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(54) **Title:** AEROSOL-GENERATING DEVICE WITH PROGRESS INDICATION

(57) **Abstract:** An aerosol-generating device for generating an aerosol from an aerosol-forming substrate is configured to indicate progress of an event during use of the aerosol-generating device. An example of such an event is a usage session during which an aerosol is generated. The aerosol-generating device comprises an indicator configured to indicate progress of the event as a sequence of 1st to nth different indication states, n being a number equal to or greater than 7, and a controller configured to monitor progress of the event, and to control the indicator to indicate in an indication state representative of the progress of the event. Progress of the event is both determined and displayed to the user.

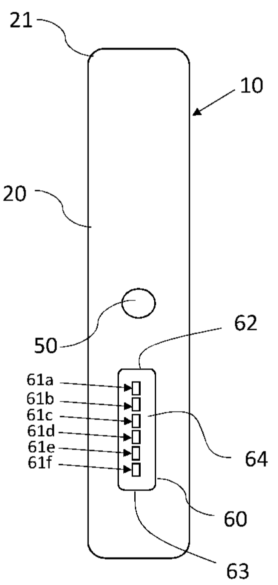

Figure 1

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AEROSOL-GENERATING DEVICE WITH PROGRESS INDICATION

The invention relates to aerosol-generating devices configured to generate an aerosol, and methods of using such devices. In particular, the invention relates to aerosol-generating devices in which data concerning the progression of an operational phase of the device is visually conveyed to a user of the device.

Aerosol-generating devices configured to generate an aerosol from an aerosol-forming substrate, such as a tobacco containing substrate, are known in the art. Typically, an inhalable aerosol is generated by the transfer of heat from a heat source to a physically separate aerosol-forming substrate or material, which may be located within, around or downstream of the heat source. An aerosol-forming substrate may be a liquid substrate contained in a reservoir. An aerosol-forming substrate may be a solid substrate. An aerosol-forming substrate may be a component part of a separate aerosol-generating article configured to engage with an aerosol-generating device to form an aerosol. During consumption, volatile compounds are released from the aerosol-forming substrate by heat transfer from the heat source and entrained in air drawn through the aerosol-generating article. As the released compounds cool, they condense to form an aerosol that is inhaled by the consumer.

Some aerosol-generating devices are configured to have at least one operational phase. Such an operational phase may be termed an event. For example, some aerosol-generating devices may be configured to provide user experiences that have a finite duration. For example, an aerosol-generating device may be configured to operate for a predetermined period of time in any single usage session. Aerosol-generating devices configured to be used with separate aerosol-generating articles may be configured to operate in discrete usage sessions lasting no longer than the time taken to deplete the aerosol-forming substrate within an individual aerosol-generating article. An aerosol-generating article may be configured to undergo a preheating phase, which may have a fixed or variable duration.

An aerosol-generating device configured to monitor and indicate progress of an event such as an operational phase may improve a user experience.

According to an aspect of the present invention, an aerosol-generating device for generating an aerosol from an aerosol-forming substrate is configured to indicate progress of an event during use of the aerosol-generating device. The aerosol-generating device may comprise an indicator configured to indicate progress of the event as a sequence of 1^{st} to n^{th} different indication states, n being a number equal to or greater than 7, for example equal to or greater than 10. A controller is configured to control the indicator to indicate in an indication state representative of the progress of the event. The controller is preferably configured to monitor progress of the event and to control the indicator to indicate in an indication state representative of the progress of the event.

Thus, an aerosol-generating device for generating an aerosol from an aerosol-forming substrate, may configured to indicate progress of an event during use of the aerosol-generating device, the aerosol-generating device comprising: an indicator configured to indicate progress of the event as a sequence of 1st to nth different indication states, n being a number equal to or greater than 7, and a controller configured to monitor progress of the event and to control the indicator to indicate in an indication state representative of the progress of the event.

It may be convenient for a user to be able to determine with precision how long any particular event has to run. For example, a user may wish to know how far they have progressed through a usage session, or how much further to go until the end of the usage session. A traditional combustible cigarette has a combustion line that moves along the cigarette as it is consumed and thereby provides a user with a constant visual indication of the progress through a user experience. A user is thus able to judge at any point in time how much of the cigarette is available to be consumed. In many aerosol-generating devices, such judgement is more difficult. Some devices provide an indication that a usage session will end shortly before the end of such a session, but this does not provide a user with information regarding progress of the usage session during the usage session. Information regarding progress may be particularly useful to a user where duration of a usage session is controlled by more than one parameter.

The number of indication states is preferably greater than 7. That is, the number n is preferably greater than 7, for example greater than 8, or greater than 9, or greater than 10. For example, n may be 8, or 9, or 10, or 11, or 12. The number n may be, for example, between 7 and 144. The higher the number, the greater the resolution that the progress of the event can be presented. However, if the number of states is too high then meaningful differentiation between adjacent states in the sequence may be harder to achieve.

The indicator of the device may include one or more indicators selected from the list consisting of visual indicator, audio indicator, and haptic indicator. Preferably, the indicator is a light-emitting indicator. A light-emitting indicator may be conveniently controlled to display in the 7 or more sequential indication states. Preferably the light emitting indicator comprises three or more discrete light emitting units. Each of the light emitting units is individually controllable to deliver a sequence of indication states.

Preferably, the indicator is a visual indicator comprising a predetermined number (i) of discrete light emitting units, each light emitting unit being controllable to emit light in a predetermined number (j) of different states, the different indication states being different intensities or static luminance levels, i being a number between 3 and 24, or 4 and 24, and j being a number between 2 and 5. Preferably, each of the predetermined number j of indication states represents a light intensity levels of between 0% and 100% of possible emission intensity. By controlling each of the discrete light emitting units to emit light at a predetermined number of different intensities or static luminance levels, it becomes possible to configure the device to display a relatively high number of sequential indication states without needing a corresponding high number of different light emitting units.

Each of the discrete light emitting units may be controlled to emit light in 2 different intensities, for example intensities of about 50% of possible emission intensity and about 100% of possible emission intensity.

Each of the discrete light emitting units may be controlled to emit light in 3 different intensities, for example intensities of about 33% of possible emission intensity, about 66% of possible emission intensity, and about 100% of possible emission intensity.

Each of the discrete light emitting units is controlled to emit light in 4 different intensities, for example intensities of about 25% of possible emission intensity, about 50% of possible emission intensity, about 75% of possible emission intensity, and about 100% of possible emission intensity.

The controller of the device is preferably configured to interact with one or more drivers to control the indicator to indicate progress in the sequence of 1st to nth different indication states. For example, the controller may interact with one or more LED drivers. The device may comprise a visual indicator comprising a plurality of light emitting units, and in which the controller is configured to interact with one or more drivers to control the visual indicator to indicate progress in the sequence of 1st to nth different visual indication states.

The aerosol-generating device may comprise control electronics and at least one visual indicator, for example a lighting array, comprising a plurality of light emitting units. The control electronics are preferably configured to independently control each one of the plurality of light emitting units in at least:

i) "an off state", in which the light emitting unit does not emit light;

ii) "a first lighting state", in which the light emitting unit emits light at a first intensity or static luminance level; and

iii) "a second lighting state", in which the light emitting unit emits light at a second intensity or static luminance level that is different to the first static luminance level. The control electronics are preferably configured to control each one of the light emitting units to be in at least one of the off state, the first lighting state and the second lighting state so as to indicate the progression of the event to a user as the sequence of 1st to nth different visual indication states. The light emitting units may be further controlled in a "third lighting state", in which the light emitting unit emits light at a third intensity or static luminance level that is different to the first or second static luminance level. The light emitting units may be further controlled in a "a fourth lighting state", in which the light emitting unit emits light at a fourth intensity or static luminance level that is different to the first, second, or third static luminance level.

In preferred examples, the device comprises a plurality of light emitting units, the light emitting units being LEDs. Each of the plurality of light emitting units is preferably configured to be independently controlled at different static luminance levels for indication of progression of the event, and at least one of the light emitting units is controllable to display different colour of light to indicate a status, such as low power level, or proximity to end of the event.

The control electronics may be configured to independently control each one of the plurality of light emitting units in the plurality of indication states, wherein in each one of the plurality of indication states the respective light emitting unit emits light at a different static intensity/static luminance level. The use of different static luminance levels for each one of the plurality of lighting states facilitates data relating to a large number of incremental changes in the event being conveyed to a user. The greater the number of indication states, the more data that can be conveyed to the user concerning changes in the event. In this manner, a high degree of granularity in the data concerning the status of the event is able to be conveyed to the user.

Where the device comprises a visual indicator, the visual indicator may comprise a plurality of windows for communicating light to a user, and may further comprise one or more waveguides.

The discrete light emitting units may be configured as a linear matrix on, or extending through, a housing of the device. For example, the linear matrix may be a 1x3 matrix, or a 1x4 matrix, or a 1x5 matrix, or a 1x6 matrix, or a 2x3 matrix, or a 2x4 matrix, or a 2x5 matrix, or a 2x6 matrix, or a 3x3 matrix, or a 3x4 matrix, or a 3x5 matrix, or a 3x6 matrix. A linear matrix may conveniently display a progression as a linear progression of changing light intensities or luminosities.

The discrete light emitting units may be configured as an annular matrix on, or extending through a housing, of the device. For example, an annular matrix may comprise a single ring formed from between 3 and 12 light emitting units, for example 4, or 5, or 6, or 7, or 8, or 9, or 10, or 11 light emitting units. The annular matrix may comprise 2 concentric rings, each ring formed from between 3 and 12 light emitting units, for example 4, or 5, or 6, or 7, or 8, or 9, or 10, or 11 light emitting units.

The indicator may be a visual indicator comprising a LCD display screen or an OLED display screen.

Progress of the event may be displayed by a visual indicator such that progression through the first to nth indication states involves a corresponding increase in intensity or luminance of light displayed by the visual indicator.

Progress of the event may be displayed by a visual indicator such that progression through the first to nth indication states involves a corresponding decrease in intensity or luminance of light displayed by the visual indicator.

The event may be any operational phase of the device having a duration. The duration of the event may be measured by time, or by one or more other parameter. The duration of the event may depend on more than one parameter. The aerosol-generating device may be configured to perform a function during the event. The event may be a heating event, for example a preheating event during which a heater or heating element is heated to a temperature required to generate an aerosol. The event may be a calibration event, for example in which the response of a monitored parameter to heating of a heating element is determined. The event may be a charging event, during which a battery in the device is charged. The event may be a pause event, during which a usage session or a heating mode is paused for a period of time. The event may be a usage session during which an aerosol-forming substrate is heated to form an aerosol. An event may be defined as having an event start and an event end, a duration of the event defined by the event start and the event end.

Typically, a usage session is a finite usage session; that is a usage session having a start and an end. The duration of the usage session as measured by time may be influenced by use during the usage session. The duration of the usage session may have a maximum duration determined by a maximum time from the start of the usage session. The duration of the usage session may be less than the maximum time if one or more monitored parameters reaches a predetermined threshold before the maximum time from the start of the usage session. A usage session may include a preheating period and/or a calibration period. By way of example, the one or more monitored parameters may comprise one or more of: i) a cumulative puff count of a series of puffs drawn by a user since the start of the usage session, and ii) a cumulative volume of aerosol evolved from the aerosol-forming substrate since the start of the usage session.

As used herein, the term “aerosol-generating device” is used to describe a device that interacts with an aerosol-forming substrate of an aerosol-generating article to generate an aerosol. Preferably, the aerosol-generating device is a smoking device that interacts with an aerosol-forming substrate of an aerosol-generating article to generate an aerosol that is directly inhalable into a user’s lungs thorough the user's mouth. The aerosol-generating device may be a holder for an aerosol-generating article. Preferably, the aerosol-generating article is a smoking article that generates an aerosol that is directly inhalable into a user’s lungs through the user's mouth. More preferably, the aerosol-generating article is an article that generates a nicotine-containing aerosol that is directly inhalable into a user’s lungs through the user's mouth. The aerosol-generating article may be an article that generates a nicotine-free aerosol that is directly inhalable into a user’s lungs through the user's mouth.

As used herein, the term ‘aerosol-generating article’ refers to an article comprising an aerosol-forming substrate capable of releasing volatile compounds, which can form an aerosol. In certain embodiments, the aerosol-generating article may comprise an aerosol-forming substrate capable of releasing upon heating volatile compounds, which can form an aerosol.

As used herein, the term “aerosol-forming substrate” denotes a substrate consisting of or comprising an aerosol-forming material that is capable of releasing volatile compounds upon heating to generate an aerosol. The aerosol may comprise nicotine. The aerosol may be a nicotine-free aerosol comprising one or more inhalable substances, but not comprising nicotine.

As used herein, the term ‘usage session’ refers to an operational period of the aerosol-generating device having a finite duration. A usage session may be initiated by the action of a user. A usage session may be terminated after a predetermined period of time has elapsed from the initiation of the usage session. A usage session may be terminated after a monitored parameter has reached a threshold during the usage session. Typically, a usage session has a duration that allows a user to enjoy a single user experience. For example, in certain aerosol-generating devices, a usage session may have a duration that allows the user to consume a single disposable aerosol-generating article. After a usage session has been terminated, further action is required by a user to initiate a subsequent usage session.

As used herein, the term ‘light emitting indicator’ refers to an element of an aerosol-generating device capable of emitting an indication in the form of light visible to a user of the device.

As used herein, the term ‘light emitting unit’ refers to a discrete component of a light emitting indicator capable of emitting light. Each light emitting unit provides a single display area of the light emitting indicator. A light emitting unit may, for example, comprise or be an individual light bulb or an individual LED. A light emitting unit may comprise more than one bulb or LED. Light emitted by the light emitting unit is visible to a user of the aerosol-generating device. A light emitting unit may be mounted such that it projects through a housing of the aerosol-generating device. A light emitting unit may be enclosed within a housing of the aerosol-generating device such that light emitted from the light emitting unit is visible through a window of the aerosol-generating device. Light emitted from a light emitting unit may be transmitted along a waveguide structure such that it is visible to a user of the device.

Where the device comprises LEDs, for example a plurality of LEDs, a light emitting diode control driver may be configured to control a supply of electricity from a power source to one or more of the LEDs by a pulse width modulation regime having a predetermined resolution, so as to control the luminance or intensity of the one or more of the plurality of light emitting diodes. By way of example, the resolution of the pulse width modulation regime may be 8 bit (having 256 levels), 10 bit (having 1024 levels), 12 bit (having 4096 levels). The higher the predetermined resolution, the greater the number of discrete indication states are able to be generated by each one of the plurality of light emitting diodes. In this manner, the granularity or level of detail of data conveyed to the user through the different indication states may be controlled by the predetermined resolution chosen for the light emitting diode control driver.

As used herein, the term “light” refers to emissions of electromagnetic radiation which are in the visible range of the electromagnetic spectrum. The visible range of the electromagnetic spectrum is generally understood to encompass wavelengths in a range of about 380 nanometres to about 750 nanometres.

As used herein, the term “waveguide” denotes a structure adapted to guide electromagnetic waves of light. The waveguide may conveniently be in the form of one or more optical fibres or light pipes. Conveniently, each of the light emitting units is associated with a corresponding waveguide, so that the light emitted from each light emitting unit is conveyed to the one or more display windows via the corresponding waveguide.

The aerosol-generating device is preferably configured to monitor a parameter relating to progress of the event. The parameter may have an initial value at initiation or the start of the event, and a terminal value different to the initial value. A monitored value of this parameter may then be used to calculate progress of the parameter between the initial value and the terminal value, progress of the parameter being used to determine progress of the event. Such a parameter relating to progress of the event may be termed a first parameter.

In some configurations, an aerosol-generating device may be configured to monitor both the first parameter relating to progress of the event and a second parameter relating to progress of the event, the second parameter being a different parameter to the first parameter. The device may then be configured to determine progress of the event with respect to both the first parameter and the second parameter. It becomes increasingly difficult for a user to determine progress of an event when the duration of the event is controlled with respect to more than one parameter. Thus, a detailed indication of progress improves the user experience.

Duration of a usage session may depend on the manner in which a user interacts with the device during the usage session. Thus, the parameter, or one or both of the first parameter and the second parameter, may be a user interaction parameter indicative of use of the aerosol-generating device during the event. Such a parameter, or parameters, may a monitored parameter. The parameter, or one or both of the first parameter and the second parameter, may be a cumulative parameter, for example a cumulative value of a monitored parameter over the duration of the event. Progress of an event may be determined by progress of the parameter, or progress of one or both of the first parameter and the second parameter, between its initial value and its terminal value.

Progress of an event may be conveniently determined as a percentage. For example, progress of the parameter (which may be a first parameter or a second parameter) may be determined by the formula {(monitored value of the parameter – initial value of the parameter) / (terminal value of the parameter – initial value of the parameter) x 100}. It is noted that for some parameters the initial value of the parameter may be zero.

Where more than one parameter is used to determine progress of an event, real time progress may be determined by the most advanced in progress of all of the parameters. For example, progress of the first parameter may be determined during the event, progress of the second parameter may be determined during the event, and the progress of the event may then be determined by the most advanced of the progress of the first parameter and the progress of the second parameter.

