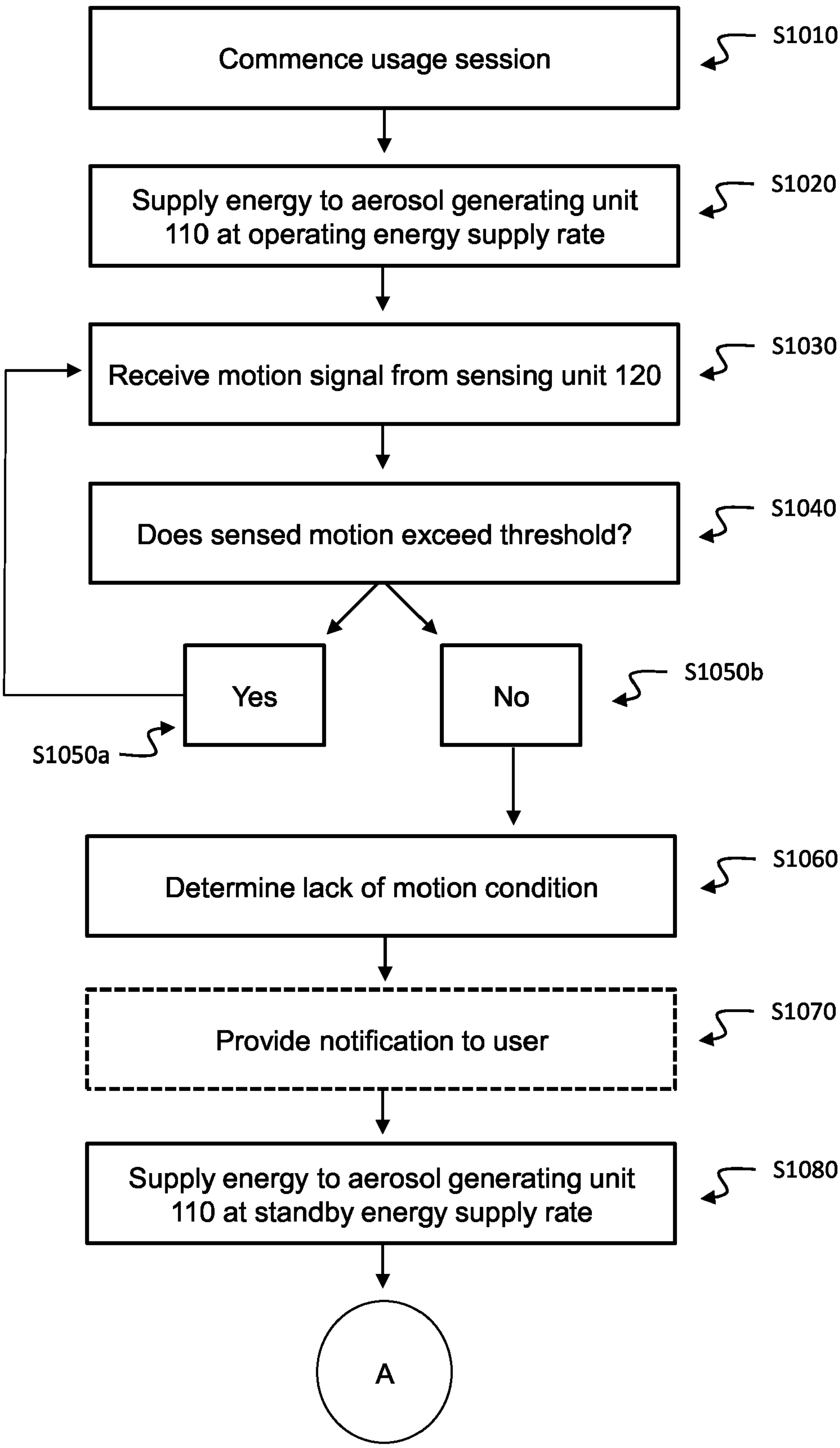
Commence usage session
S1010
Supply energy to aerosol generating unit 110 at operating energy supply rate
S1020
Receive motion signal from sensing unit 120
S1030
Does sensed motion exceed threshold?
S1040
Yes
S1050a
No
S1050b
Determine lack of motion condition
S1060
Provide notification to user
S1070
Supply energy to aerosol generating unit 110 at standby energy supply rate
S1080
A

