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(54) SMOKING SUBSTITUTE SYSTEM

(57) A smoking substitute system comprising a device to switch between child safety mode (CSM) and non-child safety mode (N-CSM) is described, along with method of switching such a device between such modes. The device comprises a controller that is configured to detect the mode of operation selected by a user and switch from the current mode to the selected mode based on user selection. The device may be switched from non-child safety mode (N-CSM) to child safety mode (CSM). The controller may be configured to modify at least one control action of the device.

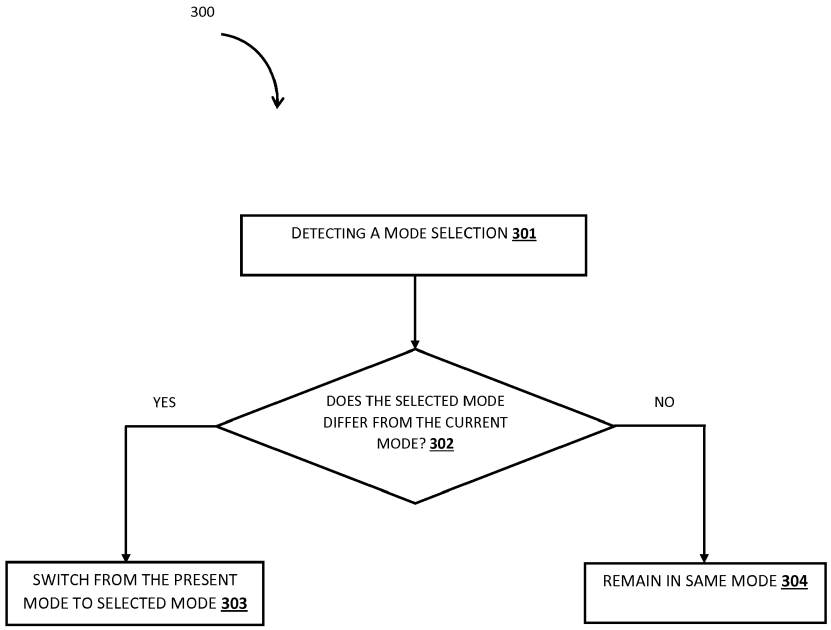

FIGURE 3

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Description

TECHNICAL FIELD

[0001] The present invention relates to a smoking substitute system and particularly, although not exclusively, to a smoking substitute system comprising a device which can be operated based on a selected mode, and methods of using such devices.

BACKGROUND

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

[0003] Conventional combustible smoking articles, such as cigarettes, typically comprise a cylindrical rod of tobacco comprising shreds of tobacco which is surrounded by a wrapper, and usually also a cylindrical filter axially aligned in an abutting relationship with the wrapped tobacco rod. The filter typically comprises a filtration material which is circumscribed by a plug wrap. The wrapped tobacco rod and the filter are joined together by a wrapped band of tipping paper that circumscribes the entire length of the filter and an adjacent portion of the wrapped tobacco rod. A conventional cigarette of this type is used by lighting the end opposite to the filter, and burning the tobacco rod. The smoker receives mainstream smoke into their mouth by drawing on the mouth end or filter end of the cigarette.

[0004] Combustion of organic material such as tobacco is known to produce tar and other potentially harmful by-products. There have been proposed various smoking substitute systems (or "substitute smoking systems") in order to avoid the smoking of tobacco.

[0005] Such smoking substitute systems can form part of nicotine replacement therapies aimed at people who wish to stop smoking and overcome a dependence on nicotine.

[0006] Smoking substitute systems include electronic systems that permit a user to simulate the act of smoking by producing an aerosol (also referred to as a "vapour") that is drawn into the lungs through the mouth (inhaled) and then exhaled. The inhaled aerosol typically bears nicotine and/or flavourings without, or with fewer of, the odour and health risks associated with traditional smoking.

[0007] In general, smoking substitute systems are intended to provide a substitute for the rituals of smoking, whilst providing the user with a similar experience and satisfaction to those experienced with traditional smoking and with combustible tobacco products. Some smoking substitute systems use smoking substitute articles (also referred to as a "consumables") that are designed to resemble a traditional cigarette and are cylindrical in form with a mouthpiece at one end.

[0008] The popularity and use of smoking substitute systems has grown rapidly in the past few years. Although originally marketed as an aid to assist habitual smokers wishing to quit tobacco smoking, consumers are increasingly viewing smoking substitute systems as desirable lifestyle accessories.

[0009] There are a number of different categories of smoking substitute systems, each utilising a different smoking substitute approach.

[0010] One approach for a smoking substitute system is the so-called Heated Tobacco ("HT") approach in which tobacco (rather than an "e-liquid") is heated or warmed to release vapour. HT is also known as "heat not burn" ("HNB"). The tobacco may be leaf tobacco or reconstituted tobacco. The vapour may contain nicotine and/or flavourings. In the HT approach the intention is that the tobacco is heated but not burned, i.e. the tobacco does not undergo combustion.

[0011] A typical HT smoking substitute system may include a device and a consumable. The consumable may include the tobacco material. The device and consumable may be configured to be physically coupled together. In use, heat may be imparted to the tobacco material by a heating element of the device, wherein airflow through the tobacco material causes components in the tobacco material to be released as vapour. A vapour may also be formed from a carrier in the tobacco material (this carrier may for example include propylene glycol and/or vegetable glycerine) and additionally volatile compounds released from the tobacco. The released vapour may be entrained in the airflow drawn through the tobacco.

[0012] As the vapour passes through the consumable (entrained in the airflow) from the location of vaporisation to an outlet of the consumable (e.g. a mouthpiece), the vapour cools and condenses to form an aerosol for inhalation by the user. The aerosol will normally contain the volatile compounds.

[0013] In HT smoking substitute systems, heating as opposed to burning the tobacco material is believed to cause fewer, or smaller quantities, of the more harmful compounds ordinarily produced during smoking. Consequently, the HT approach may reduce the odour and/or health risks that can arise through the burning, combustion and pyrolytic degradation of tobacco.

[0014] However, current heated tobacco devices usually return to standby mode once the consumable has been used within the heating cycle. If a child picks up the device and presses the power button for the required time, during this standby mode, the heating element would start to ramp up (like if a cycle was started) which makes the device potentially unsafe for a child.

[0015] There may be a need for improved design of smoking substitute systems, in particular HT smoking substitute systems, to enhance the user experience, improve the function of the HT smoking substitute system and provide the HT smoking substitute system with an

enhanced child safe mode.

[0016] The present disclosure has been devised in the light of the above considerations.

SUMMARY OF THE INVENTION

[0017] At its most general, the present invention relates to a smoking substitute device that switches between a current mode and a mode selected by a user.

[0018] According to a first aspect of the present invention, there is provided a smoking substitute device comprising a controller configured to detect a mode selected by the user and switch between a child safety mode (CSM) and non-child safety mode (N-CSM) in response to the mode selection.

[0019] By providing a device comprising a child safety mode (CSM), the device may provide enhanced safety to prevent a child from using the device.

[0020] Optional features will now be set out. These are applicable singly or in any combination with any aspect.

[0021] Optionally, the controller of the device may be configured to modify at least one control action of the device in response to the mode selection. In this way, one or more control actions which are necessary to activate one or more functions of the device (such as heater operation) differ when in the CSM as compared with the N-CSM. In some embodiments, the control action comprises a user input. Any suitable user input may be used, and illustrative examples include depressing a button on a user interface, voice command, touch-screen input, rotation of a dial or knob and the like. Providing a controller which modifies at least one control action of the device in response to the mode selection provides a child-safe function, since the necessary control action when in CSM can be designed to be more difficult for a child to perform (for example, more complex or convoluted or of longer duration).

[0022] In some embodiments, the at least one control action of the device may be a tactile input on a user interface of the device. In some embodiments, the at least one control action of the device may be depressing of a power button on a user interface of the device. The control action may be an action which controls one or more device functions, and these may be any device function. In some embodiments, the control action is an action which activates the heater of the device. For example, the control action may be a tactile input (e.g. depressing of a power button) on a user interface of the device which activates the heater of the device, e.g. to begin a heating cycle for the smoking of a consumable. In some embodiments, the control action is an action which controls or adjusts another function of the device.

[0023] In some embodiments, the controller of the device may be configured to modify the duration of time for which the control action must be performed in order to activate the heater, in response to the mode selection, i.e. when moving between CSM and N-CSM. For example, the controller of the device may be configured to modify the duration of time for which a button on the user interface must be depressed in order to activate the heater, in response to the mode selection.