In a preferable example, the aerosol-generating device may comprise a visual indicator configured to display progress of the event as a sequence of 1st to nth different visual indication states, n being a number equal to or greater than 7, and a controller configured to monitor progress of the event and to control the visual indicator to display in a visual indication state representative of the progress of the event. The aerosol-generating device may be further configured to monitor a first parameter relating to progress of the event and to monitor a second parameter relating to progress of the event, the progress of the event at a moment during the event being determined with respect to both a value of the first parameter at that moment and a value of the second parameter at that moment.

Typically, time may be used as a convenient parameter to monitor, and the aerosol-generating device may comprise a timer in communication with, or comprised in, the controller. For example, the parameter, the first parameter, or the second parameter may be time. Time is a useful parameter to monitor as many events, for example a usage session, may benefit from a maximum time limit or time threshold.

In some preferred examples, the parameter, the first parameter, or the second parameter may be a parameter selected from the list consisting of time, number of user puffs (for example, cumulative number of user puffs taken during the event), volume of aerosol delivered for example, cumulative volume of aerosol delivered during the event), energy consumed (for example, cumulative volume of energy consumed during the event), current consumed (for example, cumulative amount of current consumed during the event), temperature (for example, temperature of a heating element, or temperature of a susceptor), resistance of heating element, and user interaction (for example, any other monitorable or derivable parameter relating to user interactions, for example user interactions during a usage session).

Certain parameters may require an aerosol-generating device to comprise specific monitoring means. For example, the aerosol-generating device may comprise a temperature sensor for monitoring actual temperature of a heating element, or a puff sensor for detecting and recording user puffs. The device may also be configured to monitor changes in power supplied by a battery, for example to monitor current and voltage. The device may also be configured to derive parameters from other monitored parameters. For example, the controller of the device may be configured to determine resistance of a heating element, or apparent resistance of an inductor/susceptor couple, by monitoring current and voltage supplied by a battery. The device may be configured to run one or more algorithm to determine parameters such as volume of aerosol generated.

Progress of the event may be determined with reference to a first parameter and a second parameter, in which the indication state displayed by the indicator reflects the progress of the first parameter, or the progress of the second parameter if the progress of the second parameter is greater than the progress of the first monitored parameter.

In preferential examples, the event may be a usage session and the usage session may extend between a usage session start and a usage session stop. The aerosol-generating device may be configured such that the usage session has a maximum duration determined by a timer, for example the maximum possible duration of the usage session is set by a time threshold. For example, the device may be configured to monitor a first parameter relating to progress of the usage session and a second parameter relating to progress of the usage session, the first parameter being time and the second parameter being a user interaction parameter selected from the list consisting of number of user puffs (cumulative number of user puffs taken during the event), volume of aerosol delivered (cumulative volume of aerosol delivered during the event), energy consumed (cumulative volume of energy consumed during the event), and current consumed (cumulative amount of current consumed during the event).

Preferably, a usage session is configured to be terminated if a monitored user interaction parameter reaches a predetermined threshold. The user interaction parameter may be indicative of user puffs taken during the usage session, or may be indicative of volume of aerosol released by the aerosol-forming substrate, or delivered to the user, during the usage session. The aerosol-generating device may comprise a puff counting mechanism to determine number of user puffs taken, for example the number of puffs taken during the event, for example the number of puffs taken during the usage session. The aerosol-generating device may be configured to terminate the usage session when the number of user puffs taken during the usage session reaches a predetermined threshold.

An exemplary aerosol-generating device may be configured to perform steps of monitoring a parameter indicative of progress of the usage session, for example monitoring a parameter indicative of aerosol generation during operation of the aerosol-generating device, analysing the monitored parameter to identify a user puff, the user puff defined by a puff start and a puff end, analysing the monitored parameter during the user puff to calculate a puff volume, the puff volume being a volume of aerosol generated during the user puff, and using the puff volume as the user interaction parameter.

Preferably the event, for example the usage session, comprises, or can be divided into, at least 7 sequential phases. Advantageously, the controller may be configured to control the indicator to indicate a different one of the sequence of 1st to nth different indication states during each of the at least 7 sequential phases. For example, the controller may be configured to control a light emitting indicator to display a different one of the sequence of 1st to nth different indication states during each of the at least 7 sequential phases. Preferably the light emitting indicator comprises 3 or more discrete lighting units, for example 4 lighting units, or 5 lighting units, or 6 lighting units.

The event, for example the usage session, may divided into n sequential phases, n being the number greater than 7, for example between 12 and 144 sequential phases, or for example between 18 and 72 sequential phases. Thus, the number of sequential phases may be equal to the number of sequential indication states.

The aerosol-generating device may be configured such that any, or each, of the n sequential phases has a phase duration defined by a phase start and a phase end. The aerosol-generating device may be configured such that any, or each, of the n sequential phases has a maximum phase duration determined by a timer. Any, or each, of the n sequential phases may end when a monitored period of time reaches a predetermined threshold for the phase, if the phase has not ended sooner.

An exemplary aerosol-generating device is configured such that a first phase of n sequential phases has a first phase duration defined by a first phase start and a first phase end, in which the first phase starts at the event start, for example at the usage session start. A second phase of the n sequential phases may have a second phase duration defined by a second phase start and a second phase end, in which the second phase starts at the end of the first phase. The n sequential phases may be defined as a first phase and n-1 subsequent phases, each of the subsequent phases following a preceding phase, in which each of the n-1 subsequent phases has a phase duration defined by a phase start and a phase end, and in which the phase starts at the end of the preceding phase. The event, for example the usage session, preferably ends at the end of the nth phase.

The aerosol-generating device may be configured to monitor a user interaction parameter indicative of use of the aerosol-generating device during the event, for example during the usage session. Advantageously, duration of any, or each, of the n sequential phases may be controlled with reference to the user interaction parameter. A duration of any, or each, of the n sequential phases may be controlled with reference to the user interaction parameter and at least one further parameter.

Preferably the event, for example the usage session, has a maximum duration of between 60 seconds and 600 seconds, for example between 300 seconds and 400 seconds, for example about 360 seconds. Such a maximum duration may replicate the length of a typical smoking session using a conventional cigarette.

Advantageously, the event, for example the usage session, may have a maximum duration of x seconds, x being a number between 100 and 600. For example, the event may be divided into n sequential phases, with a maximum duration of each of the n sequential phases being about x/n seconds.

The event, for example the usage session, may be controlled with respect to a monitored number of user puffs, the usage session having a threshold number of user puffs of between 10 and 14, for example about 12.

In some examples, an aerosol-generating device may be configured to monitor a parameter indicative of aerosol generation during operation of the aerosol-generating device, analyse the monitored parameter to identify a user puff, the user puff defined by a puff start and a puff end, analyse the monitored parameter during the user puff to calculate a puff volume, the puff volume being a volume of aerosol generated during the user puff, and use the puff volume as a parameter relating to progress of the event, for example progress of a usage session. The parameter indicative of aerosol generation may be representative of power supplied by the power supply, for example current, or both current and voltage. Advantageously, the puff volume may be used as a parameter for indicating progress of the usage session. In particular, a usage session may have a threshold value of aerosol that can be delivered and cumulative volume of aerosol generated may be used as a parameter for indicating progress of the usage session.

A measurement of the actual volume of aerosol generated may be complex to implement. Thus, a function of the monitored parameter may be calculated in real time and evaluated to determine a puff volume. Analysis of the monitored parameter may comprise steps of calculating a first characteristic of the monitored parameter and analysing the first characteristic to determine a puff start and a puff stop. Analysis of the monitored parameter may comprise steps of calculating a second characteristic of the monitored parameter and analysing both the first characteristic and the second characteristic to determine the puff start and the puff stop. A puff start may be determined when the first characteristic and the second characteristic satisfy one or more predetermined conditions. Likewise, a puff end may be determined when the first characteristic and the second characteristic satisfy one or more predetermined conditions. Preferably, the first characteristic may be a first moving average value of the monitored parameter computed on a first time window having a first time window duration. The second characteristic may be a second moving average value of the monitored parameter computed on a second time window having a second time window duration, the second time window duration being different to the first time window duration.

In some example, the event may be a first event, the device further being configured to monitor progress of and display information such as progress in relation to a second event, the second event being different to the first event. For example, the aerosol-generating device may be configured to display progress of a first event and also status of, or progress of, a second event during use of the aerosol-generating device. The aerosol-generating device may comprise a visual indicator configured to display progress of the first event as a first sequence of 1st to nth different indication states, and status of, and/or progress of the second event as a second sequence of different indication states n being a number equal to or greater than 7. The device may also comprise a controller configured to monitor progress of the first event and to control the visual indicator to display in an indication state representative of the progress of the first event, and also to monitor the second event and to control the visual indicator to display in an indication state representative of the status and/or progress of the second event. Although the term “a controller” is used, it is intended that this term covers more than one controller if more than one separate controllers are used to control operation of the aerosol-generating device.

Progress of the second event is preferably displayed as a second sequence of 1st to nth different indication states, the second sequence of indication states being different to the first sequence of indication states. By changing the sequence of indication states, the user can easily determine what type of event the device is undergoing and how much progress has been made through the event.

The first event may be an event type selected from the list consisting of a usage session, a heating period (for example, a pre-heating period), a calibration period, a charging period, and a pause period, and the second event may be an event type selected from the list consisting of a usage session, a heating period (for example, a pre-heating period), a calibration period, a charging period, and a pause period, the event type of the second event being different to the event type of the first event.

The controller may be configured to determine initiation of the first event, determine an event type of the first event, monitor progress of the first event, and control the visual indicator to display a predetermined sequence of indication states representative of progress of the first event. The controller may also be configured to determine initiation of the second event, determine the event type of the second event, monitor status and/or progress of the second event, and control the visual indicator to display a predetermined sequence of indication states representative of status and/or progress of the second event.

The second event may occur after termination of the first event. For example, the first event may be a preheating period and the second event may be a usage session that occurs after completion or termination of the preheating period. For example, the first event may be a calibration period and the second event may be a usage session that occurs after completion or termination of the calibration period.

The second event may occur during a hiatus in the first event. For example, the first event may be a usage session and the second event may be a pause period that occurs during a hiatus in the usage session. For example, the first event may be a usage session and the second event may be a recalibration period that occurs during a hiatus in the usage session.

The device may further be configured to monitor progress of and display progress in relation to a third event, the third event being different to the first event and the second event. In such a case, the third event may be an event type selected from the list consisting of a usage session, a heating period (for example a pre-heating period), a calibration period, a charging period, and a pause period. As an example, the first event may be a preheating event, the second event may be a usage session, and the third event may be a pause event.

An aerosol-generating device may be configured to allow a user to pause an event, for example the first event, during progress of the event and enter a pause period. The device may therefore comprise a memory configured to store progress of the event such that display of progress can be resumed on re-initiation of the event.

An aerosol-generating device may further comprise a user interaction interface, for example an interface selected from the list consisting of a button, a touch sensitive button, a strain sensitive button, a gesture recognition interface, a haptic interface, and an accelerometer. An aerosol-generating device may comprise a power source for supplying energy to generate an aerosol from an aerosol-forming substrate, for example a power source such as a battery.

An aerosol-generating device as described herein may comprise a heater for heating an aerosol-forming substrate, for example a resistance heater or an induction heater. The device may be configured to operate with a solid aerosol-forming substrate. The device may be configured to operate with a liquid aerosol-forming substrate.

Advantageously, the aerosol-generating device may comprise a sensor, for example a sensor for detecting a parameter indicative of progress of the event, for example a sensor for detecting a user interaction parameter.

The aerosol-generating device may comprise a heater for heating an aerosol-forming substrate to form an aerosol. The heater may be an induction heater. An induction heater may comprise an inductor configured to generate a fluctuating magnetic field designed to heat a susceptor. The heater may be a resistance heater.

The heater may comprise a heating element for heating a consumable aerosol-generating article. The heating element may be an internal heater designed to be inserted into a consumable aerosol-generating article, for example a resistive heating element or a susceptor in the form of a pin or blade that can be inserted into an aerosol-forming substrate located within a consumable aerosol-generating article. The heating element may be an external heater designed to heat an external surface of a consumable aerosol-generating article, for example a resistive heating element or a susceptor located at the periphery of, or surrounding, a substrate receiving cavity for receiving the consumable aerosol-generating article.

The aerosol-generating device may comprise a replaceable substrate section containing an aerosol-forming substrate. The replaceable substrate section may form a portion of body of the aerosol-generating device and may itself locate or contain a portion of aerosol-forming substrate for consumption in the device. The replaceable substrate section may be located distal to the proximal end of the device, for example distal to a mouthpiece. The replaceable substrate section may be located proximal to the distal end of the device. The replaceable substrate section may be coupled to one or more other sections forming the body of the aerosol-generating device by coupling means such as screw threads, or bayonet fitting, or magnetic connection, or mechanical latching means such as snap fits or interference fit.

A replaceable substrate section may comprise a reservoir of liquid aerosol-forming substrate. For example, a replaceable substrate section may comprise a reservoir of a liquid comprising nicotine and an aerosol former such as propylene glycol or glycerine. Alternatively, a replaceable substrate section may comprise a container of solid aerosol-forming substrate, or a container of colloidal aerosol-forming substrate such as a gel substrate.

The aerosol-generating device may comprise a replaceable substrate section containing two or more components which form an aerosol when combined.

A replaceable substrate section may comprise an atomizer, such as a heating element for heating the aerosol-forming substrate, or for heating at least one of the two or more components which form an aerosol when combined. Thus, a replaceable substrate section may be a form of cartomizer and include both an aerosol-forming substrate and an atomizing component. The replaceable substrate section would, in such embodiments, preferably include electrical contacts configured to contact corresponding electrical contacts on a battery portion of the aerosol-generating device to provide power for actuation of the atomizer.

In an example, the atomizer may be a resistance heater such as a resistive wire, or a resistive track on a substrate. In other examples, the atomizer may be an inductive susceptor capable of heating when within a fluctuating magnetic field generated by an inductive coil.

The aerosol-generating device may be configured such that power is supplied to the heater to maintain the heater at a predetermined temperature during the usage session.

Power may be supplied to the heater to increase the temperature of a heater element to an operating temperature range for generating an aerosol, the heater element remaining within the operating temperature range until the end of a usage session. Power may be supplied to the heater during a usage session both when a user is taking a puff and when a user is not taking a puff. In such a configuration, the power supplied during a user puff is likely to be greater than that supplied when a user is not talking a puff, as less power with be required to maintain the temperature of the heater between puffs.

An aerosol-generating device may be configured to receive an aerosol-generating article comprising an aerosol-forming substrate. The aerosol-forming substrate may be a solid aerosol-forming substrate. The aerosol-generating device may, for example, comprise a substrate receiving cavity for receiving a consumable aerosol-generating article comprising an aerosol-forming substrate. Examples of aerosol-generating articles include sachets filled with solid aerosol-forming substrates, cigarettes and cigarette-like articles that include an aerosol-forming substrate contained within a wrapper such as a cigarette paper, capsules or containers of liquid aerosol-forming substrate or colloidal aerosol-forming substrate. The consumable aerosol-generating article may comprise a replaceable substrate section containing two or more components which form an aerosol when combined.

A consumable aerosol-generating article may comprise an atomizer, such as a heating element for heating the aerosol-forming substrate, or for heating at least one of the two or more components which form an aerosol when combined. Thus, a consumable aerosol-generating article may be a form of cartomizer and include both an aerosol-forming substrate and an atomizing component. The consumable aerosol-generating article would, in such embodiments, preferably include electrical contacts configured to contact corresponding electrical contacts on a battery portion of the aerosol-generating device to provide power for actuation of the atomizer.

In examples, the atomizer may be a resistance heater such as a resistive wire, or a resistive track on a substrate. In other embodiments, the atomizer may be an inductive susceptor capable of heating when within a fluctuating magnetic field generated by an inductive coil.

A preferred consumable aerosol-generating article may be in the form of a cigarette or cigarette-like article comprising a solid aerosol-forming substrate contained within a wrapper. Preferably such an article includes a mouth end intended to be inserted into a user's mouth for consumption of the article. Preferably, the mouth end includes a filter to emulate a conventional tailored cigarette. Preferably, the consumable aerosol-generating article is configured to interact with an atomizer, preferably a heater, located in the body of the aerosol-generating device. Thus, a heating means such as a resistance heating element may be located in or around the substrate receiving cavity for receiving the consumable aerosol-generating article. The substrate receiving cavity may be located at a proximal end of the device. For example, an opening to the substrate receiving cavity may be located at the proximal end of the device.

Preferably, the aerosol-forming substrate of the aerosol-generating article is a solid aerosol-forming substrate. However, the aerosol-forming substrate may comprise both solid and liquid components. Alternatively, the aerosol-forming substrate may be a liquid aerosol-forming substrate.

