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

(11) **EP 4 458 192 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
06.11.2024 Bulletin 2024/45

(21) Application number: **22919935.1**

(22) Date of filing: **21.11.2022**

(51) International Patent Classification (IPC):
A24F 40/57 *(2020.01)* ***A24F 40/53*** *(2020.01)*
A24F 40/40 *(2020.01)*

(86) International application number:
PCT/CN2022/133129

(87) International publication number:
WO 2023/134302 (20.07.2023 Gazette 2023/29)

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

(30) Priority: **14.01.2022 CN 202210044758**

(71) Applicant: **Shenzhen Merit Technology Co., Ltd.**
Shenzhen, Guangdong 518105 (CN)

(72) Inventors:
- **LI, Xiangzhong**
  Shenzhen, Guangdong 518105 (CN)
- **LI, Yafei**
  Shenzhen, Guangdong 518105 (CN)
- **HUANG, Pengfei**
  Shenzhen, Guangdong 518105 (CN)

(74) Representative: **Manitz Finsterwald**
Patent- und Rechtsanwaltspartnerschaft mbB
Martin-Greif-Strasse 1
80336 München (DE)

(54) AEROSOL GENERATION APPARATUS, CONTROL METHOD AND CONTROL APPARATUS THEREFOR, AND STORAGE MEDIUM

(57) An aerosol generation device, a control method and control device therefor, and a storage medium. The aerosol generation device comprises: a heating element (110), which is used for heating an aerosol formation substrate to generate aerosol; a power source (120), which is electrically connected to the heating element (110); a detection assembly (130), which is electrically connected to the heating element (110) and the power source (120), respectively; and a control assembly (140), which is used for acquiring an electrical parameter of the detection assembly (130), determining the temperature of the heating element (110) according to a preset correspondence, and adjusting, according to the temperature of the heating element (110) and a preset target temperature, electric energy that is provided by the power source (120) for the heating element (110), such that the actual temperature of the heating element (110) is maintained within a target temperature interval, wherein the correspondence is the correspondence between the electrical parameter of the detection assembly (130) and the temperature of the heating element (110). The temperature can be precisely measured to realize reliable temperature control.

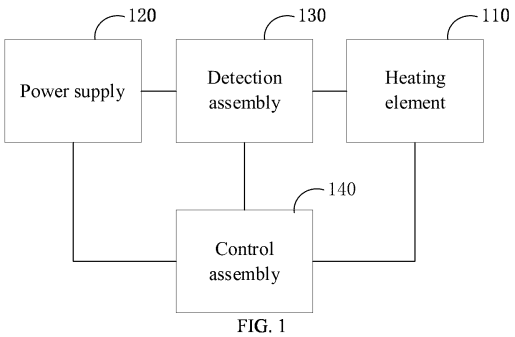

FIG. 1

EP 4 458 192 A1

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to Chinese Patent Application No. 202210044758.X, filed with the China National Intellectual Property Administration and entitled "Aerosol Generation Device, Control Method and Control Device therefor, and Storage Medium" on January 14, 2022, which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present invention relates to the field of atomization technology, and particularly to an aerosol generation device, a control method and a control device thereof, and a storage medium.

BACKGROUND

[0003] With the development of atomization technology, aerosol atomization technology has emerged, which achieves the atomization by heating an aerosol-forming substrate via a heating element to generate aerosol. The heating element needs to be maintained at a certain temperature in order to atomize the aerosol-forming substrate. Therefore, it is necessary to obtain the current temperature of the heating element as feedback and then perform heating control based on the current temperature. Accordingly, in order to achieve the reliable operation of the aerosol generation device, the temperature of the heating element needs to be acquired accurately.

SUMMARY

[0004] In view of this, in order to address the above technical problem, it is necessary to provide an aerosol generation device, a control method and a control device thereof, and a storage medium capable of accurately acquiring the temperature.

[0005] An aerosol generation device is provided, including:

a heating element, configured to heat an aerosol-forming substrate to generate aerosol;
a power supply electrically connected to the heating element;
a detection assembly electrically connected to the heating element and the power supply respectively;
a control assembly, electrically connected to the detection assembly and configured to acquire an electrical parameter of the detection assembly, determine a temperature of the heating element according to a preset corresponding relationship, and regulate electric energy provided by the power supply to the heating element according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the heating element within a target temperature range, the corresponding relationship refers to a corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element.