[0024] Optionally, the controller of the device may be configured to modify the duration of time for which the control action must be performed in order to activate the heater, between a first duration when in the child safety mode (CSM) and a second duration when in the non-child safety mode (N-CSM). For example, the controller of the device may be configured to modify the duration of time for which the power button must be depressed in order to activate the heater, between a first duration when in the child safety mode (CSM) and a second duration when in the non-child safety mode (N-CSM).

[0025] In some embodiments, the first duration is longer than the second duration. In this way, the control action must be performed for a longer duration when in the CSM than required in the N-CSM, making it less likely that a child will be able to activate the heater. In some embodiments, the first duration is at least 1.5 times the length of the second duration, for example at least 1.6 times, at least 1.7 times, at least 1.8 times or at least 1.9 times. In some embodiments, the first duration is about twice the length of the second duration. In some embodiments, the first duration is about 6 seconds. In some embodiments, the second duration is about 3 seconds.

[0026] In some embodiments the controller of the device is configured to remain in the selected mode at all times until a user selects a different mode. In other words, when the device is in a specific mode, such as CSM, the device will not return to another mode, such as N-CSM, until the user selects the alternative mode, regardless of the status of the device. So, in such embodiments, even powering down or battery depletion of the device will not change the mode of the device from the most recently selected mode. In this way, the device is safer because once CSM is selected it is impossible for the device to return to N-CSM unless N-CSM is selected by the user.

[0027] In some embodiments, the controller of the device may be configured to modify the at least one control action such that two or more distinct control actions must be performed when in CSM in a pre-defined pattern in order to activate a function of the device (such as the heater). In some embodiments, the same control action must be performed two or more separate times, one after the other. In some embodiments, the duration of one of the control actions in the sequence is different from the duration of another of the control actions in the sequence. For example, the controller may require a first long control action to be performed (e.g. the depression of a button), followed by a subsequent second shorter control action (e.g. the depression of a button) to activate the heater. In some embodiments, the control action is depressing a power button on a user interface, and the button must be pressed two or more times in a pre-defined pattern when in CSM in order to activate the function (e.g. heater). In this way, a more complex control action is necessary when in CSM to activate the function, thereby mak-

ing activation by a child more difficult.

[0028] In some embodiments, the controller is configured to modify an output function of the device in response to the mode selection. In some embodiments, the controller is configured to modify the heater operation in response to the mode selection. For example, the controller may be configured to introduce a time delay in supplying power to the heater when in CSM, wherein such a delay is absent when in N-CSM. In some embodiments, the controller may be configured to reduce the power supplied to the heater when in CSM relative to when in N-CSM. In some embodiments, the controller may be configured to prevent any power supply to the heater when in CSM, but re-enable power supply to the heater when in N-CSM.

[0029] The device may comprise an elongate body. An end of the elongate body may be configured for engagement with an aerosol-forming article. For example, the body may be configured for engagement with a heated tobacco (HT) consumable (or heat-not-burn (HNB) consumable). The terms "heated tobacco" and "heat-not-burn" are used interchangeably herein to describe a consumable that is of the type that is heated rather than combusted (or are used interchangeably to describe a device for use with such a consumable). The device may comprise a cavity that is configured for receipt of at least a portion of the consumable (i.e. for engagement with the consumable). The aerosol-forming article may be of the type that comprises an aerosol former (e.g. carried by an aerosol-forming substrate).

[0030] The device may comprise a heater for heating the aerosol-forming article. The heater may comprise a heating element, which may be in the form of a rod that extends from the body of the device. The heating element may extend from the end of the body that is configured for engagement with the aerosol-forming article.

[0031] The heater (and thus the heating element) may be rigidly mounted to the body. The heating element may be elongate so as to define a longitudinal axis and may, for example, have a transverse profile (i.e. transverse to a longitudinal axis of the heating element) that is substantially circular (i.e. the heating element may be generally cylindrical). Alternatively, the heating element may have a transverse profile that is rectangular (i.e. the heater may be a "blade heater"). The heating element may alternatively be in the shape of a tube (i.e. the heater may be a "tube heater"). The heating element may take other forms (e.g. the heating element may have an elliptical transverse profile). The shape and/or size (e.g. diameter) of the transverse profile of the heating element may be generally consistent for the entire length (or substantially the entire length) of the heating element.

[0032] The heating element may be between 15 mm and 25 mm long, e.g. between 18 mm and 20 mm long, e.g. around 19 mm long. The heating element may have a diameter of between 1.5 mm and 2.5 mm, e.g. a diameter between 2 mm and 2.3 mm, e.g. a diameter of around 2.15 mm.

[0033] The heating element may be formed of ceramic. The heating element may comprise a core (e.g. a ceramic core) comprising Al_2O_3. The core of the heating element may have a diameter of 1.8 mm to 2.1 mm, e.g. between 1.9 mm and 2 mm. The heating element may comprise an outer layer (e.g. an outer ceramic layer) comprising Al_2O_3. The thickness of the outer layer may be between 160 μm and 220 μm, e.g. between 170 μm and 190 μm, e.g. around 180 μm. The heating element may comprise a heating track, which may extend longitudinally along the heating element. The heating track may be sandwiched between the outer layer and the core of the heating element. The heating track may comprise tungsten and/or rhenium. The heating track may have a thickness of around 20 μm.

[0034] The heating element may be located in the cavity (of the device), and may extend (e.g. along a longitudinal axis) from an internal base of the cavity towards an opening of the cavity. The length of the heating element (i.e. along the longitudinal axis of the heater) may be less than the depth of the cavity. Hence, the heating element may extend for only a portion of the length of the cavity. That is, the heating element may not extend through (or beyond) the opening of the cavity.

[0035] The heating element may be configured for insertion into an aerosol-forming article (e.g. a HT consumable) when an aerosol-forming article is received in the cavity. In that respect, a distal end (i.e. distal from a base of the heating element where it is mounted to the device) of the heating element may comprise a tapered portion, which may facilitate insertion of the heating element into the aerosol-forming article. The heating element may fully penetrate an aerosol-forming article when the aerosol-forming article is received in the cavity. That is, the entire length, or substantially the entire length, of the heating element may be received in the aerosol-forming article.

[0036] The heating element may have a length that is less than, or substantially the same as, an axial length of an aerosol-forming substrate forming part of an aerosol-forming article (e.g. a HT consumable). Thus, when such an aerosol-forming article is engaged with the device, the heating element may only penetrate the aerosol-forming substrate, rather than other components of the aerosol-forming article. The heating element may penetrate the aerosol-forming substrate for substantially the entire axial length of the aerosol forming-substrate of the aerosol-forming article. Thus, heat may be transferred from (e.g. an outer circumferential surface of) the heating element to the surrounding aerosol-forming substrate, when penetrated by the heating element. That is, heat may be transferred radially outwardly (in the case of a cylindrical heating element) or e.g. radially inwardly (in the case of a tube heater).

[0037] Where the heater is a tube heater, the heating element of the tube heater may surround at least a portion of the cavity. When the portion of the aerosol-forming article is received in the cavity, the heating element may surround a portion of the aerosol-forming article (i.e. so

as to heat that portion of the aerosol-forming article). In particular, the heating element may surround an aerosol forming substrate of the aerosol-forming article. That is, when an aerosol-forming article is engaged with the device, the aerosol forming substrate of the aerosol-forming article may be located adjacent an inner surface of the (tubular) heating element. When the heating element is activated, heat may be transferred radially inwardly from the inner surface of the heating element to heat the aerosol forming substrate.

[0038] The cavity may comprise a (e.g. circumferential) wall (or walls) and the (tubular) heating element may extend around at least a portion of the wall(s). In this way, the wall may be located between the inner surface of the heating element and an outer surface of the aerosol-forming article. The wall (or walls) of the cavity may be formed from a thermally conductive material (e.g. a metal) to allow heat conduction from the heating element to the aerosol-forming article. Thus, heat may be conducted from the heating element, through the cavity wall (or walls), to the aerosol-forming substrate of an aerosol-forming article received in the cavity.

[0039] In some embodiments the device may comprise a cap disposed at the end of the body that is configured for engagement with an aerosol-forming article. Where the device comprises a heater having a heating element, the cap may at least partially enclose the heating element. The cap may be moveable between an open position in which access is provided to the heating element, and a closed position in which the cap at least partially encloses the heating element. The cap may be slideably engaged with the body of the device, and may be slideable between the open and closed positions.