Preferably, the aerosol-forming substrate comprises nicotine. More preferably, the aerosol-forming substrate comprises tobacco. Alternatively or in addition, the aerosol-forming substrate may comprise a non-tobacco containing aerosol-forming material.

If the aerosol-forming substrate is a solid aerosol-forming substrate, the solid aerosol-forming substrate may comprise, for example, one or more of: powder, granules, pellets, shreds, strands, strips or sheets containing one or more of: herb leaf, tobacco leaf, tobacco ribs, expanded tobacco and homogenised tobacco.

Optionally, the solid aerosol-forming substrate may contain tobacco or non-tobacco volatile flavour compounds, which are released upon heating of the solid aerosol-forming substrate. The solid aerosol-forming substrate may also contain one or more capsules that, for example, include additional tobacco volatile flavour compounds or non-tobacco volatile flavour compounds and such capsules may melt during heating of the solid aerosol-forming substrate.

Optionally, the solid aerosol-forming substrate may be provided on or embedded in a thermally stable carrier. The carrier may take the form of powder, granules, pellets, shreds, strands, strips or sheets. The solid aerosol-forming substrate may be deposited on the surface of the carrier in the form of, for example, a sheet, foam, gel or slurry. The solid aerosol-forming substrate may be deposited on the entire surface of the carrier, or alternatively, may be deposited in a pattern in order to provide a non-uniform flavour delivery during use.

In a preferred embodiment, the aerosol-forming substrate comprises homogenised tobacco material. As used herein, the term “homogenised tobacco material” refers to a material formed by agglomerating particulate tobacco.

Preferably, the aerosol-forming substrate comprises a gathered sheet of homogenised tobacco material. As used herein, the term “sheet” refers to a laminar element having a width and length substantially greater than the thickness thereof. As used herein, the term “gathered” is used to describe a sheet that is convoluted, folded, or otherwise compressed or constricted substantially transversely to the longitudinal axis of the aerosol-generating article.

Preferably, the aerosol-forming substrate comprises an aerosol former. As used herein, the term “aerosol former” is used to describe any suitable known compound or mixture of compounds that, in use, facilitates formation of an aerosol and that is substantially resistant to thermal degradation at the operating temperature of the aerosol-generating article.

Suitable aerosol-formers are known in the art and include, but are not limited to: polyhydric alcohols, such as propylene glycol, triethylene glycol, 1,3-butanediol and glycerine;

esters of polyhydric alcohols, such as glycerol mono-, di- or triacetate; and aliphatic esters of mono-, di- or polycarboxylic acids, such as dimethyl dodecanedioate and dimethyl tetradecanedioate. Preferred aerosol formers are polyhydric alcohols or mixtures thereof, such as propylene glycol, triethylene glycol, 1,3-butanediol and, most preferred, glycerine.

The aerosol-forming substrate may comprise a single aerosol former. Alternatively, the aerosol-forming substrate may comprise a combination of two or more aerosol formers.

An aerosol-generating system may comprise an aerosol-generating as described above and an aerosol-generating article configured to be received by the aerosol-generating device, the aerosol-generating article comprising the aerosol-forming substrate.

An aerosol-generating system may further comprise a charging device for charging the aerosol-generating device. A charging device may comprise a primary power source and may have a docking arrangement configured to engage with the aerosol-generating device.

In an aspect, the invention may provide a method of operating an aerosol-generating device comprising steps of;

(a) monitoring progress of an event or operation performed by the aerosol-generating device, and

(b) controlling an indicator to indicate progress of the event or operation as a sequence of 1st to nth different indication states, n being a number equal to or greater than 7.

The aerosol-generating device may comprise a light emitting indicator, and a controller configured to control the light emitting indicator to indicate progress of the event, in which the light emitting indicator indicates progress of the event as a sequence of 1st to nth different indication states, n being a number equal to or greater than 7.

The invention may provide a method of operating an aerosol-generating device comprising steps of;

(a) monitoring progress of an event or operation performed by the aerosol-generating device, and

(b) controlling a visual indicator to indicate progress of the event as a sequence of 1st to nth different visual indication states, n being a number equal to or greater than 7.

The device may comprise a plurality of light emitting units that are controlled in a plurality of light intensities or luminance levels in order to display the sequence of 1st to nth different indication states.

A method of operating an aerosol-generating device may be a method of operating any device described herein.

The invention is defined in the claims. However, below there is provided a non-exhaustive list of non-limiting examples. Any one or more of the features of these examples may be combined with any one or more features of another example, embodiment, or aspect described herein.

Exi. An aerosol-generating device for generating an aerosol from an aerosol-forming substrate,

the aerosol-generating device being configured to perform a function during an event,

the aerosol-generating device comprising:

a controller configured to monitor progress of the event and control an indicator to indicate progress of the event, in which the indicator is configured to indicate progress of the event as a sequence of 1st to nth different indication states, n being a number equal to or greater than 7.

Exii. An aerosol-generating device for generating an aerosol from an aerosol-forming substrate,

the aerosol-generating device being configured to perform a function during an event,

the aerosol-generating device comprising:

a light emitting indicator, and

a controller configured to control the light emitting indicator to indicate progress of the event, in which the light emitting indicator is configured to indicate progress of the event as a sequence of 1st to nth different indication states, n being a number equal to or greater than 7.

Ex1. An aerosol-generating device for generating an aerosol from an aerosol-forming substrate, the aerosol-generating device being configured to indicate progress of an event during use of the aerosol-generating device, the aerosol-generating device comprising:

an indicator configured to indicate progress of the event as a sequence of 1st to nth different indication states, n being a number equal to or greater than 7,

and a controller configured to monitor progress of the event and to control the indicator to indicate in an indication state representative of the progress of the event.

Ex2. An aerosol-generating device according to any preceding example in which the indicator comprises one or more indicator selected from the list consisting of visual indicator, audio indicator, and haptic indicator.

Ex3. An aerosol-generating device for generating an aerosol from an aerosol-forming substrate, the aerosol-generating device being configured to display progress of an event during use of the aerosol-generating device, the aerosol-generating device comprising:

a visual indicator configured to display progress of the event as a sequence of 1st to nth different visual indication states, n being a number equal to or greater than 7,

and a controller configured to monitor progress of the event and to control the visual indicator to display in a visual indication state representative of the progress of the event.

Ex4. An aerosol-generating device according to any preceding example in which,

the aerosol-generating device is configured to monitor a parameter relating to progress of the event.

Ex5. An aerosol-generating device according to example Ex4, the parameter having an initial value at initiation or the start of the event, and a terminal value different to the initial value.

Ex6. An aerosol-generating device according to example Ex5, a monitored value of the parameter being used to calculate progress of the parameter between the initial value and the terminal value, progress of the parameter being used to determine progress of the event.

Ex7. An aerosol-generating device according to any of examples Ex4 to Ex6 in which, the parameter relating to progress of the event is a first parameter.

Ex8. An aerosol-generating device according to example Ex7 in which,

the aerosol-generating device is configured to monitor both the first parameter relating to progress of the event and a second parameter relating to progress of the event, the second parameter being a different parameter to the first parameter.

Ex9. An aerosol-generating device according to example Ex8 in which the device is configured to determine progress of the event with respect to both the first parameter and the second parameter.

Ex10. An aerosol-generating device according to any preceding example in which the event has an event start and an event end, a duration of the event defined by the event start and the event end.

Ex11. An aerosol-generating device according to any of examples Ex4 to Ex10 in which the parameter, or one or both of the first parameter and the second parameter, is a user interaction parameter indicative of use of the aerosol-generating device during the event.

Ex12. An aerosol-generating device according to any of examples Ex4 to Ex11 in which the parameter, or one or both of the first parameter and the second parameter, is a monitored parameter.

Ex13. An aerosol-generating device according to any of examples Ex4 to Ex12 in which the parameter, or one or both of the first parameter and the second parameter, is a cumulative parameter, for example a cumulative value of a monitored parameter over the duration of the event.

Ex14. An aerosol-generating device according to any of examples Ex4 to Ex13 in which the progress of the event is determined by progress of the parameter, or progress of one or both of the first parameter and the second parameter, between its initial value and its terminal value.

Ex15. An aerosol-generating device according to example Ex14 in which progress of the event is determined as a percentage.

Ex16. An aerosol-generating device according to any of examples Ex4 to Ex 15 in which progress of the parameter is determined by the formula {(monitored value of the parameter – initial value of the parameter) / (terminal value of the parameter – initial value of the parameter) x 100}.

Ex17. An aerosol-generating device according to any of examples Ex4 to Ex 16 in which progress of the first parameter is determined by the formula {(monitored value of the first parameter – initial value of the first parameter) / (terminal value of the first parameter – initial value of the first parameter) x 100}.

Ex18. An aerosol-generating device according to any of examples Ex4 to Ex 17 in which progress of the second parameter is determined by the formula {(monitored value of the second parameter – initial value of the second parameter) / (terminal value of the second parameter – initial value of the second parameter) x 100}.

Ex19. An aerosol-generating device according to any of examples Ex4 to Ex17 in which progress of the first parameter is determined during the event, progress of the second parameter is determined during the event, and the progress of the event is determined by the most advanced of the progress of the first parameter and the progress of the second parameter.

Ex20. An aerosol-generating device according to any preceding example for generating an aerosol from an aerosol-forming substrate, the aerosol-generating device being configured to display progress of the event during use of the aerosol-generating device, the aerosol-generating device comprising:

a visual indicator configured to display progress of the event as a sequence of 1st to nth different visual indication states, n being a number equal to or greater than 7,

and a controller configured to monitor progress of the event and to control the visual indicator to display in a visual indication state representative of the progress of the event, in which the aerosol-generating device is configured to monitor a first parameter relating to progress of the event and to monitor a second parameter relating to progress of the event, the progress of the event at a moment during the event being determined with respect to both a value of the first parameter at that moment and a value of the second parameter at that moment.

Ex21. An aerosol-generating device according to any of examples Ex4 to Ex20 in which the parameter, the first parameter, or the second parameter is time.

Ex22. An aerosol-generating device according to any of examples Ex4 to Ex21 in which the parameter, the first parameter, or the second parameter is selected from the list consisting of time, number of user puffs, cumulative number of user puffs taken during the event, volume of aerosol delivered, cumulative volume of aerosol delivered during the event, energy consumed, cumulative volume of energy consumed during the event, and current consumed, cumulative amount of current consumed during the event, temperature,

temperature of heating element, temperature of susceptor, resistance of heating element, and user interaction.

Ex23. An aerosol-generating device according to any preceding example in which progress of the event is determined with reference to a first parameter and a second parameter, in which one of the first parameter and the second parameter is time, and the other of the first parameter and the second parameter is selected from the list consisting of number of user puffs, cumulative number of user puffs taken during the event, volume of aerosol delivered, cumulative volume of aerosol delivered during the event, energy consumed, cumulative volume of energy consumed during the event, and current consumed, cumulative amount of current consumed during the event, temperature, temperature of heating element, temperature of susceptor, resistance of heating element, and user interaction.

Ex24. An aerosol-generating device according to any preceding example in which progress of the event is determined with reference to a first parameter and a second parameter, in which the indication state displayed by the indicator reflects the progress of the first parameter or the progress of the second parameter if the progress of the second parameter is greater than the progress of the first monitored parameter.

Ex25. An aerosol-generating device according to any preceding example in which the event is an operational phase of the aerosol-generating device, for example in which the event is an event selected from the list consisting of a usage session, a heating period, and a pause period.

Ex26. An aerosol-generating device according to any preceding example in which the event is a usage session and the usage session extends between a usage session start and a usage session stop.

Ex27. An aerosol-generating device according to example Ex26 in which the aerosol-generating device is configured such that the usage session has a maximum duration determined by a timer and/or a maximum duration determined by a time threshold.

Ex28. An aerosol-generating device according to example Ex26 or Ex27 in which the device is configured to monitor a first parameter relating to progress of the usage session and a second parameter relating to progress of the usage session, the first parameter being time and the second parameter being a user interaction parameter selected from the list consisting of number of user puffs, cumulative number of user puffs taken during the event, volume of aerosol delivered, cumulative volume of aerosol delivered during the event, energy consumed, cumulative volume of energy consumed during the event, and current consumed, cumulative amount of current consumed during the event.

Ex29. An aerosol-generating device according to any of examples Ex26 to Ex28 in which the usage session is configured to be terminated if a monitored user interaction parameter reaches a predetermined threshold.

Ex30. An aerosol-generating device according to any of examples Ex28 to Ex29 in which the user interaction parameter is indicative of user puffs taken during the usage session, or in which the user interaction parameter is indicative of volume of aerosol released by the aerosol-forming substrate, or delivered to the user, during the usage session.

Ex31. An aerosol-generating device according to any preceding example in which the aerosol-generating device comprises a puff counting mechanism to determine number of user puffs taken, for example the number of puffs taken during the event, for example the number of puffs taken during the usage session.

Ex32. An aerosol-generating device according to example Ex31 in which the aerosol-generating device is configured to terminate the usage session when the number of user puffs taken during the usage session reaches a predetermined threshold.

Ex33. An aerosol-generating device according to any of examples Ex28 to Ex32 comprising steps of;

monitoring a parameter indicative of progress of the usage session, for example monitoring a parameter indicative of aerosol generation during operation of the aerosol-generating device,

analysing the monitored parameter to identify a user puff, the user puff defined by a puff start and a puff end,

analysing the monitored parameter during the user puff to calculate a puff volume, the puff volume being a volume of aerosol generated during the user puff, and

using the puff volume as the user interaction parameter.

Ex34. An aerosol-generating device according to any preceding example, in which the event, for example the usage session, comprises at least 7 sequential phases, for example at least 10 sequential phases.

Ex35. An aerosol-generating device according to example Ex34 in which the controller is configured to control the indicator to indicate a different one of the sequence of 1st to nth different indication states during each of the at least 7 sequential phases.

Ex36. An aerosol-generating device according to example Ex34 or Ex35 in which the controller is configured to control a light emitting indicator to display a different one of the sequence of 1st to nth different indication states during each of the at least 7 sequential phases.

Ex37. An aerosol-generating device according to any of examples Ex34 to Ex36 in which the event, for example the usage session, is divided into n sequential phases, n being the number greater than 7, for example a number equal to or greater than 10, for example between 7 and 144 sequential phases, or for example between 18 and 72 sequential phases.

Ex38. An aerosol-generating device according to any of examples Ex34 to Ex37 in which the aerosol-generating device is configured such that any, or each, of the n sequential phases has a phase duration defined by a phase start and a phase end.

Ex39. An aerosol-generating device according to any of examples Ex34 to Ex38 in which the aerosol-generating device is configured such that any, or each, of the n sequential phases has a maximum phase duration determined by a timer.

Ex40. An aerosol-generating device according to any of examples Ex34 to Ex39 in which any, or each, of the n sequential phases ends when a monitored period of time reaches a predetermined threshold for the phase, if the phase has not ended sooner.

Ex41. An aerosol-generating device according to any of examples Ex34 to Ex40 in which,

a first phase of n sequential phases has a first phase duration defined by a first phase start and a first phase end, in which the first phase starts at the event start, for example at the usage session start.

Ex42. An aerosol-generating device according to any of examples Ex34 to Ex41 in which,

a second phase of the n sequential phases has a second phase duration defined by a second phase start and a second phase end, in which the second phase starts at the end of the first phase.

Ex43. An aerosol-generating device according to any of examples Ex34 to Ex42 in which the n sequential phases may be defined as a first phase and n-1 subsequent phases, each of the subsequent phases following a preceding phase, in which

each of the n-1 subsequent phases has a phase duration defined by a phase start and a phase end, in which the phase starts at the end of the preceding phase.

Ex44. An aerosol-generating device according to any of examples Ex34 to Ex42 in which the event, for example the usage session, ends at the end of the nth phase.

Ex45. An aerosol-generating device according to any preceding example in which the aerosol-generating device is configured to monitor a user interaction parameter indicative of use of the aerosol-generating device during the event, for example during the usage session.

Ex46. An aerosol-generating device according to any of examples Ex34 to Ex46 in which the aerosol-generating device is configured to monitor a user interaction parameter indicative of use of the aerosol-generating device during the event, for example during the usage session.

Ex47. An aerosol-generating device according to example Ex46 in which duration of any, or each, of the n sequential phases is controlled with reference to the user interaction parameter.

Ex48. An aerosol-generating device according to example Ex46 or Ex47 in which a duration of any, or each, of the n sequential phases is controlled with reference to the user interaction parameter and at least one further parameter.

Ex49. An aerosol-generating device according to example Ex48 in which the at least one further parameter is passage of time determined by a timer.

Ex50. An aerosol-generating device according to any of examples Ex45 to Ex49 in which the user interaction parameter is indicative of user puffs taken during the usage session.

Ex51. An aerosol-generating device according to any of examples Ex45 to Ex49 in which the user interaction parameter is indicative of power supplied to a heating element during the usage session.

Ex52. An aerosol-generating device according to any of examples Ex34 to Ex51 in which the aerosol-generating device comprises a puff counting mechanism to determine number of user puffs taken during the usage session and in which duration of any, or each, of the n sequential phases is controlled with reference to the number of user puffs taken during the usage session.