[0006] In an embodiment, the detection assembly includes a reference resistor and a detection switch;

a first terminal of the detection switch is electrically connected to the power supply, a second terminal of the detection switch is electrically connected to a first terminal of the reference resistor, a control terminal of the detection switch is electrically connected to the control assembly;
a second terminal of the reference resistor is electrically connected to the heating element, the electrical parameter is a voltage value across the reference resistor;
the control assembly is configured to acquire a first voltage value at the first terminal of the reference resistor and a second voltage value at the second terminal of the reference resistor, and determine the temperature of the heating element according to the first voltage value, the second voltage value and the corresponding relationship, and is further configured to control the detection switch to be turned on or off to implement turn-on or turn-off of a detection mode.

[0007] In an embodiment, the control assembly includes:

a power switch, a first terminal of the power switch being connected to the heating element, and a second terminal of the power switch being electrically connected to the power supply;
a controller, electrically connected to the control terminal of the detection switch, the reference resistor, and the control terminal of the power switch respectively, and configured to acquire a first voltage value at the first terminal of the reference resistor and a second voltage value at the second terminal of the reference resistor, determine the temperature of the heating element according to the first voltage value, the second voltage value and the corresponding relationship, and output a pulse width modulation (PWM) signal to the power switch according to the temperature and the preset target temperature of the heating element; the PWM signal is configured to control the power switch to periodically switch between on and off states to maintain the actual temperature of the heating element within the target temperature range.

[0008] In an embodiment, the controller is configured to control the detection switch to be turned on when the PWM signal controls the power switch to be in the off

state, and acquire the first voltage value and the second voltage value to determine the temperature of the heating element.

[0009] In an embodiment, the corresponding relationship is expressed as the following formulation:

$$T=K*V2\ (V1-V2)+b,$$

where, T represents the temperature of the heating element, K represents a preset temperature coefficient, V1 represents the first voltage value, V2 represents the second voltage value, and b represents a preset correction constant.

[0010] A control method for an aerosol generation device is provided, the aerosol generation device includes a heating element, a power supply and a detection assembly, the heating element is configured to heat an aerosol-forming substrate to generate aerosol, the detection assembly is electrically connected to the heating element and the power supply respectively;
the control method includes:

acquiring an electrical parameter of the detection assembly;
determining a temperature of the heating element according to a preset corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element;
regulating electric energy provided by the power supply to the heating element according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the heating element within a target temperature range.

[0011] In an embodiment, the detection assembly includes a reference resistor, a first terminal of the reference resistor is electrically connected to the power supply, and a second terminal of the reference resistor is electrically connected to the heating element; the electrical parameter of the detection assembly includes a first voltage value at the first terminal of the reference resistor and a second voltage value at the second terminal of the reference resistor;
the determining the temperature of the heating element according to the preset corresponding relationship includes:
determining the temperature of the heating element according to the first voltage value, the second voltage value and the corresponding relationship.

[0012] In an embodiment, the aerosol atomization device further includes a power switch, a first terminal of the power switch is connected to the heating element, and a second terminal of the power switch is electrically connected to the power supply;
the regulating the electric energy provided by the power supply to the heating element according to the temperature and the preset target temperature of the heating element includes:

outputting a PWM signal to the power switch according to the temperature and the preset target temperature of the heating element;
the PWM signal is configured to control the power switch to periodically switch between on and off states to maintain the actual temperature of the heating element within the target temperature range.

[0013] In an embodiment, the detection assembly further includes a detection switch, a first terminal of the detection switch is electrically connected to the power supply, and a second terminal of the detection switch is electrically connected to the first terminal of the reference resistor;
the control method further includes:

before acquiring the electrical parameter of the detection assembly,
determining whether the power switch is in the off state according to the PWM signal;
controlling the detection switch to be turned on when the power switch is in the off state.

[0014] In an embodiment, the corresponding relationship is expressed as the following formulation:

$$T=K*V2\ (V1-V2)+b,$$

where T represents the temperature of the heating element, K represents a preset temperature coefficient, V1 represents the first voltage value, V2 represents the second voltage value, and b represents a preset correction constant.

[0015] A control device for an aerosol generation device is provided, the aerosol generation device includes a heating element, a power supply, and a detection assembly, the heating element is configured to heat an aerosol-forming substrate to generate aerosol, the detection assembly is electrically connected to the heating element and the power supply respectively;
the control device includes:

a parameter acquisition module, configured to acquire an electrical parameter of the detection assembly;
a temperature determination module, configured to determine a temperature of the heating element according to a preset corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element;
an electric energy regulation module, configured to regulate electric energy provided by the power supply to the heating element according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the

heating element within the target temperature range.