Fig. 7A

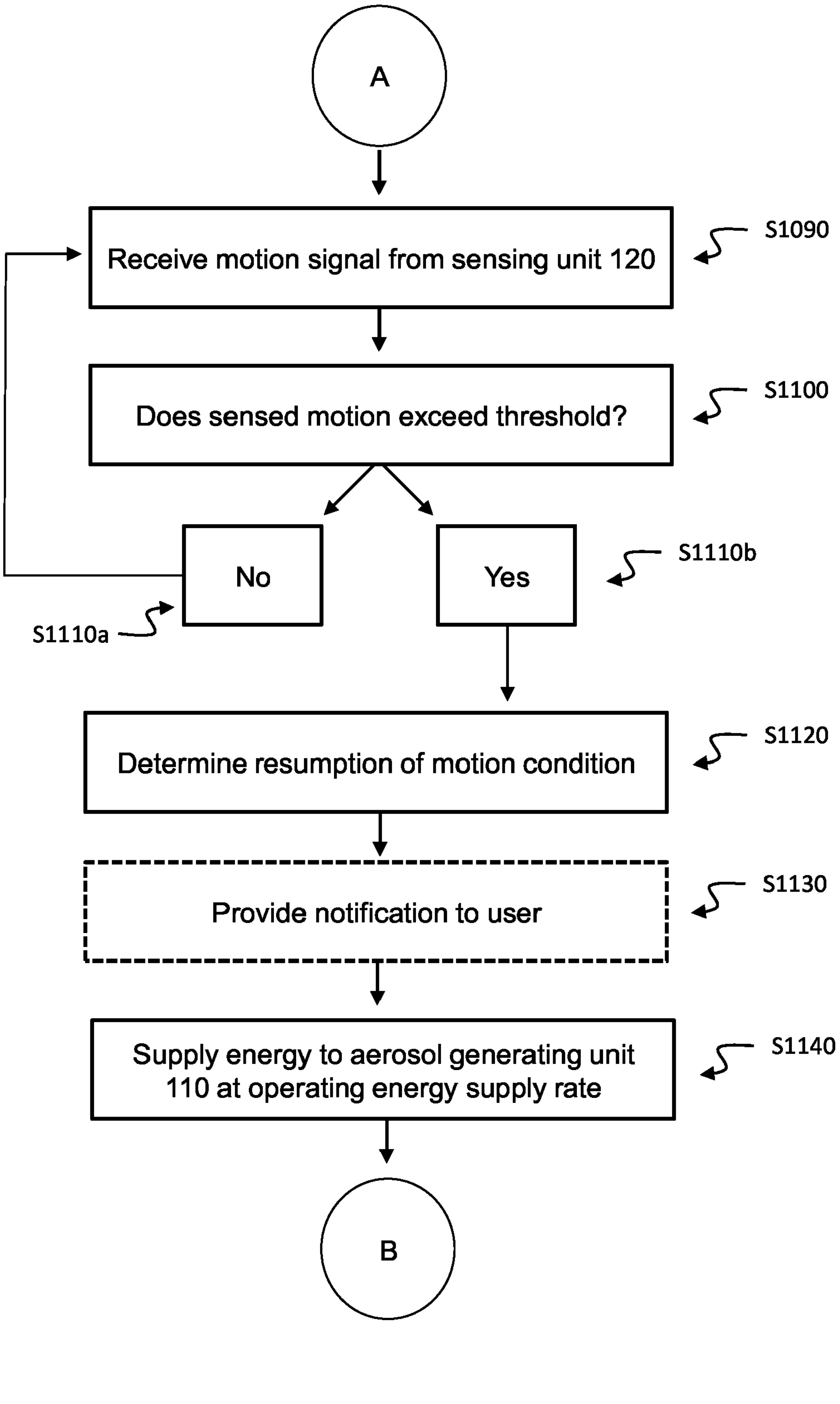
A
Receive motion signal from sensing unit 120
S1090
Does sensed motion exceed threshold?
S1100
No
Yes
S1110a
S1110b
Determine resumption of motion condition
S1120
Provide notification to user
S1130
Supply energy to aerosol generating unit 110 at operating energy supply rate
S1140
B