[0040] The cap may define at least a portion of the cavity of the device. That is, the cavity may be fully defined by the cap, or each of the cap and body may define a portion of the cavity. Where the cap fully defines the cavity, the cap may comprise an aperture for receipt of the heating element into the cavity (when the cap is in the closed position). The cap may comprise an opening to the cavity. The opening may be configured for receipt of at least a portion of an aerosol-forming article. That is, an aerosol-forming article may be inserted through the opening and into the cavity (so as to be engaged with the device).

[0041] The cap may be configured such that when an aerosol-forming article is engaged with the device (e.g. received in the cavity), only a portion of the aerosol-forming article is received in the cavity. That is, a portion of the aerosol-forming article (not received in the cavity) may protrude from (i.e. extend beyond) the opening. This (protruding) portion of the aerosol-forming article may be a terminal (e.g. mouth) end of the aerosol-forming article, which may be received in a user's mouth for the purpose of inhaling aerosol formed by the device.

[0042] The device may comprise a power source or may be connectable to a power source (e.g. a power source separate to the device). The power source may be electrically connectable to the heater. In that respect, altering (e.g. toggling) the electrical connection of the power source to the heater may affect a state of the heater. For example, toggling the electrical connection of the power source to the heater may toggle the heater between an on state and an off state. The power source may be a power store. For example, the power source may be a battery or rechargeable battery (e.g. a lithium ion battery).

[0043] The device may comprise an input connection (e.g. a USB port, Micro USB port, USB-C port, etc.). The input connection may be configured for connection to an external source of electrical power, such as a mains electrical supply outlet. The input connection may, in some cases, be used as a substitute for an internal power source (e.g. battery or rechargeable battery). That is, the input connection may be electrically connectable to the heater (for providing power to the heater). Hence, in some forms, the input connection may form at least part of the power source of the device.

[0044] Where the power source comprises a rechargeable power source (such as a rechargeable battery), the input connection may be used to charge and recharge the power source.

[0045] The device may comprise a user interface (UI). In some embodiments the UI may include input means to receive operative commands from the user. The input means of the UI may allow the user to control at least one aspect of the operation of the device. In some embodiments the input means may comprise a power button to switch the device between an on state and an off state.

[0046] In some embodiments the UI may additionally or alternatively comprise output means to convey information to the user. In some embodiments the output means may comprise a light to indicate a condition of the device (and/or the aerosol-forming article) to the user. The condition of the device (and/or aerosol-forming article) indicated to the user may comprise a condition indicative of the operation of the heater. For example, the condition may comprise whether the heater is in an off state or an on state. In some embodiments, the UI unit may comprise at least one of a button, a display, a touchscreen, a switch, a light, and the like. For example, the output means may comprise one or more (e.g. two, three, four, etc.) light-emitting diodes ("LEDs") that may be located on the body of the device.

[0047] The device may further comprise a puff sensor (e.g. airflow sensor), which form part of the input means of the UI. The puff sensor may be configured to detect a user drawing on an end (i.e. a terminal (mouth) end) of the aerosol-forming article. The puff sensor may, for example, be a pressure sensor or a microphone. The puff sensor may be configured to produce a signal indicative of a puff state. The signal may be indicative of the user drawing (an aerosol from the aerosol-forming article) such that it is e.g. in the form of a binary signal. Alternatively or additionally, the signal may be indicative of a characteristic of the draw (e.g. a flow rate of the draw,

length of time of the draw, etc).

[0048] The device may comprise a controller, or may be connectable to a controller that may be configured to control at least one function of the device. The controller may comprise a microcontroller that may e.g. be mounted on a printed circuit board (PCB). The controller may also comprise a memory, e.g. non-volatile memory. The memory may include instructions, which, when implemented, may cause the controller to perform certain tasks or steps of a method. Where the device comprises an input connection, the controller may be connected to the input connection.

[0049] The controller may be configured to control the operation of the heater (and e.g. the heating element). Thus, the controller may be configured to control vaporisation of an aerosol forming part of an aerosol-forming article engaged with the device. The controller may be configured to control the voltage applied by power source to the heater. For example, the controller may be configured to toggle between applying a full output voltage (of the power source) to the heater and applying no voltage to the heater. Alternatively or additionally, the control unit may implement a more complex heater control protocol.

[0050] The device may further comprise a voltage regulator to regulate the output voltage supplied by the power source to form a regulated voltage. The regulated voltage may subsequently be applied to the heater.

[0051] In some embodiments, where the device comprises a UI, the controller may be operatively connected to one or more components of the UI. The controller may be configured to receive command signals from an input means of the UI. The controller may be configured to control the heater in response to the command signals. For example, the controller may be configured to receive "on" and "off" command signals from the UI and, in response, may control the heater so as to be in a corresponding on or off state.

[0052] The controller may be configured to send output signals to a component of the UI. The UI may be configured to convey information to a user, via an output means, in response to such output signals (received from the controller). For example, where the device comprises one or more LEDs, the LEDs may be operatively connected to the controller. Hence, the controller may configured to control the illumination of the LEDs (e.g. in response to an output signal). For example, the controller may be configured to control the illumination of the LEDs according to (e.g. an on or off) state of the heater.

[0053] Where the device comprises a sensor (e.g. a puff/airflow sensor), the controller may be operatively connected to the sensor. The controller may be configured to receive a signal from the sensor (e.g. indicative of a condition of the device and/or engaged aerosol-forming article). The controller may be configured to control the heater, or an aspect of the output means, based on the signal from the sensor.

[0054] In some embodiments, the controller may be configured to change at least one control action of the device based on the mode selected. The device may therefore be able to operate differently in child safety mode (CSM) and non-child safety mode (N-CSM).

[0055] The device may comprise a wireless interface configured to communicate wirelessly (e.g. via Bluetooth (e.g. a Bluetooth low-energy connection) or Wi-Fi) with an external device. Similarly, the input connection may be configured for wired connection to an external device so as to provide communication between the device and the external device.

[0056] The external device may be a mobile device. For example, the external device may be a smart phone, tablet, smart watch, or smart car. An application (e.g. app) may be installed on the external device (e.g. mobile device). The application may facilitate communication between the device and the external device via the wired or wireless connection.

[0057] The wireless or wired interface may be configured to transfer signals between the external device and the controller of the device. In this respect, the controller may control an aspect of the device in response to a signal received from an external device. Alternatively or additionally, an external device may respond to a signal received from the device (e.g. from the controller of the device).

[0058] According to a second aspect of the present invention, there is provided a method for switching a smoking substitute device between child safety mode (CSM) and non-child safety mode (N-CSM). The method comprises the steps of detecting the mode selected by the user and in response to mode selection switching between the child safety mode (CSM) and the non-child safety mode (N-CSM).

[0059] Optionally, the method further comprises modifying at least one control action of the device in response to the mode selection. In some embodiments, the at least one control action of the device is depressing of a power button on a user interface of the device to activate heater of the device.

[0060] In some embodiments, modifying the at least one control action comprises modifying the duration of time for which the control action must be performed in order to activate the heater, in response to the mode selection.

[0061] In some embodiments, modifying the at least one control action comprises modifying the duration of time for which the power button must be depressed in order to activate the heater, between a first duration when in the child safety mode (CSM) and a second duration when in the non-child safety mode (N-CSM). In some embodiments the first duration is longer than the second duration.

[0062] Optionally, modifying the at least one control action comprises modifying the at least one control action such that two or more distinct control actions must be performed when in CSM in a pre-defined pattern in order to activate the heater.

[0063] The invention includes the combination of the

aspects and preferred features described except where such a combination is clearly impermissible or expressly avoided.

[0064] The skilled person will appreciate that except where mutually exclusive, a feature or parameter described in relation to any one of the above aspects may be applied to any other aspect. Furthermore, except where mutually exclusive, any feature or parameter described herein may be applied to any aspect and/or combined with any other feature or parameter described herein.

SUMMARY OF THE FIGURES

[0065] So that the invention may be understood, and so that further aspects and features thereof may be appreciated, embodiments illustrating the principles of the invention will now be discussed in further detail with reference to the accompanying figures, in which:

Figure 1A is a schematic of a smoking substitute system;

Figure 1B is a schematic of a variation of the smoking substitute system of Figure 1A;

Figure 2A is a front view of a first embodiment of a smoking substitute system with the consumable engaged with the device;

Figure 2B is a front view of the first embodiment of the smoking substitute system with the consumable disengaged from the device;

Figure 2C is a detailed view of an end of the device of the first embodiment of the smoking substitute system;

Figure 2D is a section view of the first embodiment of the substitute smoking system; and

Figure 3 is a flowchart illustrating method of switching the smoking substitute device between child safety mode (CSM) and non-child safety mode (N-CSM).