Ex53. An aerosol-generating device according to any of examples Ex34 to Ex52, in which in which the aerosol-generating device is configured such that each of the n sequential phases of the usage session has a maximum phase duration determined by a timer, and in which the aerosol-generating device is configured to record at least one user interaction parameter during the usage session, the phase duration of any, or each, of the n sequential phases having a duration less than the maximum phase duration if the value of the user interaction parameter reaches a predetermined threshold.

Ex54. An aerosol-generating device according to any preceding example in which the event, for example the usage session, has a maximum duration of between 60 seconds and 600 seconds, for example between 300 seconds and 400 seconds, for example about 360 seconds.

Ex55. An aerosol-generating device according to any preceding example in which the event, for example the usage session, has a maximum duration of x seconds, x being a number between 100 and 600, in which the event is divided into n sequential phases, a maximum duration of each of the n sequential phases being about x/n seconds.

Ex56. An aerosol-generating device according to any preceding example in which the event, for example the usage session, is controlled with respect to a monitored number of user puffs, the usage session having a threshold number of user puffs of between 10 and 14, for example about 12.

Ex57. An aerosol-generating device according to any preceding example in which the aerosol-generating device is configured to monitor a parameter indicative of aerosol generation during operation of the aerosol-generating device, analyse the monitored parameter to identify a user puff, the user puff defined by a puff start and a puff end, analyse the monitored parameter during the user puff to calculate a puff volume, the puff volume being a volume of aerosol generated during the user puff, and using the puff volume as a parameter relating to progress of the event, for example progress of a usage session.

Ex58. An aerosol-generating device according to example Ex57 in which, the parameter indicative of aerosol generation is representative of power supplied by the power supply.

Ex59. An aerosol-generating device according to any of examples Ex57 to Ex58 in which the aerosol-generating device is configured to generate the aerosol during a usage session, the device being configured to determine a start of the usage session, monitor the parameter indicative of aerosol generation during the usage session, and use the puff volume as a parameter for indicating progress of the usage session.

Ex60. An aerosol-generating device according to and of examples Ex57 to Ex59 in which the device is configured to perform a method comprising the steps of, analysing the monitored parameter to identify a plurality of user puffs performed during operation of the device, each of the plurality of user puffs having a puff start and a puff end determined by analysing the monitored parameter.

Ex61. An aerosol-generating device according example Ex60 in which the device is configured to perform a method comprising steps of, analysing the monitored parameter during each of the plurality of identified user puffs to calculate a puff volume for each of the plurality of user puffs, determining a cumulative puff volume of aerosol generated during each of the plurality of identified user puffs, and using the cumulative puff volume as a parameter for controlling operation of the device and/or indicating progress of the usage session.

Ex62. An aerosol-generating device according example Ex61 in which the device is configured to perform a method comprising steps of, determining a start of a usage session, monitoring the parameter indicative of aerosol generation during the usage session, and using the cumulative puff volume as a parameter for determining the end of the usage session.

Ex63. An aerosol-generating device according to any of examples Ex57 to Ex62 in which a function of the monitored parameter is calculated in real time and evaluated to determine puff volume.

Ex64. An aerosol-generating device according to any of examples Ex57 to Ex63 in which analysis of the monitored parameter comprises steps of calculating a first characteristic of the monitored parameter and analysing the first characteristic to determine a puff start and a puff stop.

Ex65. An aerosol-generating device according to example Ex64 in which analysis of the monitored parameter comprises steps of calculating a second characteristic of the monitored parameter and analysing both the first characteristic and the second characteristic to determine the puff start and the puff stop.

Ex66. An aerosol-generating device according to example Ex65 in which a puff start is determined when the first characteristic and the second characteristic satisfy one or more predetermined conditions.

Ex67. An aerosol-generating device according to example Ex65 or Ex66 in which a puff end is determined when the first characteristic and the second characteristic satisfy one or more predetermined conditions.

Ex68. An aerosol-generating device according to any of examples Ex65 to Ex67 in which the first characteristic is a first moving average value of the monitored parameter computed on a first time window having a first time window duration.

Ex69. An aerosol-generating device according to any of examples Ex65 to Ex68 in which the second characteristic is a second moving average value of the monitored parameter computed on a second time window having a second time window duration, the second time window duration being different to the first time window duration.

Ex70. An aerosol-generating device according to example Ex69 in which a puff start is determined when the first moving average value and the second moving average value meet a predetermined relationship with respect to each other; for example in which the first time window duration is shorter that the second time window duration and a puff start is determined when the first moving average increases with respect to the second moving average and reaches a puff start value in which the first moving average equals the second moving average plus a first predetermined puff start constant.

Ex71. An aerosol-generating device according to example Ex70 in which a puff end is determined when the first moving average decreases with respect to the second moving average, after the detection of a puff start, and reaches a puff end value in which the first moving average is greater than the second moving average minus a first predetermined puff end constant, and the second moving average is lesser than the value of the second moving average at puff start plus a second predetermined puff end constant.

Ex72. An aerosol-generating device according to any of examples Ex65 to Ex71 in which the first characteristic is a first moving median value of the monitored parameter computed on a first time window having a first time window duration; and/or in which the second characteristic is a second moving median value of the monitored parameter computed on a second time window having a second time window duration, the second time window duration being different to the first time window duration; preferably in which a puff start is determined when the first moving median value and the second moving median value meet a predetermined relationship with respect to each other; for example in which the first time window duration is shorter that the second time window duration and a puff start is determined when the first moving median increases with respect to the second moving median and reaches a puff start value in which the first moving median equals the second moving median plus a first predetermined puff start constant; for example in which a puff end is determined when the first moving median decreases with respect to the second moving median, after the detection of a puff start, and reaches a puff end value in which the first moving median is greater than the second moving median minus a first predetermined puff end constant, and the second moving median is lesser than the value of the second moving median at puff start plus a second predetermined puff end constant.

Ex73. An aerosol-generating device according to any preceding example in which the indicator is a visual indicator comprising a predetermined number (i) of discrete light emitting units, each light emitting unit being controllable to emit light in a predetermined number (j) of different intensities, i being a number between 4 and 24, and j being a number between 2 and 5.

Ex74. An aerosol-generating device according to example Ex73 in which each of the predetermined number j of indication states represents a light intensity levels of between 0% and 100% of possible emission intensity.

Ex75. An aerosol-generating device according to example Ex74 in which each of the discrete light emitting units is controlled to emit light in 2 different intensities, for example intensities of about 50% of possible emission intensity and about 100% of possible emission intensity.

Ex76. An aerosol-generating device according to example Ex74 in which each of the discrete light emitting units is controlled to emit light in 3 different intensities, for example intensities of about 33% of possible emission intensity, about 66% of possible emission intensity, and about 100% of possible emission intensity.

Ex77. An aerosol-generating device according to example Ex74 in which each of the discrete light emitting units is controlled to emit light in 4 different intensities, for example intensities of about 25% of possible emission intensity, about 50% of possible emission intensity, about 75% of possible emission intensity, and about 100% of possible emission intensity.

Ex73A. An aerosol-generating device according to any preceding example in which the indicator is a visual indicator comprising a predetermined number (i) of discrete light emitting units, each light emitting unit being controllable to emit light in a predetermined number (j) of different static luminance levels, i being a number between 4 and 24, and j being a number between 2 and 5.

Ex74A. An aerosol-generating device according to example Ex73A in which each of the predetermined number j of indication states represents a static luminance level of between 0% and 100% of possible static luminance.

Ex75A. An aerosol-generating device according to example Ex74A in which each of the discrete light emitting units is controlled to emit light at 2 different static luminance levels, for example static luminance levels of about 50% of possible luminance and about 100% of possible luminance.

Ex76A. An aerosol-generating device according to example Ex74A in which each of the discrete light emitting units is controlled to emit light in 3 different static luminance levels, for example static luminance levels of about 33% of possible luminance, about 66% of possible luminance, and about 100% of possible luminance.

Ex77A. An aerosol-generating device according to example Ex74A in which each of the discrete light emitting units is controlled to emit light in 4 different static luminances, for example static luminances of about 25% of possible luminance, about 50% of possible luminance, about 75% of possible luminance, and about 100% of possible luminance.

Ex78. An aerosol-generating device according to any of examples Ex73 to Ex77 or Ex73A to Ex77A in which the discrete light emitting units are configured as a linear matrix on or extending through a housing of the device.

Ex79. An aerosol-generating device according to example Ex78 in which the linear matrix is a 1x4 matrix, or a 1x5 matrix, or a 1x6 matrix, or a 2x4 matrix, or a 2x5 matrix, or a 2x6 matrix, or 3x4 matrix, or a 3x5 matrix, or a 3x6 matrix.

Ex80. An aerosol-generating device according to any of examples Ex73 to Ex77 or Ex73A to Ex77A in which the discrete light emitting units are configured as an annular matrix on or extending through a housing of the device.

Ex81. An aerosol-generating device according to example Ex80 in which the annular matrix comprises a single ring formed from between 4 and 12 light emitting units, for example 5, or 6, or 7, or 8, or 9, or 10, or 11 light emitting units.

Ex82. An aerosol-generating device according to example Ex80 in which the annular matrix comprises 2 concentric rings, each ring formed from between 4 and 12 light emitting units, for example 5, or 6, or 7, or 8, or 9, or 10, or 11 light emitting units.

Ex83. An aerosol-generating device according to any preceding example in which the indicator is a visual indicator comprising a LCD display screen or an OLED display screen.

Ex84. An aerosol-generating device according to any preceding example in which progress of the event is determined and displayed by a visual indicator, in which progression through the first to nth indication states involves a corresponding increase in intensity or luminance of light displayed by the visual indicator.

Ex85. An aerosol-generating device according to any of examples Exi to Ex83 in which progress of the event is determined and displayed by a visual indicator, in which progression through the first to nth indication states involves a corresponding decrease in intensity or luminance of light displayed by the visual indicator.

Ex86. An aerosol-generating device according to any preceding example in which the event is a first event, the device further being configured to monitor progress of and display progress in relation to a second event, the second event being different to the first event.

Ex87. An aerosol-generating device for generating an aerosol from an aerosol-forming substrate, the aerosol-generating device being configured to display progress of a first event and status and/or progress of a second event during use of the aerosol-generating device, the aerosol-generating device comprising:

a visual indicator configured to display progress of the first event as a first sequence of 1st to nth different indication states, and status and/or progress of the second event as a second sequence of different indication states,

n being a number equal to or greater than 7,

and a controller configured to monitor progress of the first event and to control the visual indicator to display in an indication state representative of the progress of the first event,

and to monitor the second event and to control the visual indicator to display in an indication state representative of the status and/or progress of the second event.

Ex88. An aerosol-generating device according to example Ex86 or Ex87 in which progress of the second event is displayed as a second sequence of 1st to nth different indication states, the second sequence of indication states being different to the first sequence of indication states.

Ex89. An aerosol-generating device according to any of examples Ex86 to Ex88 in which the first event is an event type selected from the list consisting of a usage session, a heating period, and a pause period, and the second event is an event type selected from the list consisting of a usage session, a heating period, and a pause period, the event type of the second event being different to the event type of the first event.

Ex90. An aerosol-generating device according to any of examples 86 to 89 in which the controller is configured to determine initiation of the first event, determine an event type of the first event, monitor progress of the first event, and control the visual indicator to display a predetermined sequence of indication states representative of progress of the first event, and in which the controller is configured to determine initiation of the second event, determine the event type of the second event, monitor status and/or progress of the second event, and control the visual indicator to display a predetermined sequence of indication states representative of status and/or progress of the second event.

Ex91. An aerosol-generating device according to any of examples 86 to 90 in which the second event occurs after termination of the first event.

Ex92. An aerosol-generating device according to any of examples 86 to 90 in which the second event occurs during a hiatus in the first event.

Ex93. An aerosol-generating device according to any of examples 86 to 90 in which the second event occurs before initiation of the first event.

Ex94. An aerosol-generating device according to any of examples 86 to 93 the device further being configured to monitor progress of and display progress in relation to a third event, the third event being different to the first event and the second event.

Ex95. An aerosol-generating device according to any of examples 86 to 94 in which the first event is a preheating event and the second event is a usage session.

Ex96. An aerosol-generating device according to any of examples 86 to 94 in which the first event is a usage session and the second event is a pause event.

Ex97. An aerosol-generating device according to any of examples 86 to 94 in which the first event is a preheating event, the second event is a usage session, and the third event is a pause event.

Ex98. An aerosol-generating device according to any preceding example configured to allow a user to pause the first event during progress of the first event and enter a pause period, the device comprising a memory configured to store progress of the first event such that display of progress can be resumed on re-initiation of the first event.

Ex99. An aerosol-generating device according to any preceding example, further comprising a user interaction interface, for example an interface selected from the list consisting of a button, a touch sensitive button, a strain sensitive button, a gesture recognition interface, a haptic interface, and an accelerometer.

Ex100. An aerosol-generating device according to any preceding example, comprising a power source for generating an aerosol from an aerosol-forming substrate, for example a battery.

Ex101. An aerosol-generating device according to any preceding example, comprising a heater for heating an aerosol-forming substrate, for example a resistance heater or an induction heater.

Ex102. An aerosol-generating device according to any preceding example, in which the device is configured to operate with a solid aerosol-forming substrate.

Ex103. An aerosol-generating device according to any preceding example, in which the device is configured to operate with a liquid aerosol-forming substrate.

Ex104. An aerosol-generating device according to any preceding example, comprising a sensor, for example a sensor for detecting a parameter indicative of progress of the event, for example a sensor for detecting a user interaction parameter.

Ex105. An aerosol-generating device according to any preceding example, in which the controller is configured to interact with one or more drivers to control the indicator to indicate progress in the sequence of 1st to nth different indication states.

Ex106. An aerosol-generating device according to any preceding example, in which the device comprises a visual indicator comprising a plurality of light emitting units, and in which the controller is configured to interact with one or more drivers to control the visual indicator to indicate progress in the sequence of 1st to nth different visual indication states.

Ex107. An aerosol-generating device according to any preceding example in which the device comprises control electronics; and

at least one visual indicator, for example a lighting array, comprising a plurality of light emitting units;

wherein the control electronics is configured to independently control each one of the plurality of light emitting units in at least:

i) an off state in which the light emitting unit does not emit light;

ii) a first lighting state in which the light emitting unit emits light at a first static luminance level; and

iii) a second lighting state in which the light emitting unit emits light at a second static luminance level that is different to the first static luminance level; and

wherein the control electronics is configured to control each one of the light emitting units to be in one of the off state, first lighting state and the second lighting state so as to indicate the progression of the event to a user as the sequence of 1st to nth different visual indication states.

Ex108. An aerosol-generating device according to any preceding example in which the device comprises a plurality of light emitting units, the light emitting units being LEDs.

Ex109. An aerosol-generating device according to examples Ex107 or Ex108 in which each of the plurality of light emitting units is configured to be independently controlled at different static luminance levels for indication of progression of the event, and at least one of the light emitting units is controllable to display different colour of light to indicate a status, such as low power level, or proximity to end of the event.

Ex110. An aerosol-generating device according to any preceding example comprising a visual indicator, wherein the visual indicator comprises a plurality of windows for communicating light to a user; and preferably further comprises one or more waveguides.

Ex111. A method of operating an aerosol-generating device comprising steps of,

monitoring progress of an event or operation performed by the aerosol-generating device and controlling an indicator to indicate progress of the event or operation as a sequence of 1st to nth different indication states, n being a number equal to or greater than 7.

Ex112. A method of operating an aerosol-generating device, the aerosol-generating device comprising:

a light emitting indicator, and

a controller configured to control the light emitting indicator to indicate progress of the event, in which the light emitting indicator indicates progress of the event as a sequence of 1st to nth different indication states, n being a number equal to or greater than 7.

Ex113. A method of operating an aerosol-generating device comprising steps of,

monitoring progress of an event or operation performed by the aerosol-generating device and controlling a visual indicator to indicate progress of the event as a sequence of 1st to nth different visual indication states, n being a number equal to or greater than 7.

Ex114. A method according to example Ex113 in which a plurality of light emitting units are controlled in a plurality of light intensities or luminance levels in order to display the sequence of 1st to nth different indication states.

Ex115. A method according to any of examples Ex111 to Ex114 used as a method of operating any device defined in any of examples Exi to Ex110.

Examples will now be further described with reference to the figures, in which:

Figure 1 illustrates a schematic side view of an aerosol-generating device;

Figure 2 illustrates a schematic upper end view of the aerosol-generating device of Figure 1;

Figure 3 illustrates a schematic cross-sectional side view of the aerosol-generating device of Figure 1 and an aerosol-generating article for use with the device;

Figure 4 is a block diagram providing a schematic illustration of various electronic components of the aerosol-generating device of Figures 1 to 3 and their interactions;

Figure 5 illustrates an example illustrating the operation of a lighting array provided on the aerosol-generating device of Figures 1 to 4 with progression through a usage session;

Figure 6 illustrates a second example illustrating the operation of a lighting array provided on the aerosol-generating device of Figures 1 to 4 with progression through a usage session;

Figures 7, 8, and 9 illustrate a flow diagram illustrating method steps involved in determining and indicating progress of a usage session to a user, where progress is determined by time and puff count.