Fig. 7B

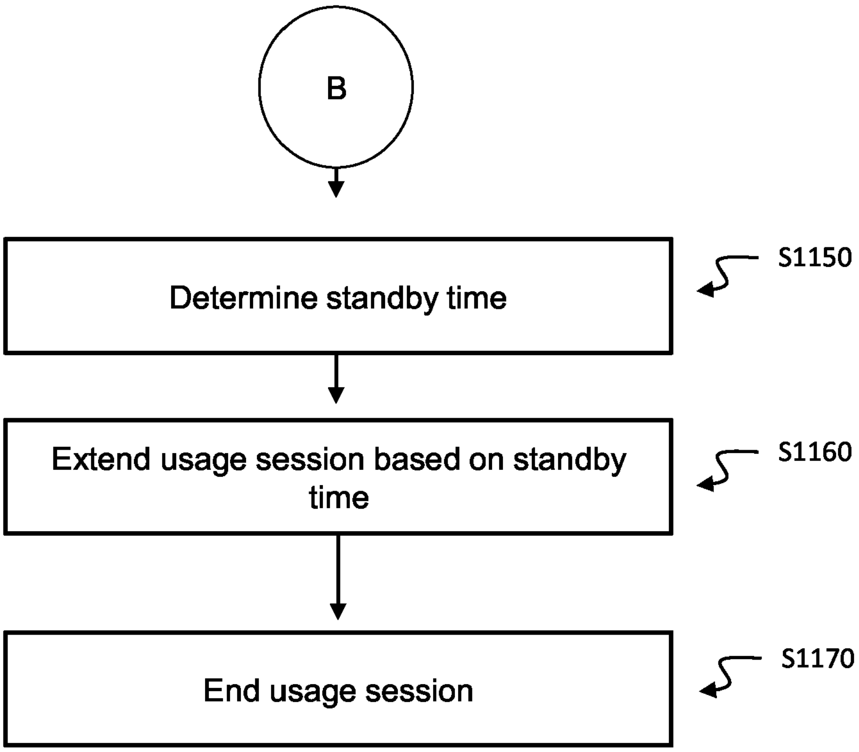
B
Determine standby time
S1150
Extend usage session based on standby time
S1160
End usage session
S1170