DETAILED DESCRIPTION OF THE INVENTION

[0066] Aspects and embodiments of the present invention will now be discussed with reference to the accompanying figures. Further aspects and embodiments will be apparent to those skilled in the art. All documents mentioned in this text are incorporated herein by reference.

[0067] Figure 1A is a schematic providing a general overview of a smoking substitute system 100. The system 100 includes a substitute smoking device 101 and an aerosol-forming article in the form of a consumable 102, which comprises an aerosol former 103. The system is configured to vaporise the aerosol former by heating the aerosol former 103 (so as to form a vapour/aerosol for inhalation by a user).

[0068] In the illustrated system, the heater 104 forms part of the consumable 102 and is configured to heat the aerosol former 103. In this variation, the heater 104 is electrically connectable to the power source 105, for example, when the consumable 102 is engaged with the device 101. Heat from the heater 104 vaporises the aerosol former 103 to produce a vapour. The vapour subsequently condenses to form an aerosol, which is ultimately inhaled by the user.

[0069] The system 100 further comprises a power source 105 that forms part of the device 101. In other embodiments the power source 105 may be external to (but connectable to) the device 101. The power source 105 is electrically connectable to the heater 104 such that the power source 105 is able to supply power to the heater 104 (i.e. for the purpose of heating the aerosol former 103). Thus, control of the electrical connection of the power source 105 to the heater 104 provides control of the state of the heater 104. The power source 105 may be a power store, for example a battery or rechargeable battery (e.g. a lithium ion battery).

[0070] The system 100 further comprises an I/O module comprising a connector 106 (e.g. in the form of a USB port, Micro USB port, USB-C port, etc.). The connector 106 is configured for connection to an external source of electrical power, e.g. a mains electrical supply outlet. The connector 106 may be used in substitution for the power source 105. That is the connector 106 may be electrically connectable to the heater 104 so as to supply electricity to the heater 104. In such embodiments, the device may not include a power source, and the power source of the system may instead comprise the connector 106 and an external source of electrical power (to which the connector 106 provides electrical connection).

[0071] In some embodiments, the connector 106 may be used to charge and recharge the power source 105 where the power source 105 includes a rechargeable battery.

[0072] The system 100 also comprises a user interface (UI) 107. Although not shown, the UI 107 may include input means to receive commands from a user. The input means of the UI 107 allows the user to control at least one aspect of the operation of the system 100. The input means may, for example, be in the form of a button, touchscreen, switch, microphone, etc. In an embodiment, the UI 107 may allow the user to choose, the mode of operation, between child safety mode (CSM) and non-child safety mode (N-CSM) using one of the input means.

[0073] The UI 107 also comprises output means to convey information to the user. The output means may, for example, comprise lights (e.g. LEDs), a display screen, speaker, vibration generator, etc.

[0074] The system 100 further comprises a controller 108 that is configured to control at least one function of

the device 101. In an illustrative embodiment, the controller 108 is configured to switch between the child safety mode (CSM) and the non-child safety mode (N-CSM) in response to user selection of the mode. In another illustrative embodiment, the controller 108 is configured to modify at least one control action, for operating the device, in response to the mode selected by the user. In the illustrated embodiment, the controller 108 is a component of the device 101, but in other embodiments may be separate from (but connectable to) the device 101. The controller 108 is configured to control the operation of the heater 104 and, for example, may be configured to control the voltage applied from the power source 105 to the heater 104. The controller 108 may be configured to toggle the supply of power to the heater 104 between an on state, in which the full output voltage of the power source 105 is applied to the heater 104, and an off state, in which the no voltage is applied to the heater 104. In an illustrative embodiment, the controller 108 may be configured to include a delay while supplying power to the heater 104. In another illustrative embodiment, the controller 108 may be configured to include the delay while supplying power to the heater 104 when child safe mode (CSM) is selected by the user via the user interface (UI) 107. Although not shown, the controller 108 may include an internal clock that is used to introduce a time delay while supplying power to the heater 104 when child safe mode (CSM) is selected.

[0075] Although not shown, the system 100 may also comprise a voltage regulator to regulate the output voltage from the power source 105 to form a regulated voltage. The regulated voltage may then be applied to the heater 104.

[0076] In addition to being connected to the heater 104, the controller 108 is operatively connected to the UI 107. Thus, the controller 108 may receive an input signal from the input means of the UI 107. Similarly, the controller 108 may transmit output signals to the UI 107. In response, the output means of the UI 107 may convey information, based on the output signals, to a user. The controller also comprises a memory 109, which is a non-volatile memory. The memory 109 includes instructions, which, when implemented, cause the controller to perform certain tasks or steps of a method. The memory also allows the current selected mode to be retained during e.g. a power down or battery depletion.

[0077] Figure 1B is a schematic showing a variation of the system 100 of Figure 1A. In the system 100' of Figure 1B, the heater 104 forms part of the device 101, rather than the consumable 102. In this variation, the heater 104 is electrically connected to the power source 105.

[0078] Figures 2A and 2B illustrate a heated-tobacco (HT) smoking substitute system 200. The system 200 is an example of the systems 100, 100' described in relation to Figures 1A or 1B. System 200 includes an HT device 201 and an HT consumable 202. The description of Figures 1A and 1B above is applicable to the system 200 of Figures 2A and 2B, and will thus not be repeated.

[0079] The device 201 and the consumable 202 are configured such that the consumable 202 can be engaged with the device 201. Figure 2A shows the device 201 and the consumable 202 in an engaged state, whilst Figure 2B shows the device 201 and the consumable 202 in a disengaged state.

[0080] The device 201 comprises a body 209 and cap 210. In use the cap 210 is engaged at an end of the body 209. Although not apparent from the figures, the cap 210 is moveable relative to the body 209. In particular, the cap 210 is slideable and can slide along a longitudinal axis of the body 209.

[0081] The device 201 comprises an output means (forming part of the UI of the device 201) in the form of a plurality of light-emitting diodes (LEDs) 211 arranged linearly along the longitudinal axis of the device 201 and on an outer surface of the body 209 of the device 201. A button 212 is also arranged on an outer surface of the body 209 of the device 201 and is axially spaced (i.e. along the longitudinal axis) from the plurality of LEDs 211.

[0082] The device 201 optionally comprises an indicator unit (not shown) coupled to the controller 108. The indicator unit (not shown) is configured to provide an indication to the user of the current mode. In an illustrative embodiment, the indicator unit may be configured to provide the indication of the current mode to the user via one of visual, haptic, audio etc. signals.

[0083] Returning now to the device 201, Figure 2C illustrates a detailed view of the end of the device 201 that is configured to engage with the consumable 202. The cap 210 of the device 201 includes an opening 221 to an internal cavity 222 (more apparent from Figure 2C) defined by the cap 210. The opening 221 and the cavity 222 are formed so as to receive at least a portion of the consumable 202. During engagement of the consumable 202 with the device 201, a portion of the consumable 202 is received through the opening 221 and into the cavity 222. After engagement (see Figure 2B), the downstream end 218 of the consumable 202 protrudes from the opening 221 and thus also protrudes from the device 201. The opening 221 includes laterally disposed notches 226. When a consumable 202 is received in the opening 221, these notches 226 remain open and could, for example, be used for retaining a cover in order to cover the end of the device 201.

[0084] Figure 2D shows a cross section through a central longitudinal plane through the device 201. The device 201 is shown with the consumable 202 engaged therewith.

[0085] The device 201 comprises a heater 204 comprising heating element 223. The heater 204 forms part of the body 209 of the device 201 and is rigidly mounted to the body 209. In the illustrated embodiment, the heater 204 is a rod heater with a heating element 223 having a circular transverse profile. In other embodiments the heater may be in the form of a blade heater (e.g. heating element with a rectangular transverse profile) or a tube heater (e.g. heating element with a tubular form).

[0086] The heating element 223 of the heater 204 projects from an internal base of the cavity 222 along a longitudinal axis towards the opening 221. As is apparent from the figure, the length (i.e. along the longitudinal axis) of the heating element is less than a depth of the cavity 222. In this way, the heating element 223 does not protrude from or extend beyond the opening 221.