As illustrated in figures 1 to 3, an exemplary aerosol-generating device 10 is a hand-held aerosol generating device, and has an elongate shape defined by a housing 20 that is substantially circularly cylindrical in form. The aerosol-generating device 10 comprises an open cavity 25 located at a proximal end 21 of the housing 20 for receiving an aerosol-generating article 30 comprising an aerosol-forming substrate 31. The aerosol-generating device 10 further comprises a battery (not shown) located within the housing 20 of the device, and an electrically operated heater 40 arranged to heat at least an aerosol-forming substrate portion 31 of an aerosol-generating article 30 when the aerosol-generating article 30 is received in the cavity 25.

The aerosol-generating device is configured to receive a consumable aerosol-generating article 30. The aerosol-generating article 30 is in the form of a cylindrical rod and comprises an aerosol-forming substrate 31. The aerosol-forming substrate is a solid aerosol-forming substrate comprising tobacco. The aerosol-generating article 30 further comprises a mouthpiece such as a filter 32 arranged in coaxial alignment with the aerosol-forming substrate within the cylindrical rod. The aerosol-generating article 30 has a diameter substantially equal to the diameter of the cavity 25 of the device 10 and a length longer than a depth of the cavity 25, such that when the article 30 is received in the cavity 25 of the device 10, the mouthpiece 32 extends out of the cavity 25 and may be drawn on by a user, similarly to a conventional cigarette. In preferred embodiments, the aerosol-generating article is 45 mm long and 7.2 mm in diameter.

In use, a user inserts the article 30 into the cavity 25 of the aerosol-generating device 10 and turns on the device 10 by pressing a user button 50 to activate the heater 40 to start a usage session. The heater 40 heats the aerosol-forming substrate of the article 30 such that volatile compounds of the aerosol-forming substrate 31 are released and atomised to form an aerosol. The user draws on the mouthpiece of the article 30 and inhales the aerosol generated from the heated aerosol-forming substrate. After activation, the temperature of the heater 40 increases from an ambient temperature to a predetermined temperature for heating the aerosol-forming substrate. Control electronics of the device 10 supply power to the heater from the battery to maintain the temperature of the heater at an approximately constant level as a user puffs on the aerosol-generating article 30. The heater continues to heat the aerosol-generating article until an end of the usage session, when the heater is deactivated and cools.

At the end of the usage session, the article 30 is removed from the device 10 for disposal, and the device 10 may be coupled to an external power source for charging of the battery of the device 10.

The aerosol-generating device further comprises a light emitting indicator 60 in the form of a lighting array, the lighting array being an array of light emitting diodes (LEDs). The lighting array 60 is incorporated into the housing 20 of the aerosol-generating device 10. The lighting array 60 is formed of a linear arrangement of six LEDs 61a, 61b, 61c, 61d, 61e, 61f extending between first and second ends 62, 63 of the lighting array. The lighting array 60 also has a display window 64 which forms part of the exterior surface of the housing 20. As will be described in more detail below, in use, light generated by each of the LEDs 61a-61f is directed towards the display window 64 so as to be visible to a user of the aerosol-generating article 10.

Figure 4 provides a schematic illustration of various electronic components of the aerosol-generating device and their interactions.

A microcontroller or controller 12, located within the housing 20, is connected to a battery 11, a heater 40, a timer 430, a lighting control driver 13 and the light emitting indicator 60. The light emitting indicator comprises the array of six separate LEDs 61a-61f, coupled to six waveguides 65a-65f, to emit light 66a-65f that is visible to a user viewing the device.

The battery 11 supplies energy to heat the heater 40 and to operate other electrical components. The battery 11 has, when fully charged, sufficient energy to power two complete usage session of the aerosol-generating device. The battery 11 is a rechargeable battery and can be connected to an external power supply to be recharged.

The heater 40 converts energy supplied by the battery into heat to heat the aerosol-generating device sufficiently to form an aerosol. During operation, the controller 12 controls supply of energy from the battery to maintain the heater at a substantially constant aerosol-generating temperature.

The timer 430 provides timing signals to the controller 12. The light emitting indicator 60 generates a visual indication to a user. The light emitting indicator 60 is configured to emit a visual indication in response to a control signal from the controller 12. The battery 11 and the controller 12 are coupled to each other and located within the housing 20. The controller 12 also incorporates a memory module 12a. The controller 12 is in turn coupled to both the heater element 40 and the lighting control driver 13. The controller 12 and lighting control driver 13 collectively form a control electronics section 100 of the aerosol-generating device 10. The lighting control driver 13 is coupled to each of the LEDs 61a-61f. Waveguides 65a, 65b, 65c, 65d, 65e, 65f are provided between the LEDs 61a-61f and a display window 64. Each one of the waveguides 65a-65f is associated with a respective one of the LEDs 61a-61f, so that, in use, each waveguide functions to direct light generated by an associated one of the LEDs to the display window 64. The waveguides 65a-65f are in the form of discrete lengths of optical fibre.

The memory module 12a contains instructions for execution by the controller 12 during use of the device 10. The instructions stored in the memory module 12a include criteria determining the duration of a usage session, plus other data and information relevant to control and operation of the aerosol-generating device 10. When activated, the controller 12 accesses the instructions contained in the memory module 12a and controls a supply of energy from the battery 11 to the heater element 40 according to the instructions contained in the memory module 12a. The controller 12 also controls a supply of energy to the lighting control driver 13. In turn, the lighting control driver 13 individually controls a supply of electricity to each of the LEDs 61a-61f, such that each LED emits light 66a, 66b, 66c, 66d, 66e, 66f at one of a plurality of discrete static luminance levels under the control of the lighting control driver. As illustrated in figure 4, the three different forms of cross-hatching representing light 66a-66f generated by different ones of the LEDs 61a-61f, represent three different intensities or static luminance levels.

At the point in time represented in Figure 4, the luminance of the lighting array 60 as a whole is symmetric about the centre of the lighting array. So, the centrally located two LEDs 61c, 61d are independently controlled by the lighting control driver 13 to emit light at a first predetermined static luminance level, the neighbouring light emitting diodes 61b, 61e independently controlled to emit light at a second predetermined static luminance level and the outermost light emitting diodes 61a, 61f independently controlled to emit light at a third predetermined static luminance level. Thus, each of the discrete LEDs in the array 60 can be independently controlled to emit light at a first intensity or static luminance level 66c, 66d, at a second intensity or static luminance level 66b, 66e, and at a third intensity or static luminance level 66a, 66f.

The aerosol-generating device 10 of this specific embodiment is configured to determine and monitor progress of a usage session, and to output visual indication of the progress of the usage session as a sequence of different indication states. Each of the six LEDs can be controlled to have two different intensity or static luminance levels. The two different intensity or static luminance levels may be conveniently set to be 50% of maximum intensity and 100% of maximum intensity, although it is possible to specify different predetermined intensities. Thus, it is possible to display progress of the usage session as a sequence of 13, different indication states by using all six of the LEDs to provide a sequence of 12 illuminated states and 1 unilluminated state.

In a simple exemplary sequence illustrated in figure 5, the visual indicator may begin a progression in a first, fully illuminated, state, and indicate progress by sequentially decreasing illumination in the six LEDs in further 12 steps ending when the final LED is completely switched off. Thus, the progress of an event such as a usage session may be displayed as a countdown, with the overall luminance of the visual indicator gradually decreasing as progress of the event increases.

Figure 5 shows the array of six LEDs 61a-61f. Each of the LEDs can be switched off (indicated as intensity level = 0), illuminated at 50% of maximum intensity (indicated as intensity level = 1), or illuminated at 100% intensity (indicated as intensity level = 2).

As shown in figure 6(a), all six LEDs in the visual indicator array are illuminated with an intensity level of 2. For this sequence, this may be described as the visual indicator being in a first state.

As shown in figure 6(b), the uppermost, or first, LED in the visual indicator array is illuminated with an intensity level of 1. All other LEDs remain illuminated with an intensity level of 2. This may be described as the visual indicator being in a second state.

In a third state, the uppermost, or first, LED in the visual indicator array is illuminated with an intensity level of 0 (i.e. not illuminated). All other LEDs remain illuminated with an intensity level of 2.

In a fourth state illustrated in figure 6(c), the second LED in the visual indicator array is illuminated with an intensity level of 1. The first LED has an intensity level of 0, and third to sixth LEDs remain illuminated with an intensity level of 2.

In a fifth state, the second LED in the visual indicator array is illuminated with an intensity level of 0. The first LED has an intensity level of 0 and third to sixth LEDs remain illuminated with an intensity level of 2.

In a sixth state illustrated in figure 6(d), the third LED in the visual indicator array is illuminated with an intensity level of 1. The first and second LEDs have an intensity level of 0, and fourth to sixth LEDs remain illuminated with an intensity level of 2.

In a seventh state, the third LED in the visual indicator array is illuminated with an intensity level of 0. The first and second LEDs have an intensity level of 0, and fourth to sixth LEDs remain illuminated with an intensity level of 2.

In an eighth state illustrated in figure 6(e), the fourth LED in the visual indicator array is illuminated with an intensity level of 1. The first, second, and third LEDs have an intensity level of 0, and fifth and sixth LEDs remain illuminated with an intensity level of 2.

In a ninth state, the fourth LED in the visual indicator array is illuminated with an intensity level of 0. The first, second, and third LEDs have an intensity level of 0, and fifth and sixth LEDs remain illuminated with an intensity level of 2.

In a tenth state illustrated in figure 6(f), the fifth LED in the visual indicator array is illuminated with an intensity level of 1. The first, second, third, and fourth LEDs have an intensity level of 0, and the sixth LED remains illuminated with an intensity level of 2.

In an eleventh state, the fifth LED in the visual indicator array is illuminated with an intensity level of 0. The first, second, third, and fourth LEDs have an intensity level of 0, and the sixth LED remains illuminated with an intensity level of 2.

In a twelfth state illustrated in figure 6(g), the sixth LED in the visual indicator array is illuminated with an intensity level of 1. The first, second, third, fourth, and fifth LEDs have an intensity level of 0.

In a thirteenth state illustrated in figure 6(h), all six LEDs in the visual indicator array are illuminated with an intensity level of 0. That is, the visual indicator is not illuminated.

This same information can be represented in table form, as seen in table 1 below.

Indication State	Intensity of individual LEDs (1 x 6 array)					
	1 of 6	2 of 6	3 of 6	4 of 6	5 of 6	6 of 6
First	2	2	2	2	2	2
Second	1	2	2	2	2	2
Third	0	2	2	2	2	2
Fourth	0	1	2	2	2	2
Fifth	0	0	2	2	2	2
Sixth	0	0	1	2	2	2
Seventh	0	0	0	2	2	2
Eighth	0	0	0	1	2	2
Ninth	0	0	0	0	2	2
Tenth	0	0	0	0	1	2
Eleventh	0	0	0	0	0	2
Twelfth	0	0	0	0	0	1
Thirteenth	0	0	0	0	0	0

Table 1: Representation of a progression in a 1 x 6 array (2 = 100% intensity, 1 = 50% intensity, 0 = 0% intensity)

In a further example of a simple sequence to indicate progression, each of the six LEDs may be sequentially illuminated, each LED being stepped through the first and second intensities. In this way the overall luminance provided by the visual indicator 60 increases progressively as a series of 13 steps, as represented in table 2 below.

Indication State	Intensity of individual LEDs (1 x 6 array)					
	1 of 6	2 of 6	3 of 6	4 of 6	5 of 6	6 of 6
First	0	0	0	0	0	0
Second	1	0	0	0	0	0
Third	2	0	0	0	0	0
Fourth	2	1	0	0	0	0
Fifth	2	2	0	0	0	0
Sixth	2	2	1	0	0	0
Seventh	2	2	2	0	0	0
Eighth	2	2	2	1	0	0
Ninth	2	2	2	2	0	0
Tenth	2	2	2	2	1	0
Eleventh	2	2	2	2	2	0
Twelfth	2	2	2	2	2	1
Thirteenth	2	2	2	2	2	2

Table 2: Representation of a progression in a 1 x 6 array (2 = 100% intensity, 1 = 50% intensity, 0 = 0% intensity)

In a further simple sequence to indicate progression, each of the six LEDs may be sequentially stepped through first, second, and third intensities. The first intensity may be 33.3% of maximum intensity, the second intensity may be 66.6% of maximum intensity, and the third intensity may be 100% of maximum intensity. In this way the overall luminance provided by the visual indicator 60 increases or decreases progressively as a series of 19 steps. An example of an increasing progression over 19 states (18 different illuminated states, and 1 state in which all LEDs are unilluminated) is shown in table 3 below.

Indication State	Intensity of individual LEDs (1 x 6 array)					
	1 of 6	2 of 6	3 of 6	4 of 6	5 of 6	6 of 6
First	0	0	0	0	0	0
Second	1	0	0	0	0	0
Third	2	0	0	0	0	0
Fourth	3	0	0	0	0	0
Fifth	3	1	0	0	0	0
Sixth	3	2	0	0	0	0
Seventh	3	3	0	0	0	0
Eighth	3	3	1	0	0	0
Ninth	3	3	2	0	0	0
Tenth	3	3	3	0	0	0
Eleventh	3	3	3	1	0	0
Twelfth	3	3	3	2	0	0
Thirteenth	3	3	3	3	0	0
Fourteenth	3	3	3	3	1	0
Fifteenth	3	3	3	3	2	0
Sixteenth	3	3	3	3	3	0
Seventeenth	3	3	3	3	3	1
Eighteenth	3	3	3	3	3	2
Nineteenth	3	3	3	3	3	3

Table 3: Representation of a progression in a 1 x 6 array (3 = 100% intensity, 2 = 66.6% intensity, 1 = 33.3% intensity, 0 = 0% intensity)

It is possible to indicate a progression through an event such as a usage session without using all six LEDs. For example, progression of a usage session may be indicated by using an upper three of the six LEDs, or a lower three of the six LEDs. For example, each of the three LEDs may be controlled in 2, 3, or 4 different intensity or static luminance levels. Thus, it is possible to display progress of the usage session as a sequence of 7 different indication states by using three of the LEDs. This sequence is illustrated in figure 5.

For the embodiment of Figure 6, three LEDs 61a-61c form an upper half of the lighting array 60, and three LEDs 61d - 61f form a lower half of the lighting array. The lighting control driver 13 is configured to control the supply of energy from the battery 11 so as to progressively reduce the static luminance level of light emitted by each of the light emitting diodes 61a-61c in an upper half of the lighting array 60 over the course of the usage session, commencing with the uppermost first light emitting diode 61a. The light emitting diodes 61a-61c are controlled by the lighting control driver 13 to emit light having one of three predetermined static luminance levels, or to be in a deactivated state in which no light is emitted. The predetermined static luminance levels are designated as levels 3, 2 and 1 order of decreasing luminance, with the deactivated state numbered as level 0. At the start of the usage session, all of the light emitting diodes 61a-61c in the upper half of the lighting array 60 are controlled to emit light having a maximum static luminance level, i.e. level 3. Over the course of the usage session, the lighting control driver 13 adjusts the supply of energy to each of the light emitting diodes 61a-61c to progressively reduce the static luminance level of the light emitted by the light emitting diodes 61a-61c from level 3, to level 2, to level 1 and finally to level 0. The effect of the lighting control driver 13 is to progressively deactivate the light emitting diodes 61a-61c in the upper half of the lighting array 60 to progressively reduce an activated length of the upper half of the lighting array with progression through the usage session. At the end of the usage session, all of the light emitting diodes 61a-61c of the upper half of the lighting array are in a deactivated state, i.e. in level 0 (see Figure 6(e)). For the duration of this usage session, the light emitting diodes 61d…f in the lower half of the lighting array 60 remain deactivated with a luminance level of 0.

Where a user commences a second usage session, the light emitting diodes 61d-61f which form the lower half of the lighting array 60 can be controlled by the lighting control driver 13 in a similar manner to the light emitting diodes 61a-61c of the upper half of the lighting array for the earlier usage session. In this context, the second usage session follows the earlier usage session and is powered by the energy remaining in the battery 11 after earlier usage session. The battery 11 would not be recharged between the earlier and second usage sessions. So, at the start of the second usage session, all of the light emitting diodes 61d-61f in the lower half of the lighting array 60 are controlled to emit light having the maximum static luminance level, i.e. level 3. Over the course of the usage session, the lighting control driver 13 adjusts the supply of energy to each of the light emitting diodes 61d-61f to progressively reduce the static luminance level of the light emitted by the light emitting diodes 61d-61f from level 3 down to level 0, starting with light emitting diode 61d. At the end of the second usage session, all of the light emitting diodes 61d-61f of the lower half of the lighting array would be in a deactivated state, i.e. in level 0. For the duration of this second usage session, the light emitting diodes 61a-61c in the upper half of the lighting array remain deactivated with a luminance level of 0.