Fig. 7C

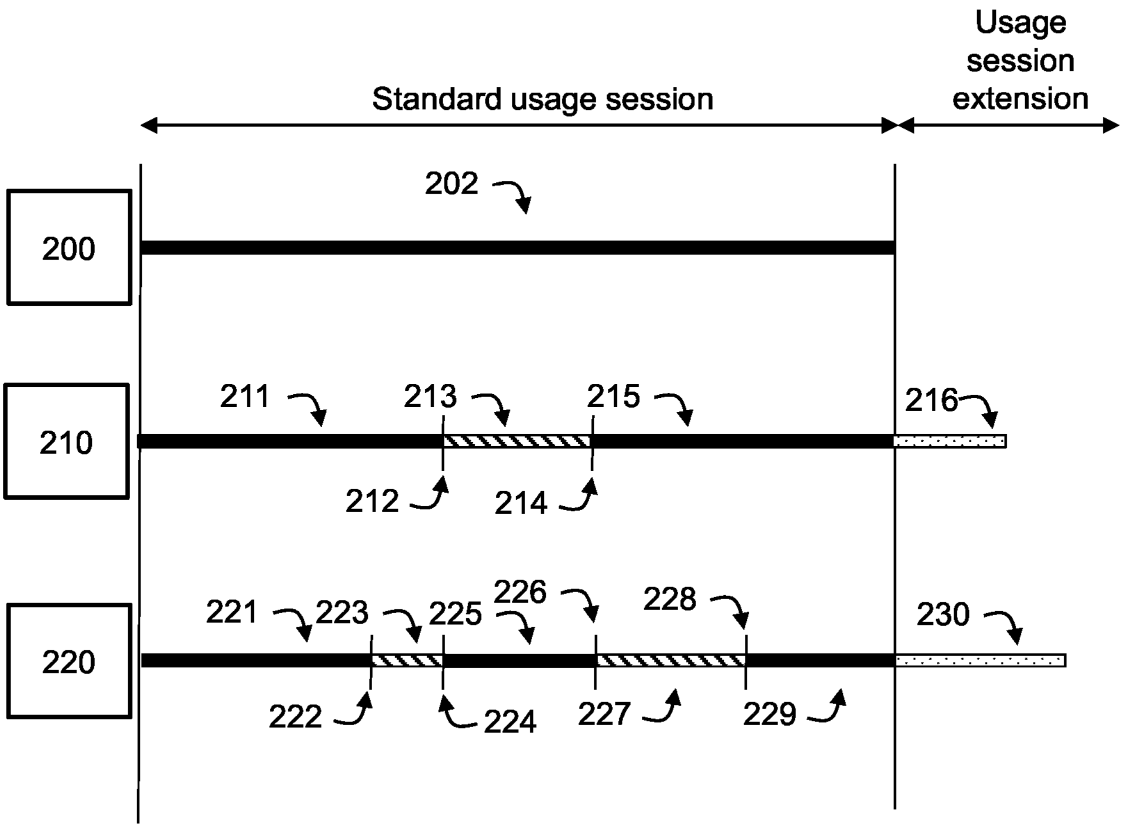
Standard usage session
Usage session extension
202
200
211
213
215
216
210
212
214
221
223
225
226
228
230
220
222
224
227
229