[0016] An aerosol atomization device is provided, including:

a heating element, configured to heat an aerosol-forming substrate to generate aerosol;
a power supply electrically connected to the heating element;
a detection assembly electrically connected to the heating element and the power supply respectively;
a control assembly including a processor and a memory storing a computer program, the processor, when executing the computer program, implements the steps of:
acquiring an electrical parameter of the detection assembly;
determining a temperature of the heating element according to a preset corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element;
regulating electric energy provided by the power supply to the heating element according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the heating element within a target temperature range.

[0017] A computer-readable storage medium is provided, on which a computer program is stored, the computer program, when executed by a processor, causes the processor to implement the steps of:

acquiring an electrical parameter of the detection assembly;
determining a temperature of the heating element according to a preset corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element;
regulating electric energy provided by the power supply to the heating element according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the heating element within a target temperature range.

[0018] With the above-mentioned aerosol generation device, the control method and control device thereof, and the storage medium, the detection assembly is electrically connected to the power supply and the heating element. As the temperature of the heating element increases, the resistance value may also increase, thereby causing the electrical parameter of the detection assembly electrically connected to the heating element to change. Accordingly, the temperature of the heating element can be determined through the corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element, and then the electric energy provided by the power supply to the heating element is regulated according to the temperature and the preset target temperature of the heating element, to maintain the actual temperature of the heating element within the target temperature range, thereby implementing the accurate detection of the temperature.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] In order to describe the technical solution in the embodiments of the present invention or in the conventional technology more clearly, accompanying drawings required for the description of the embodiments or the conventional technology will be briefly introduced. Obviously, the accompanying drawings in the following description are merely some of the embodiments of the present invention, and those skilled in the art can obtain other drawings according to these drawings without any inventive effort.

FIG. 1 is a structural block diagram of an aerosol generation device according to an embodiment of the present invention.
FIG. 2 is a schematic diagram of a circuit structure of an aerosol generation device according to another embodiment of the present invention.
FIG. 3 is a schematic diagram of a circuit structure of an aerosol generation device according to another embodiment of the present invention.
FIG. 4 is a flow chart showing a control method for an aerosol generation device according to an embodiment of the present invention.
FIG. 5 is a flow chart showing a control method for an aerosol generation device according to another embodiment of the present invention.
FIG. 6 is a structural block diagram of a control device for an aerosol generation device according to an embodiment of the present invention.
FIG. 7 is a schematic structure diagram of an aerosol generation device according to an embodiment of the present invention.
FIG. 8 is a schematic structure diagram of an aerosol generation device according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0020] In order to facilitate understanding of the present application, the present application will be described more comprehensively below with reference to the relevant drawings. Embodiments of the present invention are shown in the accompanying drawings. However, the present application may be implemented in many different forms and is not limited to the embodiments described herein. Rather, these embodiments are provided to make the disclosure of the present application more thorough and comprehensive.

[0021] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as com-

monly understood by one of ordinary skill in the art to which the present application belongs. The terms used in the description of the present application are only for the purpose of describing specific embodiments and are not intended to limit the present application.

[0022] It can be understood that the terms "first", "second", etc., used in the present application can be used for describing various technical features, but these technical features are not limited by these terms. These terms are merely used for distinguishing a first feature from another component feature.

[0023] It should be noted that when an element is considered to be "connected to" another element, it can be directly connected to another element or connected to another element through an intermediate element. In addition, the "connection" in the following embodiments should be understood as "electrical connection", "communication connection", etc., if there is transmission of electrical signals or data between the connected objects.

[0024] As used herein, the singular forms "a", "an" and "the/said" may include the plural forms as well, unless the context clearly indicates otherwise. It should also be appreciated that the terms "include/comprises" or "having" and the like specify the presence of stated features, wholes, steps, operations, components, parts or combinations thereof, but do not exclude the possibility of the presence or addition of one or more other features, wholes, steps, operations, components, parts or combinations thereof. Meanwhile, the term "and/or" used in the description includes any and all combinations of the relevant listed items.

[0025] As shown in FIG. 1, in an embodiment of the present invention, an aerosol generation device is provided, which may include a heating element 110, a power supply 120, a detection assembly 130, and a control assembly 140.