[0087] When the consumable 202 is received in the cavity 222 (as is shown in Figure 2D), the heating element 223 penetrates the aerosol-forming substrate 213 of the consumable 202. In particular, the heating element 223 extends for nearly the entire axial length of the aerosol-forming substrate 213 when inserted therein. Thus, when the heater 204 is activated, heat is transferred radially from an outer circumferential surface the heating element 223 to the aerosol-forming substrate 213.

[0088] The device 201 further comprises an electronics cavity 224. A power source, in the form of a rechargeable battery 205 (a lithium ion battery), is located in electronics cavity 224.

[0089] The device 201 includes a connector (i.e. forming part of an IO module of the device 201) in the form of a USB port 206. The connector may alternatively be, for example, a micro-USB port or a USB-C port for examples. The USB port 206 may be used to recharge the rechargeable battery 205.

[0090] The device 201 includes a controller (not shown) located in the electronics cavity 224. The controller comprises a microcontroller mounted on a printed circuit board (PCB). The USB port 206 is also connected to the controller 208 (i.e. connected to the PCB and microcontroller).

[0091] The controller 208 is configured to control at least one function of the device 202. For example, the controller 208 is configured to control the operation of the heater 204. Such control of the operation of the heater 204 may be accomplished by the controller toggling the electrical connection of the rechargeable battery 205 to the heater 204. For example, the controller 208 is configured to control the heater 204 in response to mode selected by the user via the UI 107 of the device 201.

[0092] The controller 208 is configured to determine the mode of operation selected by the user, based on which the controller 208 is configured to modify at least one control action of the device 201 such as the depression of the power button 212 on a user interface of the device 201 to activate the heater 204. In an illustrative embodiment, in response to mode selection, the controller 208 is configured to modify the duration of time for which the control action must be performed in order to activate the heater 204. Precisely, in response to mode selection, the controller 208 of the device 201 is configured to modify the duration of time for which the control action must be performed in order to activate the heater, between a first duration when the device 201 is in the child safety mode (CSM) and a second duration when the device 201 is in the non-child safety mode (N-CSM). For example, if the mode selected by the user is determined to be child safe mode (CSM), the controller 208 is configured to modify the duration of time for which the control action must be performed in order for power to be supplied to the heater 204. In a specific embodiment, the user may be required to press the power button 212 for a first duration, for example a longer duration, in the child safety mode (CSM) to activate heater 204. In a specific embodiment, the user is required to press the power button 212 when in CSM for double the duration for which the power button 212 is required to be pressed in non-child safety mode (N-CSM). In another exemplary embodiment, when in child safety mode the user is required to press the power button 212 for one or more number of times in a pre-defined pattern to activate heater 204. It is to be appreciated that depressing the power button 212 may cause the controller 208 to allow a voltage (from the rechargeable battery 205) to be applied to the heater 204 so as to cause the heating element 223 to be heated.

[0093] Further, in another embodiment, if the mode selected by the user is determined to be non-child safe mode (N-CSM), the controller 208 is configured to modify the duration of time for which the control action must be performed by reducing the length of time for which the button must be depressed to activate the heater 2014 relative to CSM. In a specific embodiment, the user may be required to press the power button 212 for a second duration, for example shorter duration than when in CSM, to activate heater 204 in non-child safety mode (N-CSM). In an exemplary embodiment, the user may be required to press the power button 212 when in N-CSM for half the duration for which the button is required to be pressed when in child safety mode (CSM). In an illustrative embodiment, the first duration may be configured to be longer in comparison to second duration.

[0094] The controller 208 is further configured to remain in a selected mode at all times until a user selects a different mode. For example, the controller will ensure that the device remains in CSM until a positive input from the user which dictates a change in mode to N-CSM. The device therefore remembers the current mode through e.g. power down operations or battery depletion. The controller 208 is also configured to control the LEDs 211 in response to (e.g. a detected) a condition of the device 201 or the consumable 202. For example, the controller may control the LEDs to indicate whether the device 201 is in an on state or an off state (e.g. one or more of the LEDs may be illuminated by the controller when the device is in an on state).

[0095] The device 201 comprises a further input means (i.e. in addition to the button 212) in the form of a puff sensor 225. The puff sensor 225 is configured to detect a user drawing (i.e. inhaling) at the downstream end 218 of the consumable 202. The puff sensor 225 may, for example, be in the form of a pressure sensor, flowmeter or a microphone. The puff sensor 225 is operatively connected to the controller 208 in the electronics cavity 224, such that a signal from the puff sensor 225, indicative of a puff state (i.e. drawing or not drawing), forms an input

to the controller 208 (and can thus be responded to by the controller 208).

[0096] Figure 3 illustrates flowchart of method of switching the device between child safety mode (CSM) and non-child safety mode (N-CSM).

[0097] As illustrated in Figure 3, the method 300 includes one or more blocks implemented by the controller 208 of the device 201. The method 300 may be described in the general context of controller executable instructions. Generally, controller executable instructions can include routines, programs, objects, components, data structures, procedures, modules, and functions, which perform particular functions or implement particular abstract data types.

[0098] The order in which the method 300 is described is not intended to be construed as a limitation, and any number of the described method blocks can be combined in any order to implement the method 300. Additionally, individual blocks may be deleted from the method 300 without departing from the scope of the subject matter described herein. Furthermore, the method 300 can be implemented in any suitable hardware, software, firmware, or combination thereof.

[0099] At block 301, the controller 208 determines the mode selected by the user. It is to be appreciated, prior to the step of determining the mode selected by the user, the method must include a step (not shown) of selecting a mode of operation, between child safety mode (CSM) and non-child safety mode (N-CSM), by the user.

[0100] At block 302, the controller 208 further determines whether the mode selected by the user at block 301 is different from the current mode, i.e. the mode last selected by the user, or not. If the controller 208 determines the mode selected by the user is different from the current mode i.e. in which the device is currently operating, then the method proceeds to block 303 along the "YES" path. Otherwise, the method proceeds to block 304 along "NO" path.

[0101] At block 303, the controller 208 switches from the current mode to the selected mode. In one example, if the current mode of operation of device 201 is non-child safe mode (N-CSM) and the mode selected by the user is child safety mode (CSM) then the method at block 303 discloses switching from non-child safe mode (N-CSM) to the child safety mode (CSM). In an exemplary embodiment, when the device is switched from the non-child safe mode (N-CSM) to the child safety mode (CSM) the controller 208 is configured for modifying the duration of time for which the control action must be performed in order to activate the heater.

[0102] Thus, in an exemplary embodiment, when the device 201 is switched to the child safety mode (CSM) the user is required to press the power button 212 for the first duration, for example for a longer duration, to activate heater 204. In a specific embodiment, the user is required to press the power button 212 for twice the duration for which the button is pressed in non-child safety mode (N-CSM). In particular, the controller increases the duration of time for which the control action must be performed in order to activate the heater, from 3 seconds when in N-CSM to 6 seconds when in CSM. In another exemplary embodiment, when the device 201 is switched to the child safety mode the user is required to press the power button 212 for one or more number of times in a pre-defined pattern to activate heater 204 of the device, i.e. to allow a voltage (from the rechargeable battery 205) to be applied to the heater 204 (so as to cause the heating element 223 to be heated.

[0103] In another example, if the current mode of operation of device 201 is child safe mode (CSM) and the mode selected by the user is non-child safety mode (N-CSM), then the method at block 303 switches from child safe mode (CSM) to non-child safety mode (N-CSM). In an exemplary embodiment, when the device 201 is switched from child safe mode (CSM) to the non-child safety mode (N-CSM) the controller 208 is configured for increasing the duration of time for which the control action must be performed in order to activate the heater 204.

[0104] Thus, in an exemplary embodiment, when the device 201 is switched to the non-child safety mode (N-CSM) the user is required to press the power button 212 for the second, shorter duration, to activate heater 204. In particular, the controller increases the duration of time for which the control action must be performed in order to activate the heater, from 6 seconds when in CSM to 3 seconds when in N-CSM.

[0105] The features disclosed in the foregoing description, or in the following claims, or in the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for obtaining the disclosed results, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

[0106] While the invention has been described in conjunction with the exemplary embodiments described above, many equivalent modifications and variations will be apparent to those skilled in the art when given this disclosure. Accordingly, the exemplary embodiments of the invention set forth above are considered to be illustrative and not limiting. Various changes to the described embodiments may be made without departing from the spirit and scope of the invention.