Fig. 8

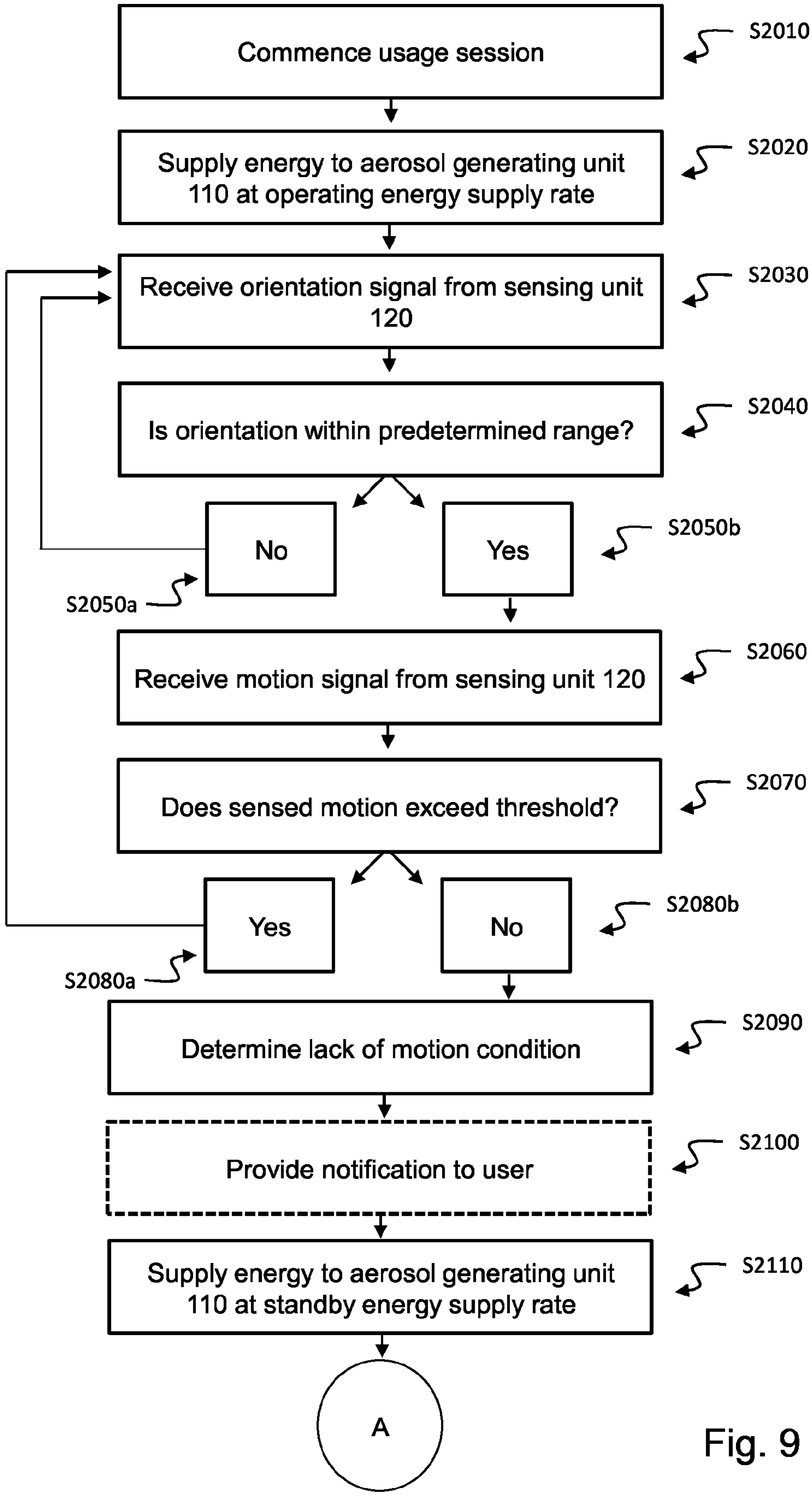
Commence usage session
S2010
Supply energy to aerosol generating unit 110 at operating energy supply rate
S2020
Receive orientation signal from sensing unit 120
S2030
Is orientation within predetermined range?
S2040
No
S2050a
Yes
S2050b
Receive motion signal from sensing unit 120
S2060
Does sensed motion exceed threshold?
S2070
Yes
S2080a
No
S2080b
Determine lack of motion condition
S2090
Provide notification to user
S2100
Supply energy to aerosol generating unit 110 at standby energy supply rate
S2110
A

Fig. 9

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 23 20 1028

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2013/042865 A1 (MONSEES JAMES [US] ET AL) 21 February 2013 (2013-02-21)	1,2,6,7, 9,10, 12-15	INV. A24F40/50 A24F40/51
Y	* figures *	8	
A	* paragraph [0021] *	3-5,11	ADD. A24F40/20
	* paragraph [0069] - paragraph [0072] *		
	* paragraph [0076] *		
	* paragraph [0089] *		

X	US 2022/061399 A1 (FERRIE KATE [GB] ET AL) 3 March 2022 (2022-03-03)	1,2,6,7, 9-15	
Y	* figures 24A-26 *	8	
A	* paragraphs [0576] - [0649] *	3-5	
	* paragraphs [1872] - [1919] *		

X	US 2023/240376 A1 (DAUGHERTY SEAN A [GB]) 3 August 2023 (2023-08-03)	1,2,6,7, 9,10, 12-15	
Y	* figures *	8	
A	* paragraph [0063] - paragraph [0064] *	11	
	* paragraph [0089] - paragraph [0091] *		TECHNICAL FIELDS SEARCHED (IPC)
	* paragraph [0095] - paragraph [0100] *		
	* paragraph [0106] - paragraph [0108] *		A24F
	* paragraph [0111] - paragraph [0115] *		

Y	US 2018/042306 A1 (ATKINS ARIEL [US] ET AL) 15 February 2018 (2018-02-15)	8	
	* paragraph [0025] *		
	* paragraph [0031] *		
	* paragraph [0047] - paragraph [0049] *		