When fully charged, the battery can provide sufficient energy for at least one full usage sessions. The battery may provide sufficient energy for two or more usage session (for instance, twenty usage sessions).

The selection of the first three LEDs to indicate progress of a first usage session, and the selection of the second three LEDs to indicate progress of a second usage session, as described above, may be represented by table 4 below. In this table each of the individual LEDs is controlled at first and second intensity levels. During a first usage session the first, second, and third LEDs 61a-61c are used to indicate progress, and during the second usage session the fourth, fifth, and sixth LEDs 61d-61f are used to indicate progress.

Indication State		Intensity of individual LEDs (1 x 6 array)					
		1 of 6	2 of 6	3 of 6	4 of 6	5 of 6	6 of 6
First Usage Session	First	0	0	0	0	0	0
	Second	1	0	0	0	0	0
	Third	2	0	0	0	0	0
	Fourth	2	1	0	0	0	0
	Fifth	2	2	0	0	0	0
	Sixth	2	2	1	0	0	0
	Seventh	2	2	2	0	0	0
Second Usage Session	First	0	0	0	0	0	0
	Second	0	0	0	1	0	0
	Third	0	0	0	2	0	0
	Fourth	0	0	0	2	1	0
	Fifth	0	0	0	2	2	0
	Sixth	0	0	0	2	2	1
	Seventh	0	0	0	2	2	2

Table 4: Representation of two successive progressions using a 1 x 6 array (2 = 100% intensity, 1 = 50% intensity, 0 = 0% intensity)

An aerosol-generating article for use with the device has a finite quantity of aerosol-forming substrate and, thus, a usage session needs to have a finite duration to prevent a user trying to produce aerosol when the aerosol-forming substrate has been depleted. A usage session is configured to have a maximum duration determined by a period of time from the start of the usage session. A usage session is also configured to have a duration of less than the maximum duration if a user interaction parameter recorded during the usage session reaches a threshold before the maximum duration as determined by the timer.

In a specific embodiment the user interaction parameter is number of puffs taken by the user during the usage session. Thus, in a specific embodiment, the aerosol-generating device is configured such that each usage session has a duration of 6.5 minutes (390 seconds) from initiation of the usage session, or 14 puffs taken by the user if 14 puffs are taken within 6.5 minutes from initiation of the usage session. The exact time or number of puffs may be varied to any suitable value. For example the session may have a duration limited to 6 minutes, or to 5.5 minutes. As a further example, the number of allowed puffs may be limited to 13 or 12.

During a usage session, a user may wish to have an indication of progress through the usage session. For example, the user may wish to know approximately how many puffs he has remaining, or approximately how much time there remains in the usage session.

The controller comprises a puff counter to monitor number of puffs taken during a usage session. Number of puffs taken by the user is determined by monitoring power supplied to the heater during the usage session. When a user takes a puff, the flow of air cools the heater and, therefore, a greater amount of energy is supplied by the battery to maintain the temperature of the heater at its operational temperature. Thus, by monitoring power supplied by the heater, the controller is able to determine the number of puffs taken during a usage session.

In order to monitor progress, a usage session is split into a number of sequential phases starting with a first phase starting when the usage session starts and ending with a final phase when the usage session ends, passage from one phase to a next phase being determined by time and puff number in the same way as the usage session. Each phase is deemed to have ended when criteria for that phase meet a predetermined threshold. As the usage session progresses through its sequential phases, the controller instructs the light emitting indicator to emit signals indicative of each successive phase. Thus, a user knows approximately the progress of the usage session.

In a specific example, a usage session may be broken into thirteen sequential phases for indication purposes. Figures 7, 8, and 9 show a flow diagram illustrating the method steps involved in indicating progress of a usage session to a user.

Step 600: The user inserts an aerosol-generating article 30 into the cavity 25 of the device 10 and initiates a usage session by pressing the user button 50.

Step 605: The timer is initiated to record time elapsed during the usage session and the puff counter is initiated to record number of puffs taken during the usage session.

Step 607: A first phase of the usage session is deemed to have started when the usage session started. The controller instructs the light emitting indicator 60 to output indications of a first, or initial, state of progress of the usage session.

Step 610: The first phase ends and the second phase begins after 30 seconds have elapsed from the start of the usage session, or after a user has taken 1 puff since the start of the usage session, if that puff is taken before 30 seconds has elapsed from the start of the usage session.

Step 615: The controller instructs the light emitting indicator 60 to output indications of a second state of progress of the usage session.

Step 620: The second phase ends and the third phase begins after 60 seconds have elapsed from the start of the usage session, or after a user has taken 2 puffs since the start of the usage session, if those puffs are taken before 60 seconds has elapsed from the start of the usage session.

Step 625: The controller instructs the light emitting indicator 60 to output indications of a third state of progress of the usage session.

Step 630: The third phase ends and the fourth phase begins after 90 seconds have elapsed from the start of the usage session, or after a user has taken 3 puffs since the start of the usage session, if those puffs are taken before 90 seconds has elapsed from the start of the usage session.

Step 635: The controller instructs the light emitting indicator 60 to output indications of a fourth state of progress of the usage session.

Step 640: The fourth phase ends and the fifth phase begins after 120 seconds have elapsed from the start of the usage session, or after a user has taken 4 puffs since the start of the usage session, if those puffs are taken before 120 seconds has elapsed from the start of the usage session.

Step 645: The controller instructs the light emitting indicator 60 to output indications of a fifth state of progress of the usage session.

Step 650: The fifth phase ends and the sixth phase begins after 150 seconds have elapsed from the start of the usage session, or after a user has taken 5 puffs since the start of the usage session, if those puffs are taken before 150 seconds has elapsed from the start of the usage session.

Step 655: The controller instructs the light emitting indicator 60 to output indications of a sixth state of progress of the usage session.

Step 660: The sixth phase ends and the seventh phase begins after 180 seconds have elapsed from the start of the usage session, or after a user has taken 6 puffs since the start of the usage session, if those puffs are taken before 180 seconds has elapsed from the start of the usage session.

Step 665: The controller instructs the light emitting indicator 60 to output indications of a seventh state of progress of the usage session.

Step 670: The seventh phase ends and the eighth phase begins after 210 seconds have elapsed from the start of the usage session, or after a user has taken 7 puffs since the start of the usage session, if those puffs are taken before 210 seconds has elapsed from the start of the usage session.

Step 675: The controller instructs the light emitting indicator 60 to output indications of an eighth state of progress of the usage session.

Step 680: The eighth phase ends and the ninth phase begins after 240 seconds have elapsed from the start of the usage session, or after a user has taken 8 puffs since the start of the usage session, if those puffs are taken before 240 seconds has elapsed from the start of the usage session.

Step 685: The controller instructs the light emitting indicator 60 to output indications of an ninth state of progress of the usage session.

Step 690: The ninth phase ends and the tenth phase begins after 270 seconds have elapsed from the start of the usage session, or after a user has taken 9 puffs since the start of the usage session, if those puffs are taken before 270 seconds has elapsed from the start of the usage session.

Step 695: The controller instructs the light emitting indicator 60 to output indications of an tenth state of progress of the usage session.

Step 700: The tenth phase ends and the eleventh phase begins after 300 seconds have elapsed from the start of the usage session, or after a user has taken 10 puffs since the start of the usage session, if those puffs are taken before 300 seconds has elapsed from the start of the usage session.

Step 705: The controller instructs the light emitting indicator 60 to output indications of an eleventh state of progress of the usage session.

Step 710: The eleventh phase ends and the twelfth phase begins after 330 seconds have elapsed from the start of the usage session, or after a user has taken 11 puffs since the start of the usage session, if those puffs are taken before 330 seconds has elapsed from the start of the usage session.

Step 715: The controller instructs the light emitting indicator 60 to output indications of an twelfth state of progress of the usage session.

Step 720: The twelfth phase ends and the thirteenth, or final, phase begins after 360 seconds have elapsed from the start of the usage session, or after a user has taken 11 puffs since the start of the usage session, if those puffs are taken before 360 seconds has elapsed from the start of the usage session.

Step 725: The controller instructs the light emitting indicator 60 to output indications of an thirteen state of progress of the usage session.

Step 730: The thirteen phase is the final phase of the usage session. During the final phase the user may take two puffs, taking the total number of puffs during the usage session to 14. The indication of the thirteenth state of progress may include further indication that the thirteenth phase is the final phase. For example, the output indication may include a change of colour as well as the change in overall intensity representing progress. The thirteenth phase ends after 390 seconds have elapsed from the start of the usage session, or after a user has taken 14 puffs since the start of the usage session, if those puffs are taken before 390 seconds has elapsed from the start of the usage session.

Step 735: The usage session ends.

The same information as set out in figures 7 to 9 may be presented in table form, as for example in table 5 below.

Phase No.	Displayed Indication State	Criteria for ending phase		
		Puff No.		Time (s)
1	1	1	or	30

2	2	2	or	60
3	3	3	or	90
4	4	4	or	120
5	5	5	or	150
6	6	6	or	180
7	7	7	or	210
8	8	8	or	240
9	9	9	or	270
10	10	10	or	300
11	11	11	or	330
12	12	12	or	360
13	13	14	or	390

Table 5: Phases of a usage session including displayed indication state and criteria for ending each phase in terms of puff number or time from the start of the usage session.

The example above divides a usage session into thirteen sequential phases, each phase ending when certain criteria regarding number of puffs taken or time elapsed are fulfilled. Each of the thirteen sequential phases can be represented by one of thirteen sequential indication states. As an example, where the aerosol-generating device has an indicator in the form of an array of six LEDs, the thirteen sequential indication states may be those set out in table 1 or table 2 above.

In a further specific embodiment, control of a usage session in an aerosol-generating device as illustrated in figures 1 to 4 may be determined with respect to volume of aerosol delivered to a user during the usage session. During a usage session, a user may wish to have an indication of progress through the usage session. For example, the user may wish to know approximately how much potentially deliverable aerosol he has remaining, or approximately how much time there remains in the usage session.

Thus, in a specific embodiment the aerosol-generating device is configured such that each usage session has a duration of 6.5 minutes (390 seconds) from initiation of the usage session, or delivery of a predetermined maximum volume of aerosol, if that predetermined volume of aerosol is delivered to the user within 6.5 minutes from initiation of the usage session. The predetermined maximum volume of aerosol may be, for example, 750 ml of aerosol. The threshold values for the time or aerosol-volume may be set to be any suitable number.

The controller is configured to detect puffs taken during a usage session. A puff start point and a puff end point for each detected puff is determined by monitoring power supplied to the heater during the usage session. When a user takes a puff, the flow of air cools the heater and, therefore, a greater amount of energy is supplied by the battery to maintain the temperature of the heater at its operational temperature. Thus, by monitoring power supplied by the heater, the controller is able to determine the start point and the end point of puffs taken during a usage session. By integrating the monitored power between the detected puff start point and the detected puff end point, a calculated value for aerosol delivered may be obtained. By summing the calculated values of aerosol delivered during the usage session, a cumulative value of aerosol delivered during the usage session may be obtained.

In order to monitor progress, a usage session is split into a number of sequential phases starting with a first phase starting when the usage session starts and ending with a final phase when the usage session ends, passage from one phase to a next phase being determined by time and cumulative volume of aerosol delivered. As the usage session progresses through its sequential phases, the controller instructs the light emitting indicator to emit signals indicative of each successive phase. Thus, a user knows approximately the progress of the usage session.

In a specific example a usage session may be broken into nineteen sequential phases for indication purposes. The user inserts an aerosol-generating article 30 into the cavity 25 of the device 10 and initiates a usage session by pressing the user button 50. The timer is then initiated to record time elapsed during the usage session and the controller is initiated to identify puffs taken during the usage session and calculate volume of aerosol delivered during each of the puffs. A first phase of the usage session is deemed to have started when the usage session started.

While in the first phase the controller instructs the light emitting indicator 60 to emit a signal indicative of the usage session being in the first phase. The first phase ends and the second phase begins after 20 seconds have elapsed from the start of the usage session, or after a first predetermined volume of aerosol has been delivered since the start of the usage session, if the first predetermined volume of aerosol is delivered before 20 seconds has elapsed from the start of the usage session. The first predetermined volume of aerosol may be, for example, 40 ml.

The second phase of the usage session is deemed to have started when the first phase has ended. While in the second phase the controller instructs the light emitting indicator 60 to emit a signal indicative of the usage session being in the second phase. The second phase ends and the third phase begins after 40 seconds have elapsed from the start of the usage session, or after a second predetermined volume of aerosol has been delivered since the start of the usage session, if the second predetermined volume of aerosol is delivered before 40 seconds has elapsed from the start of the usage session. The second predetermined volume of aerosol may be, for example, 80 ml.

This process is repeated for each of the third to nineteenth phases. After the nineteenth and final phase, the usage session ends.

Information regarding the indication state associated with each phase and the criteria for ending each phase is set out in table 6 below.

Phase No.	Displayed Indication State	Criteria for ending phase		
		Aerosol Volume (ml)		Time (s)
1	1	40	or	20
2	2	80	or	40
3	3	120	or	60
4	4	160	or	80
5	5	200	or	100
6	6	240	or	120
7	7	280	or	140
8	8	320	or	160
9	9	360	or	180
10	10	380	or	200
11	11	420	or	220
12	12	460	or	240
13	13	500	or	260
14	14	540	or	280
15	15	580	or	300
16	16	620	or	320
17	17	660	or	340
18	18	700	or	360
19	19	750	or	390

Table 6: Phases of a usage session including displayed indication state and criteria for ending each phase in terms of aerosol volume or time from the start of the usage session.

The example above divides a usage session into nineteen sequential phases, each phase ending when certain criteria regarding aerosol volume delivered or time elapsed are fulfilled. Each of the nineteen sequential phases can be represented by one of nineteen sequential indication states. As an example, where the aerosol-generating device has an indicator in the form of an array of six LEDs, the nineteen sequential indication states may be those set out in table 3 above.

An aerosol-generating device may undergo a number of different operational events. It may also be desirable for a user to be able to determine the progress or status of one or more of these events. In a further example an aerosol-generating device is configured to undergo a pre-heating operation to increase the temperature of a heater from an ambient temperature to an operational temperature before the start of a usage session. Such a preheating operation or preheating mode may be part of a usage session, but may also be instigated before a usage session. As described above in relation to usage sessions, a preheating operation may be divided into a number of sequential phases and progress through each one of those sequential phases may be represented by one of a number of indication states.

Progress through a preheating operation may be controlled with respect to temperature. Time may also be a control parameter, although the device may be configured such that it does not operate a usage session if the temperature of the heater does not reach a predetermined operating temperature.

In a specific example using an aerosol-generating device as illustrated in figures 1 to 4, a preheating operation is controlled by temperature of a heater and is divided into thirteen sequential phases, each phase ending when temperature of the heater meets a predetermined threshold. The temperature of the heater may be monitored directly, for example by use of a temperature sensor such as a thermistor or thermocouple. Alternatively, the temperature of the heater may be derived by monitoring other parameters, for example by monitoring current and/or voltage supplied to the heater. When the preheating operation is initiated, power is supplied to the heater and the temperature of the heater increases. In a specific example the preheating phase may end when the temperature of the heater reaches 390 °C. The temperature at the end of the preheating phase may be varied to any suitable temperature. It is noted that the temperature at the end of a preheating phase may be higher or lower than a desired operating temperature for generating aerosol during a usage session.

Table 7 below sets out the phases and criteria for determining and displaying progress of a preheating operation.

Phase No.	Displayed Indication State	Criteria for ending phase
		Temperature (°C)
1	1	30
2	2	60
3	3	90
4	4	120
5	5	150
6	6	180
7	7	210
8	8	240
9	9	270
10	10	300
11	11	330
12	12	360
13	13	390

Table 7: Phases of a preheating operation including displayed indication state and criteria for ending each phase in terms of temperature.

The example above divides a preheating operation into thirteen sequential phases, each phase ending when certain criteria regarding temperature of a heater are fulfilled. Each of the thirteen sequential phases can be represented by one of thirteen sequential indication states. As an example, where the aerosol-generating device has an indicator in the form of an array of six LEDs, the thirteen sequential indication states may be those set out in table 1 or table 2 above.

In specific embodiments, an aerosol-generating device as illustrated in figures 1 to 4 may be configured to determine progress through and display progress relating to more than one event. As a specific example, an aerosol generating device may be configured to undergo a preheating operation, immediately followed by a usage session. The user inserts an aerosol-generating article 30 into the cavity 25 of the device 10 and initiates a preheating operation by pressing the user button 50. Power is supplied to a heater of the device, and the controller is initiated to determine temperature of the heater. A first phase of the preheating operation is deemed to have started when the preheating operation starts. As the temperature of the heater increases, the controller instructs the visual indicator to display the sequence of indication states shown in table 7 above. The indication states may conveniently display the progress of the preheating operation as an increasing overall luminance provided by the visual indicator 60, as represented in table 2 above. Thus, at the start of the preheating operation none of the six LEDs are illuminated, but at the end of the preheating operation, when the temperature of the heater has reached its predetermined level (for example 390 °C) all six of the LEDs are fully illuminated.