[0026] The heating element 110 is configured to heat an aerosol-forming substrate to generate aerosol. The heating element 110 may be a heating wire, which is equivalent to a resistor. The power supply 120 is electrically connected to the heating element 110 and is configured to output electric energy to the heating element 110 to allow the heating element 110 to generate heat. The detection assembly 130 is electrically connected to the heating element 110 and the power supply 120 respectively. The control assembly 140 is electrically connected to the detection assembly 130, and is configured to acquire an electrical parameter of the detection assembly 130, determine a temperature of the heating element 110 according to a preset corresponding relationship, and regulate the electric energy provided by the power supply 120 to the heating element 110 according to the temperature and a preset target temperature of the heating element 110, to maintain the actual temperature of the heating element 110 within a target temperature range. The corresponding relationship refers to the corresponding relationship between the electrical parameter of the detection assembly 130 and the temperature of the heating element 110.

[0027] The detection assembly 130 is electrically connected to the power supply 120 and the heating element 110. As the temperature of the heating element 110 increases, a resistance value thereof may also increase, thereby changing the electrical parameter of the detection assembly 130 electrically connected to the heating element 110. Accordingly, the temperature of the heating element 110 can be determined through the corresponding relationship between the electrical parameter of the detection assembly 130 and the temperature of the heating element 110. Afterwards, the electric energy provided by the power supply 120 to the heating element 110 is regulated according to the temperature and the preset target temperature of the heating element 110, to maintain the actual temperature of the heating element 110 within the target temperature range.

[0028] In an embodiment, the electrical parameter of the detection assembly 130 may be a resistance value, a voltage value across both ends, a power, a current, etc. In the embodiment of the present invention, a voltage value across the detection assembly 130 is taken as an example for description.

[0029] In an embodiment, the control assembly 140 can control a heating temperature of the heating element 110 by controlling the power outputted by the power supply 120 to the heating element 110 or a duration of the output, so that the heating element 110 is maintained at a temperature for stabilizing the atomization and generating the aerosol. It should be appreciated that the power supply 120 may further have another connection path with the heating element 110, that is, when there is no need to perform the detection, the power supply 120 supplies power to the heating element through this path.

[0030] The resistance value of the heating element 110 may change with the temperature. As the temperature increases, the resistance value of the heating element 110 may also increase. The control assembly 140 can keep the resistance value of the detection assembly 130 constant by limiting a power-on duration of the detection assembly 130. Based on the voltage value division principle, the voltage value across the detection assembly 130 may reflect the temperature of the heating element 110, and the temperature of the heating element 110 can be determined according to the voltage value across the detection assembly 130 and the preset corresponding relationship.

[0031] It should be noted that, in addition to the connection mode of the detection assembly 130, the heating element 110 and the power supply 120 as shown in FIG. 1 that the detection assembly 130 is arranged between the heating element 110 and the power supply 120, it is also possible to arrange the detection assembly 130 between the heating element 110 and the ground, that is, any connection method that can form a voltage value divider structure between the detection assembly 130 and the heating element can be chosen, which is not limited to the connection mode as shown in FIG. 1.

[0032] In the above-mentioned aerosol generation device, a voltage value divider circuit is formed by arranging the detection assembly 130 and the heating element 110. Since the voltage value across the detection assembly 130 depends on the resistance value of the heating element 110 and the resistance value of the detection assembly 130, when the temperature of the heating element 110 changes, the resistance value may also change accordingly, thereby causing the voltage value across the detection assembly 130 to change. Therefore, the temperature of the heating element 110 can be determined through the corresponding relationship between the voltage value across the detection assembly 130 and the temperature of the heating element 110, and then the electrical power supplied by the power supply 120 to the heating element 110 is regulated according to the temperature and the preset target temperature of the heating element 110, to maintain the actual temperature of the heating element 110 in the target temperature range, thereby implementing the accurate detection of the temperature. In addition, compared to an aerosol generation device that uses a temperature sensor to measure the temperature, the circuit design of the aerosol generation device provided in the present application is simpler and has lower cost. Compared to the direct detection of the resistance value of the heating element 110 to perform the temperature detection, since the detection assembly 130 is not affected by the temperature, the measurement accuracy is higher.

[0033] As shown in FIG. 2, in an embodiment, the detection assembly 130 may include: a reference resistor RS and a detection switch Q1. A first terminal of the detection switch Q1 is electrically connected to the power supply 120, a second terminal of the detection switch Q1 is electrically connected to a first terminal of the reference resistor RS, and a control terminal of the detection switch Q1 is electrically connected to the control assembly 140. A second terminal of the reference resistor RS is electrically connected to the heating element 110. The electrical parameter is a voltage value across the reference resistor RS. The control assembly 140 is configured to acquire a first voltage value V1 at the first terminal of the reference resistor RS and a second voltage value V2 at the second terminal of the reference resistor RS, and determine the temperature of the heating element 110 according to the first voltage value V1, the second voltage value V2 and the corresponding relationship. The control assembly 140 is further configured to control the detection switch Q1 to be turned on or off to implement the turn-on or turn-off of the detection mode.