1

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 March 2024	Kirchmayr, Katrin

CATEGORY OF CITED DOCUMENTS

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

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 20 1028

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

07-03-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2013042865 A1	21-02-2013	AR 089648 A1	10-09-2014
		CA 2845090 A1	21-02-2013
		CA 3132352 A1	21-02-2013
		CA 3132355 A1	21-02-2013
		CA 3201179 A1	21-02-2013
		CN 204275207 U	22-04-2015
		DE 202012013641 U1	16-11-2018
		DE 202012013645 U1	22-11-2018
		EA 201490448 A1	30-12-2014
		EA 201791917 A2	31-01-2018
		EA 202190195 A1	30-07-2021
		EP 2723429 A1	30-04-2014
		EP 2727619 A2	07-05-2014
		EP 2740506 A1	11-06-2014
		EP 2740507 A1	11-06-2014
		EP 2740508 A1	11-06-2014
		EP 2756859 A1	23-07-2014
		EP 2756860 A1	23-07-2014
		ES 2586141 T3	11-10-2016
		ES 2621888 T3	05-07-2017
		HK 1197203 A1	09-01-2015
		HK 1198138 A1	13-03-2015
		HK 1198142 A1	13-03-2015
		HK 1198143 A1	13-03-2015
		HK 1198329 A1	02-04-2015
		HK 1200128 A1	31-07-2015
		HK 1200129 A1	31-07-2015
		IL 230930 A	29-06-2017
		IL 275697 A	31-08-2020
		IL 291500 A	01-05-2022
		JP 6138123 B2	31-05-2017
		JP 6495370 B2	03-04-2019
		JP 6972054 B2	24-11-2021
		JP 7359824 B2	11-10-2023
		JP 2014524313 A	22-09-2014
		JP 2017148065 A	31-08-2017
		JP 2019150023 A	12-09-2019
		JP 2022017451 A	25-01-2022
		JP 2023169399 A	29-11-2023
		KR 20140090138 A	16-07-2014
		KR 20190105123 A	11-09-2019
		KR 20210002364 A	07-01-2021
		KR 20240001273 A	03-01-2024
		RU 157882 U1	20-12-2015
		SG 2014013627 A	30-07-2014
		TW D167608 S	01-05-2015

EPO FORM P0459

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

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 23 20 1028

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

07-03-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		TW D171355 S	21-10-2015
		TW 201315397 A	16-04-2013
		TW 201733467 A	01-10-2017
		TW 202011847 A	01-04-2020
		TW 202041165 A	16-11-2020
		TW 202145909 A	16-12-2021
		TW 202304329 A	01-02-2023
		UA 112319 C2	25-08-2016
		US 2013042865 A1	21-02-2013
		US 2013312742 A1	28-11-2013
		US 2016374400 A1	29-12-2016
		US 2017079331 A1	23-03-2017
		US 2019223510 A1	25-07-2019
		WO 2013025921 A1	21-02-2013
		ZA 201401146 B	29-07-2015
US 2022061399 A1	03-03-2022	NONE	
US 2023240376 A1	03-08-2023	US 2023240376 A1	03-08-2023
		WO 2023144516 A1	03-08-2023
US 2018042306 A1	15-02-2018	AU 2017307602 A1	21-02-2019
		AU 2023204367 A1	03-08-2023
		CA 3033086 A1	08-02-2018
		CN 109789285 A	21-05-2019
		CN 113662278 A	19-11-2021
		CN 115736391 A	07-03-2023
		EP 3493869 A2	12-06-2019
		EP 4233954 A2	30-08-2023
		IL 264635 A	30-04-2019
		IL 308092 A	01-12-2023
		TW 201808127 A	16-03-2018
		TW 202310761 A	16-03-2023
		US 2018042306 A1	15-02-2018
		US 2018116292 A1	03-05-2018
		US 2021112874 A1	22-04-2021
		WO 2018027189 A2	08-02-2018

EPO FORM P0459

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