The usage session starts as soon as the preheating operation has ended. The usage session may progress, for example, as set out above in table 5. The indication states may conveniently display the progress of the usage session as a decreasing overall luminance provided by the visual indicator 60, as represented in table 1 above. Thus, at the start of the usage session all of the six LEDs are illuminated, but at the end of the usage session, when the criteria for ending the usage session have been met, none of the LEDs are illuminated.

Thus, the device is configured to monitor and determine progress of more than one different event, and to display progress of those different events as different sequences of indication states.

For the purpose of the present description and of the appended claims, except where otherwise indicated, all numbers expressing amounts, quantities, percentages, and so forth, are to be understood as being modified in all instances by the term "about". Also, all ranges include the maximum and minimum points disclosed and include any intermediate ranges therein, which may or may not be specifically enumerated herein. In this context, therefore, a number “A” is understood as “A” ± 10% of “A”. Within this context, a number “A” may be considered to include numerical values that are within general standard error for the measurement of the property that the number “A” modifies. The number “A”, in some instances as used in the appended claims, may deviate by the percentages enumerated above provided that the amount by which “A” deviates does not materially affect the basic and novel characteristic(s) of the claimed invention. Also, all ranges include the maximum and minimum points disclosed and include any intermediate ranges therein, which may or may not be specifically enumerated herein.

CLAIMS

1. An aerosol-generating device for generating an aerosol from an aerosol-forming substrate, the aerosol-generating device being configured to indicate progress of an event during use of the aerosol-generating device, the aerosol-generating device comprising:

an indicator configured to indicate progress of the event as a sequence of 1st to nth different indication states, n being a number equal to or greater than 7,

and a controller configured to monitor progress of the event and to control the indicator to indicate in an indication state representative of the progress of the event.

2. An aerosol-generating device according to claim 1 in which, the aerosol-generating device is configured to monitor a parameter relating to progress of the event.

3. An aerosol-generating device according to any claim 2 in which the parameter is selected from the list consisting of time, number of user puffs, cumulative number of user puffs taken during the event, volume of aerosol delivered, cumulative volume of aerosol delivered during the event, energy consumed, cumulative volume of energy consumed during the event, and current consumed, cumulative amount of current consumed during the event, temperature, temperature of heating element, temperature of susceptor, resistance of heating element, and user interaction.

4. An aerosol-generating device according to any preceding claim in which the event is an operational phase of the aerosol-generating device, for example in which the event is an event selected from the list consisting of a usage session, a heating period (for example, a pre-heating period), a calibration period, a charging period, and a pause period

5. An aerosol-generating device according to any preceding claim, in which the event, for example the usage session, comprises at least 7 sequential phases and in which the controller is configured to control the indicator to indicate a different one of the sequence of 1st to nth different indication states during each of the at least 7 sequential phases.

6. An aerosol-generating device according to any preceding claim in which the indicator is a visual indicator comprising a predetermined number (i) of discrete light emitting units, each light emitting unit being controllable to emit light in a predetermined number (j) of different intensities, i being a number between 4 and 24, and j being a number between 2 and 5.

7. An aerosol-generating device according to claim 6 in which each of the predetermined number j of indication states represents a light intensity levels of between 0% and 100% of possible emission intensity.

8. An aerosol-generating device according to claim 7 in which each of the discrete light emitting units is controlled to emit light in 2 different intensities, for example intensities of about 50% of possible emission intensity and about 100% of possible emission intensity.

9. An aerosol-generating device according to claim 7 or 8 in which each of the discrete light emitting units is controlled to emit light in 3 different intensities, for example intensities of about 33% of possible emission intensity, about 66% of possible emission intensity, and about 100% of possible emission intensity.

10. An aerosol-generating device according to claim 7, 8, or 9 in which each of the discrete light emitting units is controlled to emit light in 4 different intensities, for example intensities of about 25% of possible emission intensity, about 50% of possible emission intensity, about 75% of possible emission intensity, and about 100% of possible emission intensity.

11. An aerosol-generating device according to any of claims 6 to 10 in which the discrete light emitting units are configured as a linear matrix on or extending through a housing of the device, or in which the discrete light emitting units are configured as an annular matrix on or extending through a housing of the device.

12. An aerosol-generating device according to any preceding claim in which the indicator is a visual indicator comprising a LCD display screen or an OLED display screen.

13. An aerosol-generating device according to any preceding claim in which progress of the event is determined and displayed by a visual indicator, in which progression through the first to nth indication states involves a corresponding increase in intensity or luminance of light displayed by the visual indicator, or in which progression through the first to nth indication states involves a corresponding decrease in intensity or luminance of light displayed by the visual indicator.

14. An aerosol-generating device according to any preceding claim in which the event is a first event, the device further being configured to monitor progress of and display progress in relation to a second event, the second event being different to the first event.

15. An aerosol-generating device according to any preceding claim in which the device comprises control electronics; and

at least one visual indicator, for example a lighting array, comprising a plurality of light emitting units;

wherein the control electronics is configured to independently control each one of the plurality of light emitting units in at least:

i) an off state in which the light emitting unit does not emit light;

ii) a first lighting state in which the light emitting unit emits light at a first static luminance level; and

iii) a second lighting state in which the light emitting unit emits light at a second static luminance level that is different to the first static luminance level; and

wherein the control electronics is configured to control each one of the light emitting units to be in one of the off state, first lighting state and the second lighting state so as to indicate the progression of the event to a user as the sequence of 1st to nth different visual indication states.

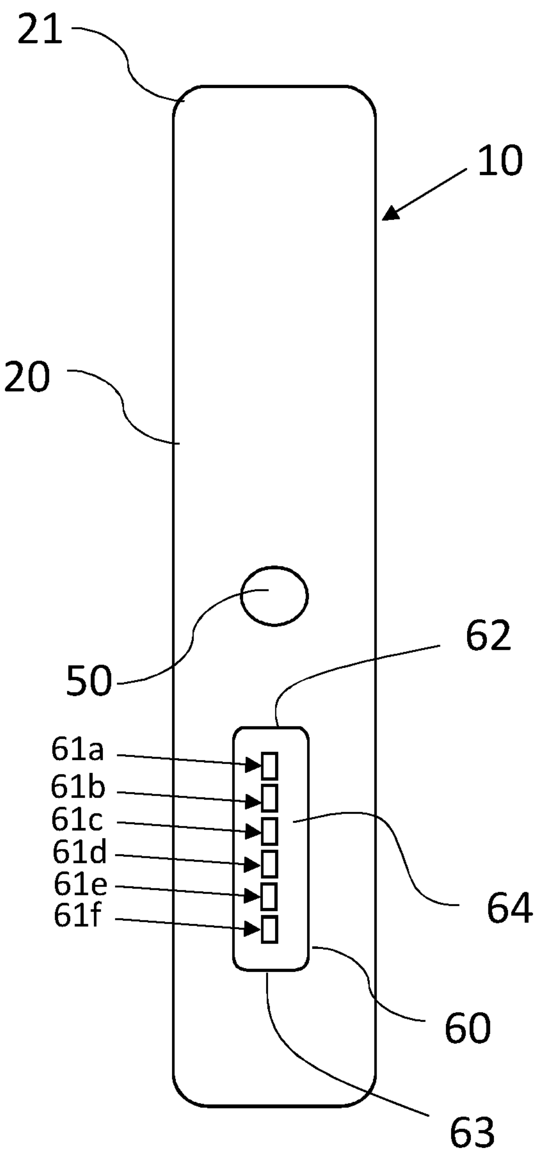


Figure 1

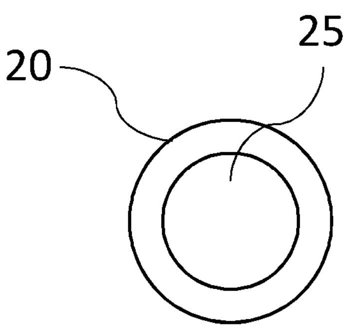


Figure 2

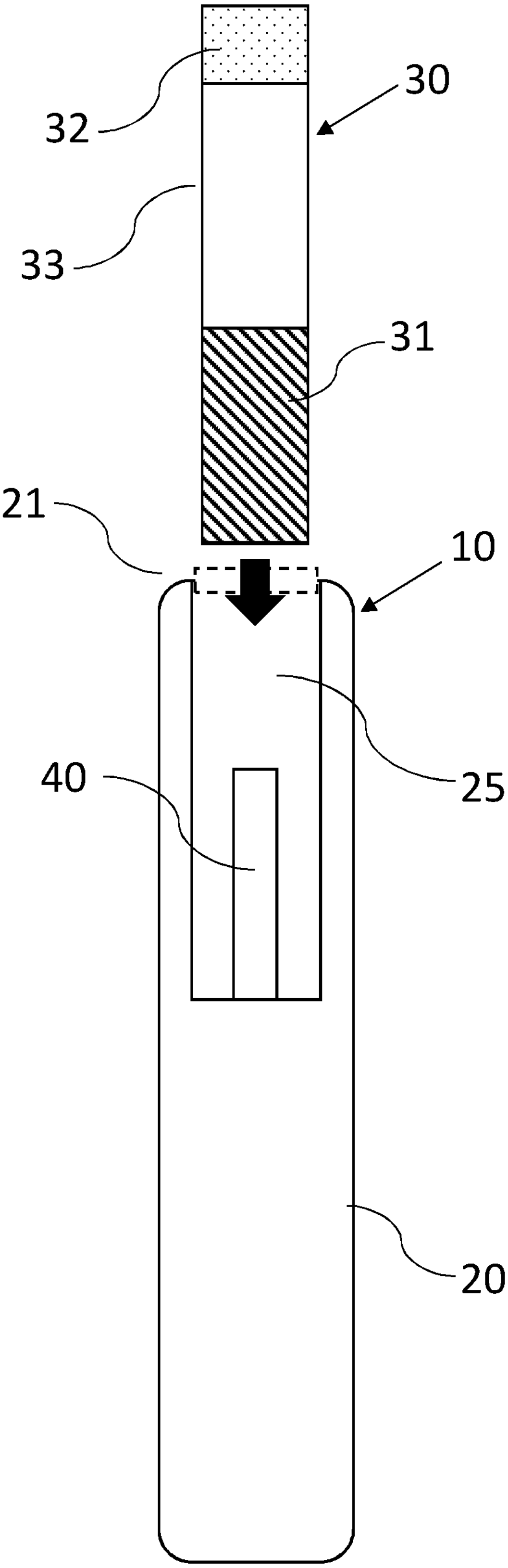
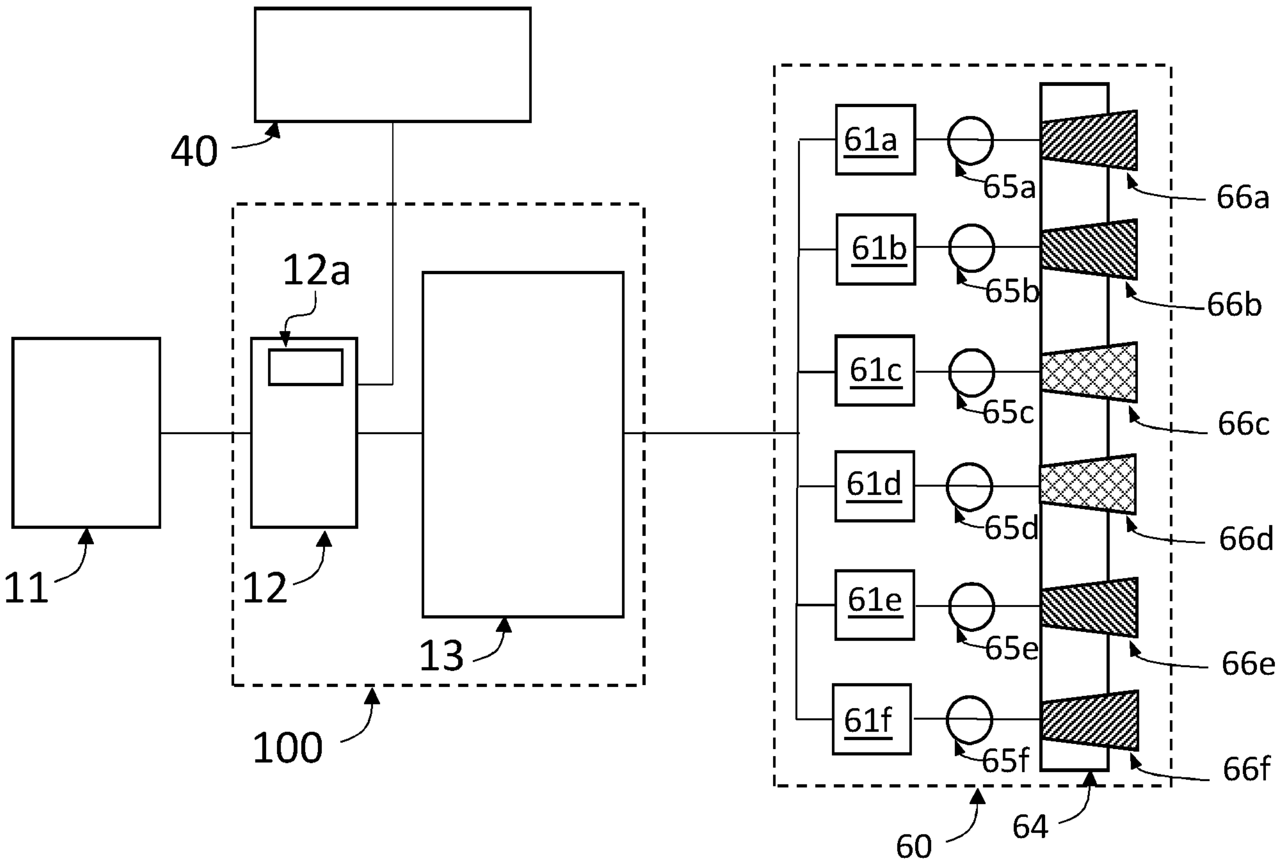


Figure 3


40
12a
11
12
13
100
61a
61b
61c
61d
61e
61f
65a
65b
65c
65d
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66d
66e
66f
60
64