[0107] For the avoidance of any doubt, any theoretical explanations provided herein are provided for the purposes of improving the understanding of a reader. The inventors do not wish to be bound by any of these theoretical explanations.

[0108] Any section headings used herein are for organizational purposes only and are not to be construed as limiting the subject matter described.

[0109] Throughout this specification, including the claims which follow, unless the context requires otherwise, the words "have", "comprise", and "include", and variations such as "having", "comprises", "comprising", and "including" will be understood to imply the inclusion

of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

[0110] It must be noted that, as used in the specification and the appended claims, the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. Ranges may be expressed herein as from "about" one particular value, and/or to "about" another particular value. When such a range is expressed, another embodiment includes from the one particular value and/or to the other particular value. Similarly, when values are expressed as approximations, by the use of the antecedent "about," it will be understood that the particular value forms another embodiment. The term "about" in relation to a numerical value is optional and means, for example, +/- 10%.

[0111] The words "preferred" and "preferably" are used herein refer to embodiments of the invention that may provide certain benefits under some circumstances. It is to be appreciated, however, that other embodiments may also be preferred under the same or different circumstances. The recitation of one or more preferred embodiments therefore does not mean or imply that other embodiments are not useful, and is not intended to exclude other embodiments from the scope of the disclosure, or from the scope of the claims.

Claims

1. A smoking substitute device comprising:
   a controller configured to detect a mode selected by a user and switch between a child safety mode (CSM) and non-child safety mode (N-CSM) in response to the mode selection.

2. A device according to claim 1, wherein the controller is configured to modify at least one control action of the device in response to the mode selection.

3. The device according to claim 2, wherein the at least one control action of the device is depressing of a power button on a user interface of the device to activate heater of the device.

4. The device according to claim 2 or 3, wherein the controller of the device is configured to modify the duration of time for which the control action must be performed in order to activate the heater, in response to the mode selection.

5. The device according to claim 4, wherein, the controller of the device is configured to modify the duration of time for which the control action must be performed in order to activate the heater, between a first duration when in the child safety mode (CSM) and a second duration when in the non-child safety mode (N-CSM).

6. The device according to claims 5, wherein the first duration is longer than the second duration.

7. The device according to any one of claims 1 to 6, wherein the controller is configured to modify the at least one control action such that two or more distinct control actions must be performed when in CSM in a pre-defined pattern to activate the heater.

8. The device according to any one of claims 1 to 7, wherein the controller of the device is configured to remain in a selected mode at all times until a user selects a different mode.

9. A method for switching a smoking substitute device between child safety mode (CSM) and non-child safety mode (N-CSM), the method comprising:

   detecting a mode selected; and
   switching between the child safety mode (CSM) and the non-child safety mode (N-CSM) in response to mode selection.

10. The method according to claim 9, further comprising modifying at least one control action of the device in response to the mode selection.

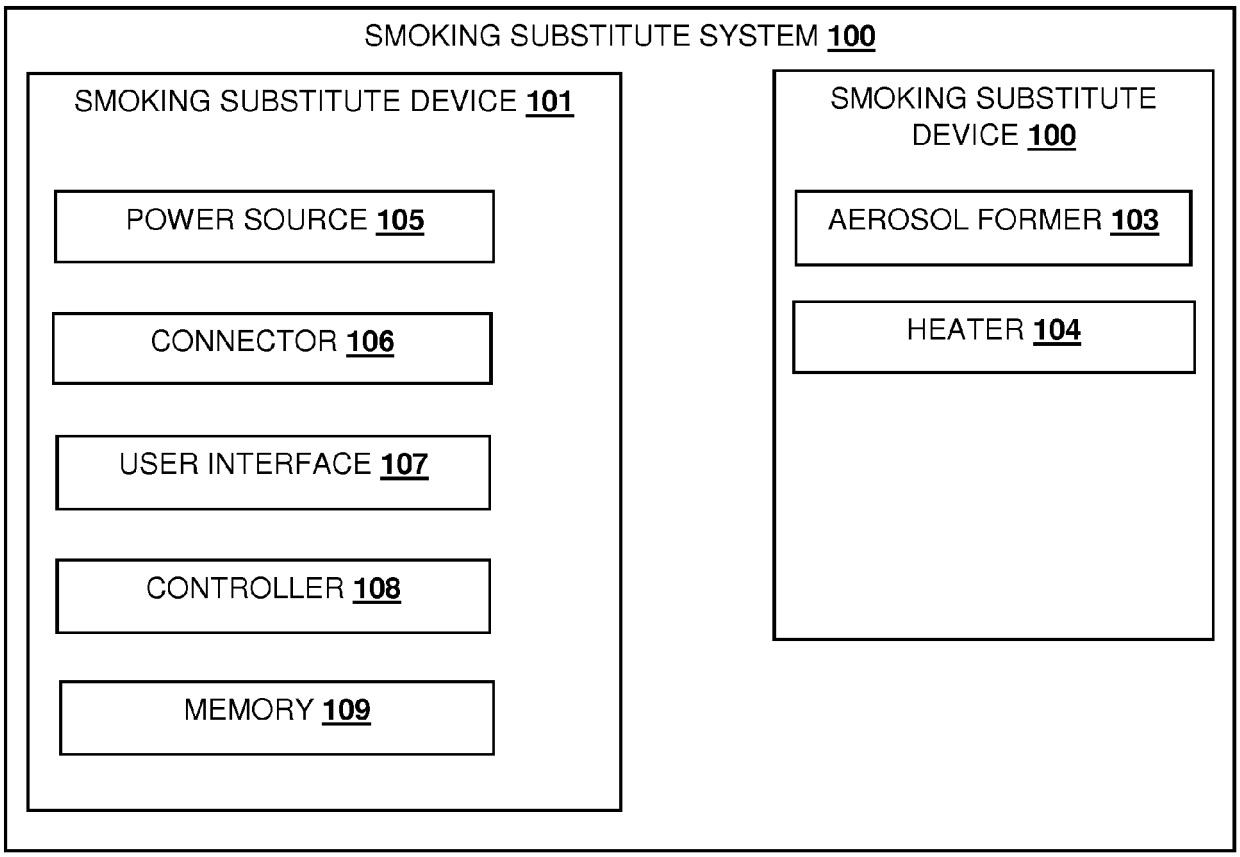
11. The method according to claim 10, wherein the at least one control action of the device is depressing of a power button on a user interface of the device to activate heater of the device.

12. The method according to claim 10 or 11, wherein modifying the at least one control action comprises modifying the duration of time for which the control action must be performed in order to activate the heater, in response to the mode selection.

13. The method according to claim 12, wherein modifying the at least one control action comprises modifying the duration of time for which the power button must be depressed in order to activate the heater, between a first duration when in the child safety mode (CSM) and a second duration when in the non-child safety mode (N-CSM).