Figure 4

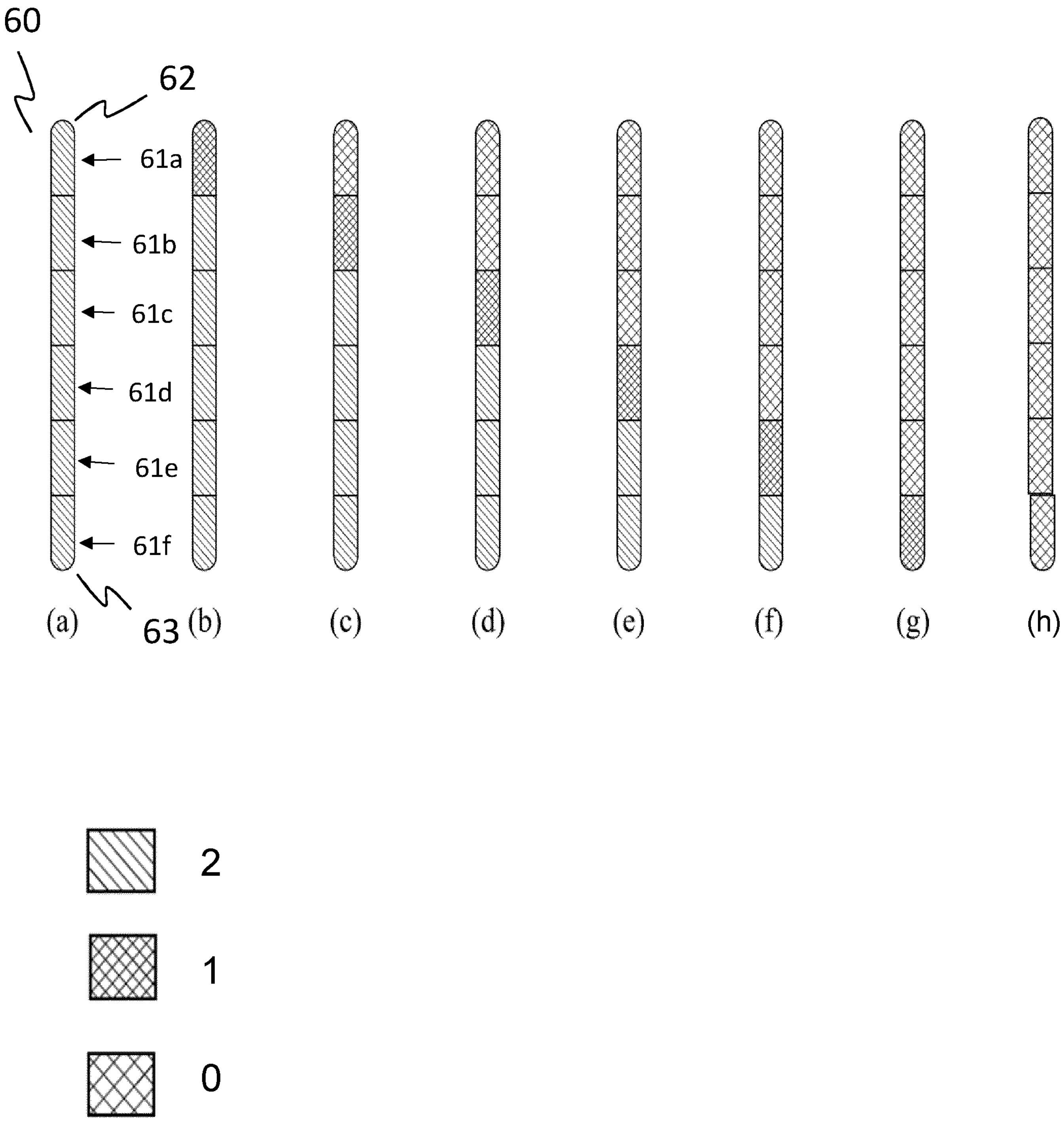

Figure 5

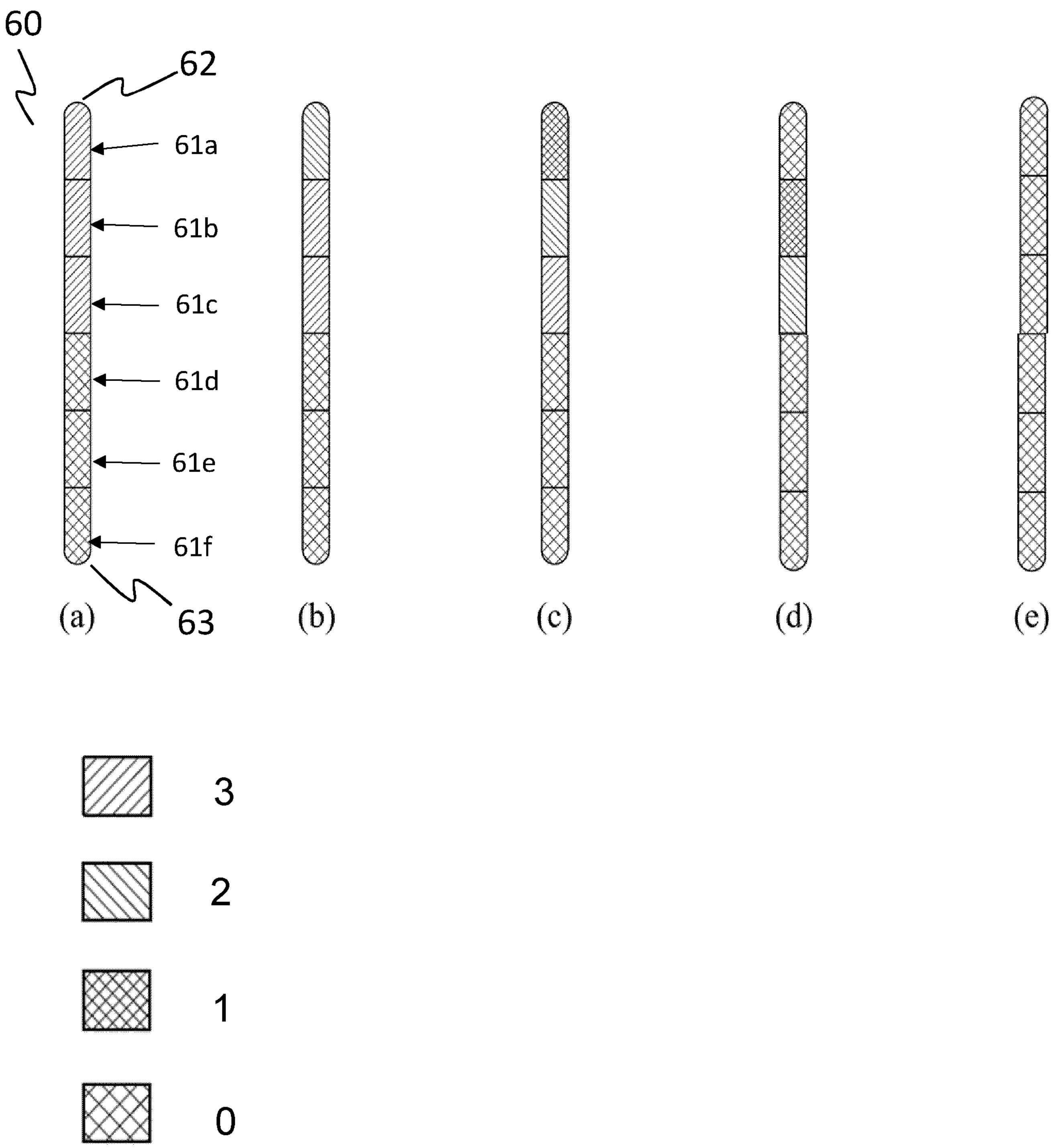

Figure 6

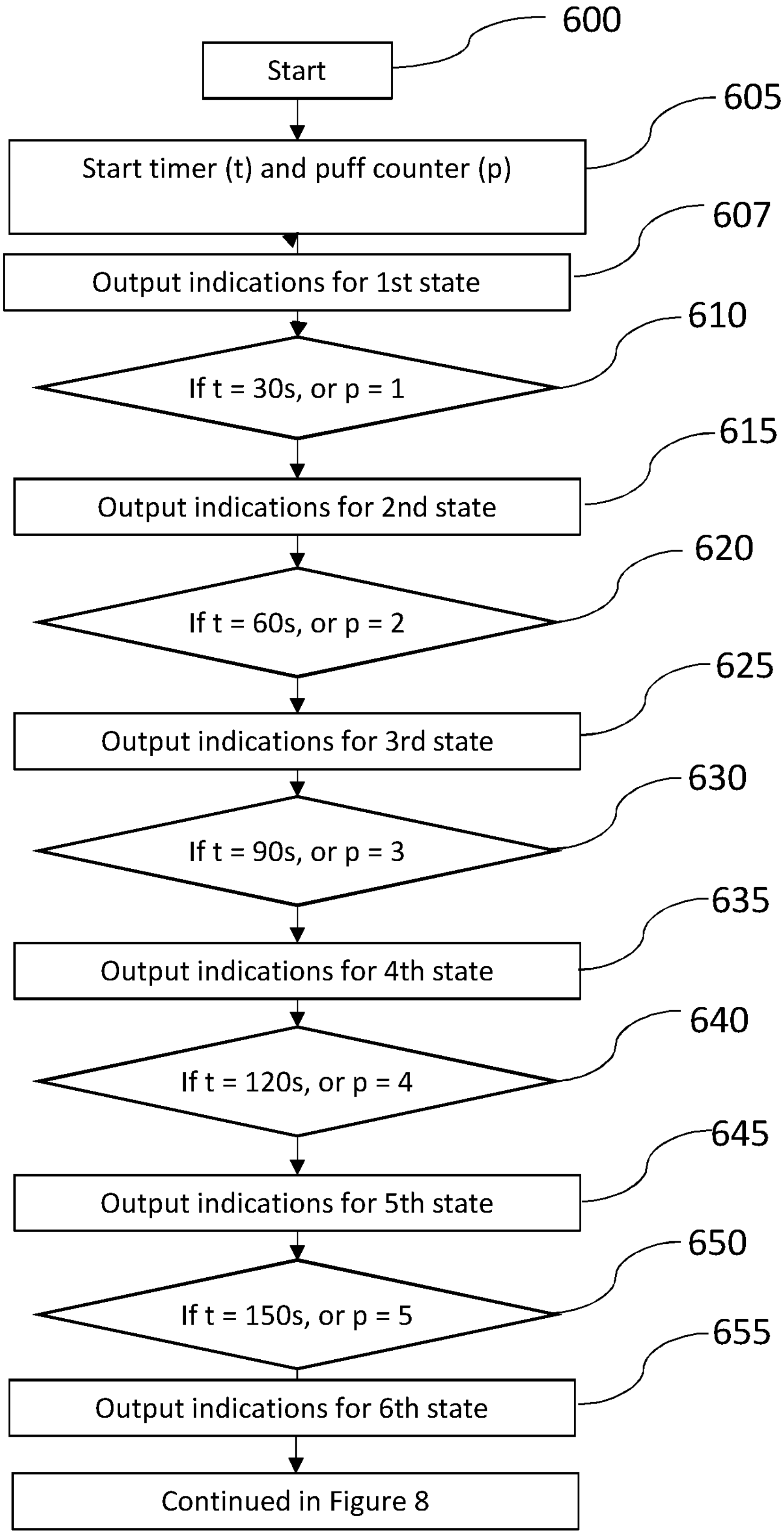
600
Start
605
Start timer (t) and puff counter (p)
607
Output indications for 1st state
610
If t = 30s, or p = 1
615
Output indications for 2nd state
620
If t = 60s, or p = 2
625
Output indications for 3rd state
630
If t = 90s, or p = 3
635
Output indications for 4th state
640
If t = 120s, or p = 4
645
Output indications for 5th state
650
If t = 150s, or p = 5
655
Output indications for 6th state
Continued in Figure 8

Figure 7

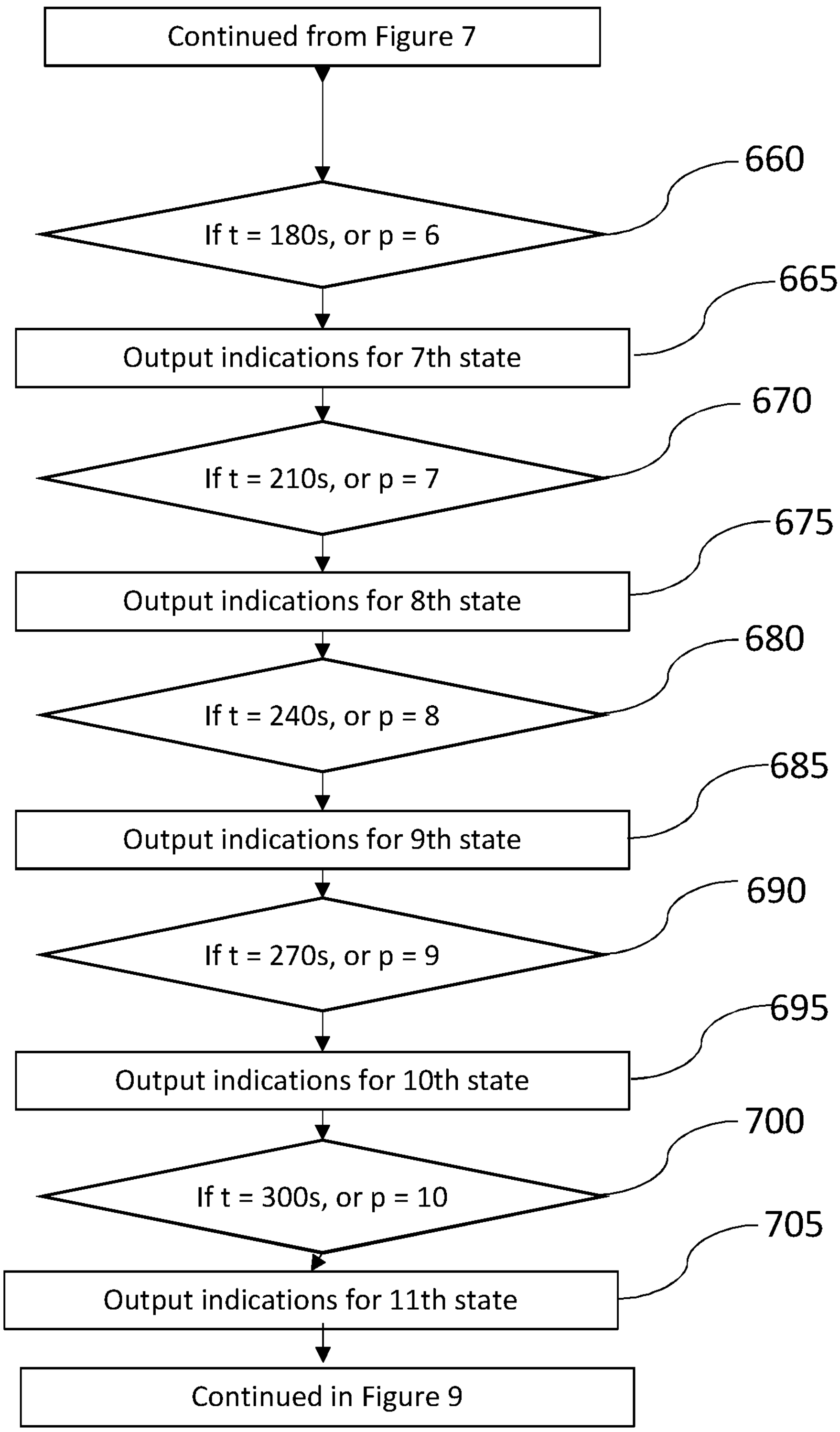
Continued from Figure 7
660
If t = 180s, or p = 6
665
Output indications for 7th state
670
If t = 210s, or p = 7
675
Output indications for 8th state
680
If t = 240s, or p = 8
685
Output indications for 9th state
690
If t = 270s, or p = 9
695
Output indications for 10th state
700
If t = 300s, or p = 10
705
Output indications for 11th state
Continued in Figure 9

Figure 8

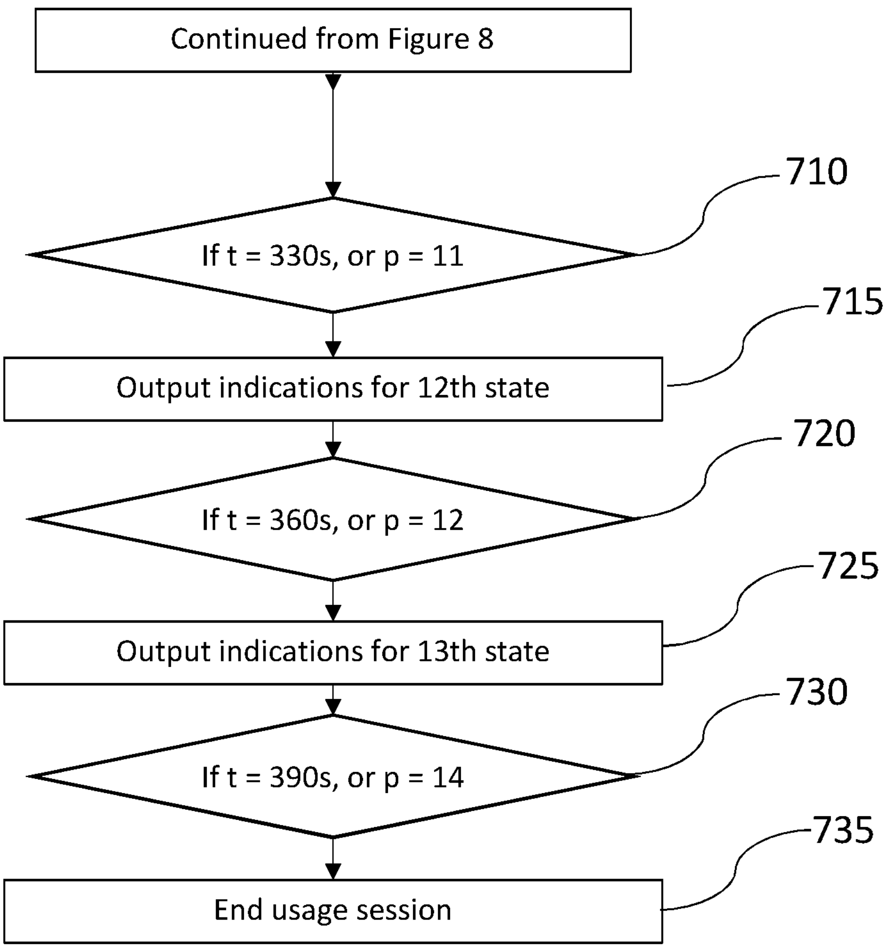
Continued from Figure 8
710
If t = 330s, or p = 11
715
Output indications for 12th state
720
If t = 360s, or p = 12
725
Output indications for 13th state
730
If t = 390s, or p = 14
735
End usage session

Figure 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2022/067602

A. CLASSIFICATION OF SUBJECT MATTER
INV. A24F40/60
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A24F A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2021/053165 A1 (JT INT SA [CH]) 25 March 2021 (2021-03-25) page 13, line 24 - line 30; figures 4a-c -----	1-15
X	US 2015/245654 A1 (MEMARI KAVEH [GB] ET AL) 3 September 2015 (2015-09-03) paragraph [0594]; figure 2 -----	1-15
X	US 2019/343184 A1 (FREEMAN DANIEL [US] ET AL) 14 November 2019 (2019-11-14) paragraph [0030] - paragraph [0031]; figure 5 -----	1-15
X	WO 2021/089465 A1 (JT INT SA [CH]) 14 May 2021 (2021-05-14) page 12, line 27 - page 13, line 7; figure 4A -----	1-15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 August 2022	09/09/2022

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Dartis, Daniel

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