14. The method according to claim 13, wherein the first duration is longer than the second duration.

15. The method according to claim 10, wherein modifying the at least one control action comprises modifying the at least one control action such that two or more distinct control actions must be performed when in CSM in a pre-defined pattern in order to activate the heater.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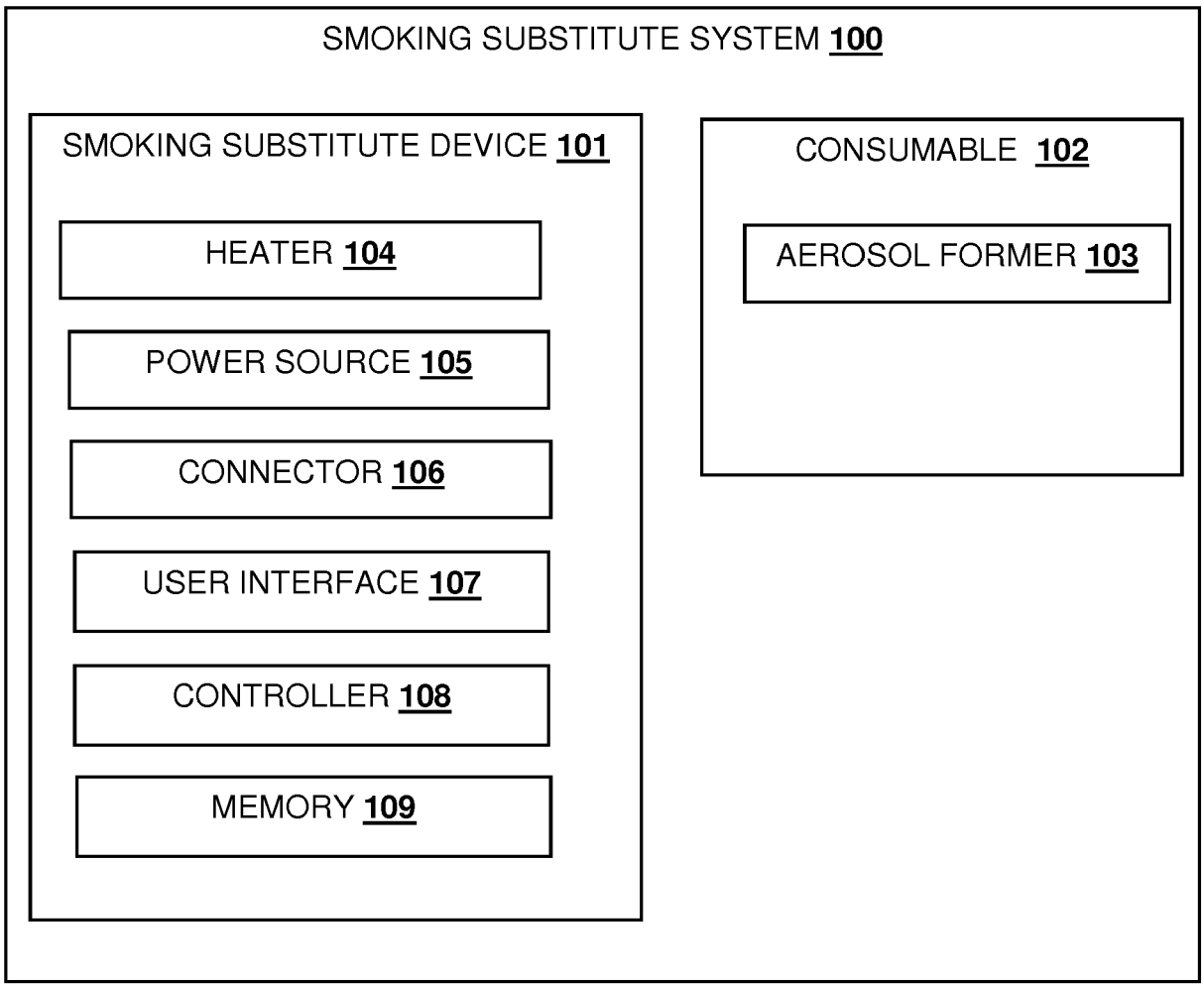
SMOKING SUBSTITUTE DEVICE 101
POWER SOURCE 105
CONNECTOR 106
USER INTERFACE 107
CONTROLLER 108
MEMORY 109
SMOKING SUBSTITUTE DEVICE 100
AEROSOL FORMER 103
HEATER 104

FIGURE- 1A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SMOKING SUBSTITUTE DEVICE 101
HEATER 104
POWER SOURCE 105
CONNECTOR 106
USER INTERFACE 107
CONTROLLER 108
MEMORY 109
CONSUMABLE 102
AEROSOL FORMER 103

FIGURE- 1B

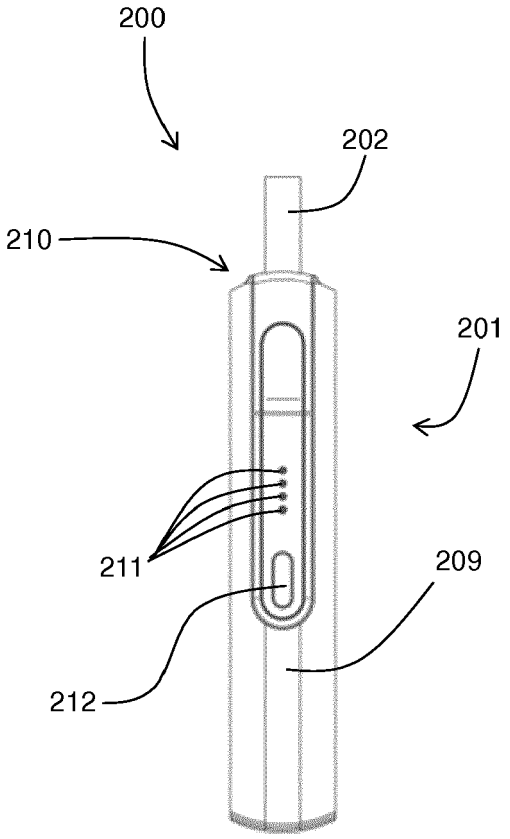

FIGURE 2A

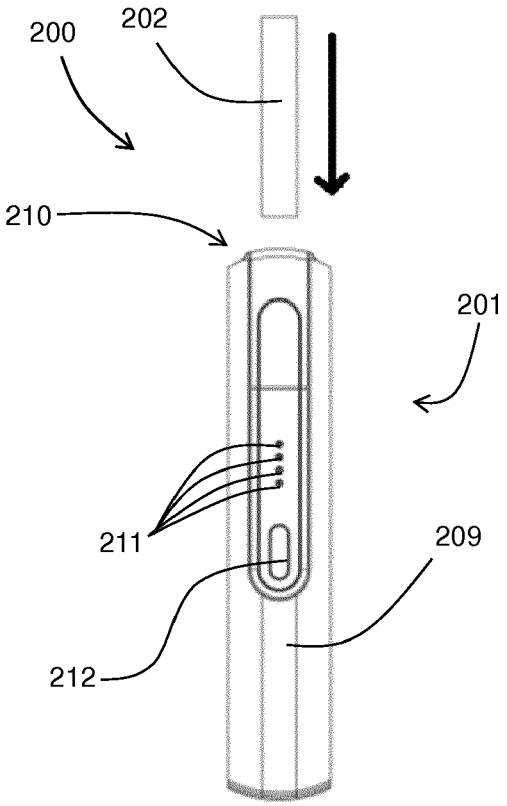

FIGURE 2B

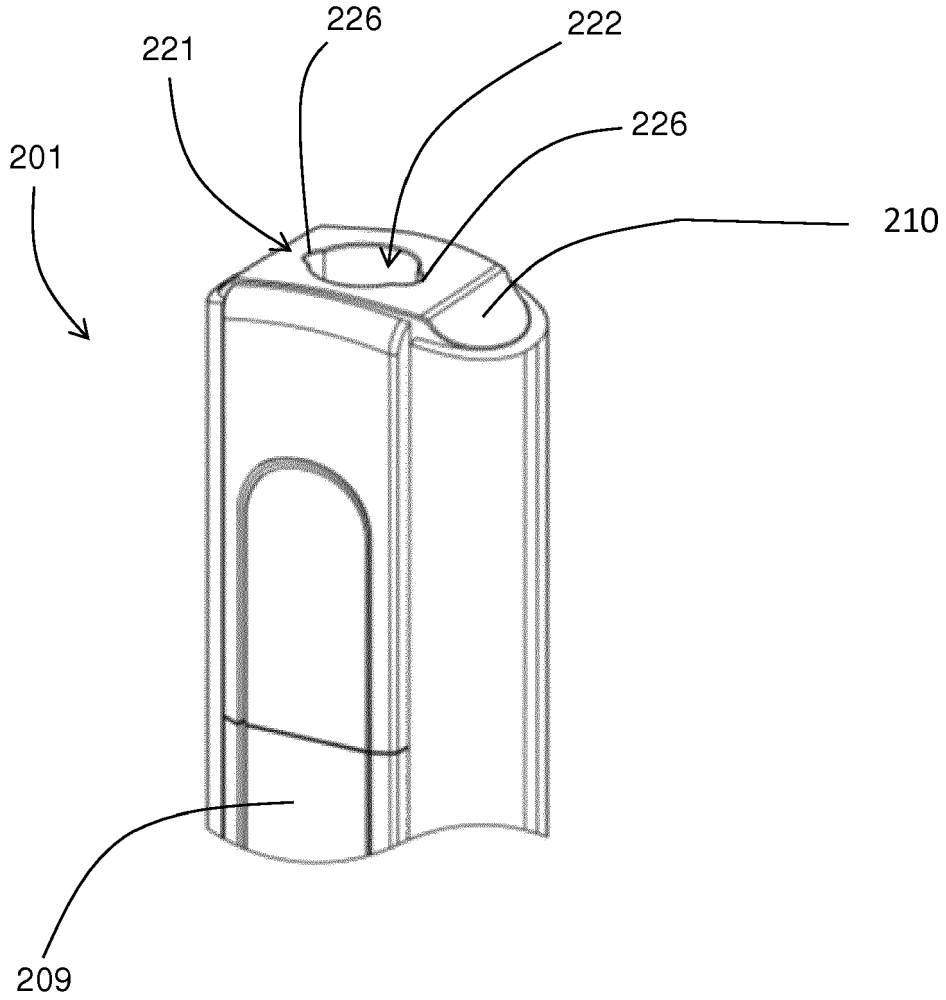

FIGURE 2C

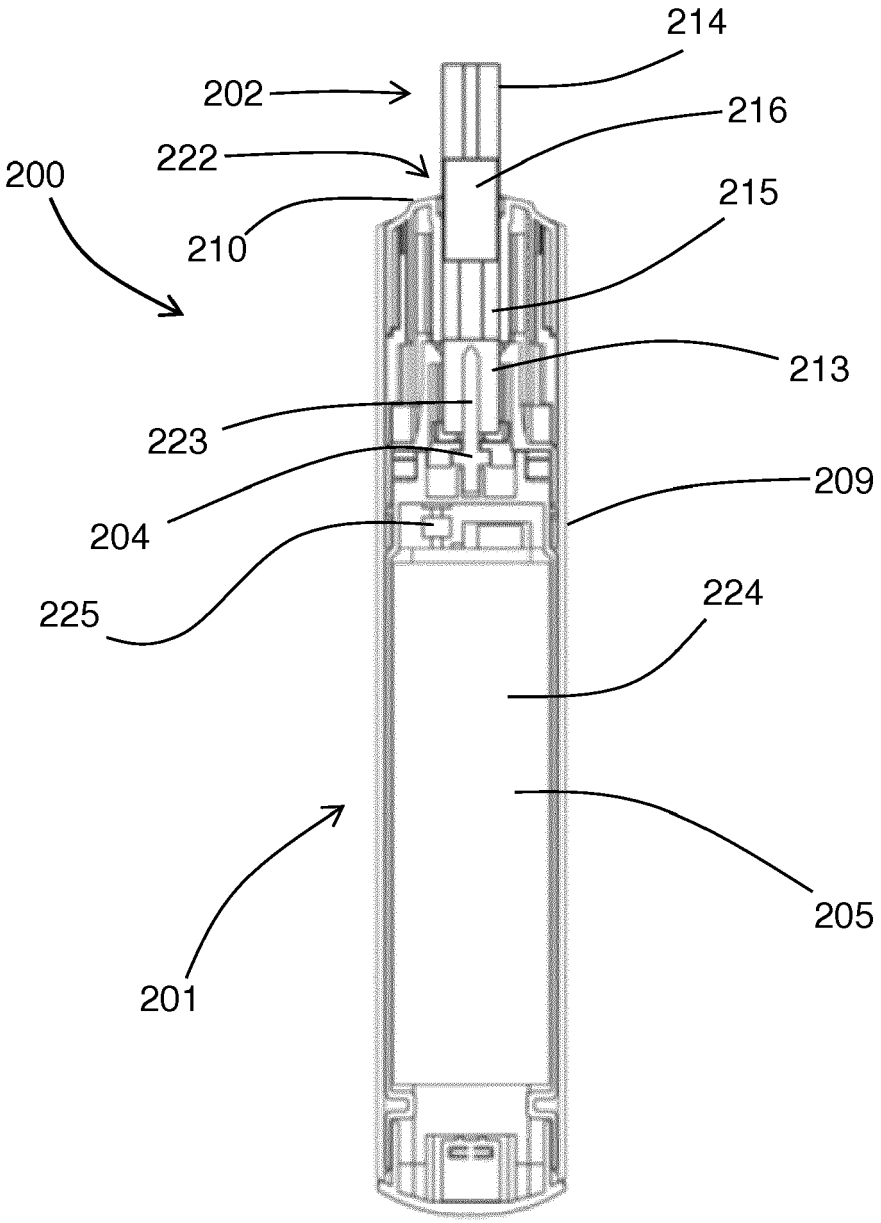

FIGURE 2D

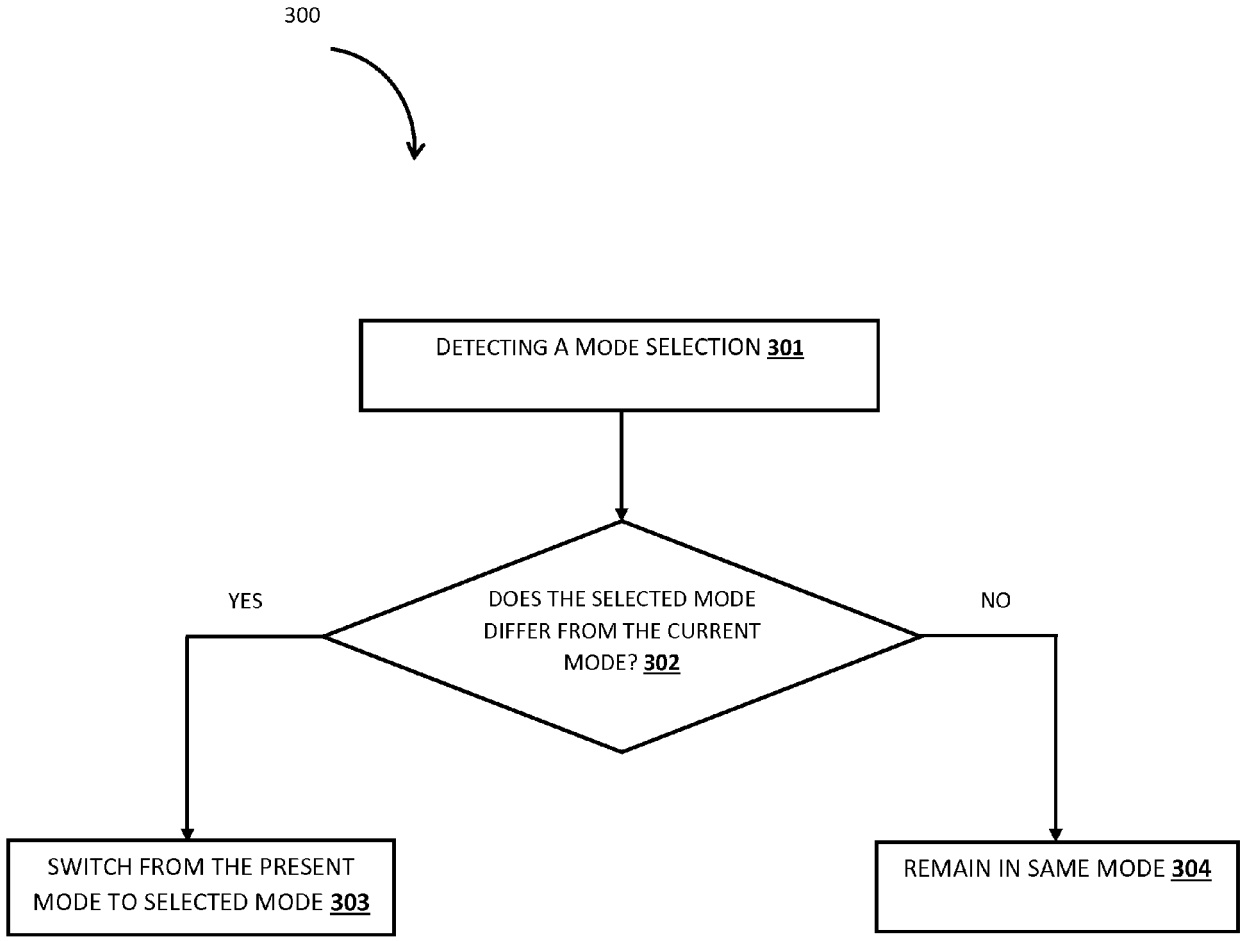
300
DETECTING A MODE SELECTION 301
DOES THE SELECTED MODE DIFFER FROM THE CURRENT MODE? 302
YES
NO
SWITCH FROM THE PRESENT MODE TO SELECTED MODE 303
REMAIN IN SAME MODE 304

FIGURE 3

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EUROPEAN SEARCH REPORT

Application Number
EP 19 02 0195

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Place of search	Date of completion of the search	Examiner
Munich	18 September 2019	Pavón Mayo, Manuel

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