[0034] The voltage value outputted by the power supply is VS. When detection is required, the control assembly 140 controls the detection switch Q 1 to be turned on, and the power supply provides power (i.e., the power supply voltage value VS) to the reference resistor RS and the heating element 110 connected in series. During this process, the control assembly 140 acquires the voltage values at both ends of the reference resistor RS, namely the first voltage value V1 and the second voltage value V2. The first voltage value V1 is the output voltage value of the power supply 120, so that the first voltage value V1 may be maintained within a relatively stable voltage value range, while the second voltage value V2 may be affected by the change in the resistance value of the heating element 110. When there is no abnormality in the first voltage value V1, the second voltage value V2 can be configured to characterize the resistance value of the heating element 110, so that the current temperature of the heating element 110 can be determined according to the first voltage value V 1, the second voltage value V2 and the preset corresponding relationship.

[0035] In an embodiment, the control assembly 140 may acquire a plurality of groups of first voltage values V1 and second voltage values V2 in the detection mode, take an average value of the first voltage values and an average value of the second voltage values after filtering out maximum values and minimum values of the first voltage values V1 and the second voltage values V2, and finally determine the temperature of the heating element 110 by using the average value of the first voltage values V1 and the average value of the second voltage values V2, thereby reducing the detection error.

[0036] When the detection mode needs to be turned off, the control assembly 140 controls the detection switch Q 1 to be turned off to cut off a branch where the reference resistor RS is located. At the moment, the power supply 120 supplies power to the heating element 110 through another branch.

[0037] In an embodiment, if the internal resistance of the detection switch Q1 is not much different from the resistance value of the heating element 110, the detection switch Q1, the reference resistor RS and the heating element form a series voltage value divider. When the resistance value of the heating element 110 changes, the first voltage value V1 may also change suddenly. At the moment, the first voltage value V1 and the second voltage value V2 are used together to perform the temperature detection, and the accuracy of identification can still be guaranteed.

[0038] In an embodiment, the detection switch Q1 may be an electronic switch such as a triode, a metal oxide semiconductor (MOS) transistor, or an insulated-gate bipolar transistor (IGBT), etc.

[0039] In an embodiment, the electrical parameter of the detection assembly 130 may also be the resistance value of the reference resistor RS, the power of the reference resistor RS, or the current flowing through the reference resistor RS.

[0040] As shown in FIG. 3, in an embodiment, the control assembly 140 may include a power switch Q2 and a controller 141. A first terminal of the power switch Q2 is connected to the heating element 110, and a second terminal of the power switch Q2 is electrically connected to the power supply 120. The controller 141 is electrically connected to the control terminal of the detection switch Q1, the reference resistor RS, and the control terminal

of the power switch Q2 respectively, and is configured to acquire a first voltage value V1 at the first terminal of the reference resistor RS and a second voltage value V2 at the second terminal of the reference resistor RS, determine the temperature of the heating element 110 according to the first voltage value V1, the second voltage value V2 and the corresponding relationship, and output a pulse width modulation (PWM) signal to the power switch Q2 according to the temperature and the preset target temperature of the heating element 110.

[0041] The PWM signal is configured to control the power switch Q2 to periodically switch between the on and off states to maintain the actual temperature of the heating element 110 within the target temperature range. The controller 141 can change the output power of the power supply 120 by changing a duty cycle of the PWM signal, thereby regulating the temperature of the heating element 110, and determining the temperature of the heating element 110 according to the first voltage value V1, the second voltage value V2 and the corresponding relationship. When the temperature of the heating element 110 is lower than the preset target temperature, the PWM signal is regulated to increase the output power of the power supply 120 and increase the temperature of the heating element 110. When the temperature of the heating element 110 is higher than the preset target temperature, the PWM signal is regulated to reduce the output power of the power supply 120 and reduce the temperature of the heating element 110, thereby implementing the precise control of the temperature.

[0042] In an embodiment, the controller 141 is configured to control the detection switch Q1 to be turned on when the PWM signal controls the power switch Q2 to be in the off state, and acquire the first voltage value V1 and the second voltage value V2 to determine the temperature of the heating element 110.

[0043] When the power switch Q2 is turned on, the second voltage value V2 may be pulled up and cannot be detected. Therefore, it is necessary to perform the detection when the power switch Q2 is turned off. In order not to affect the normal atomization, the detection switch Q1 can be controlled to be turned on when the power switch Q2 is controlled by the PWM signal to be in the off state, thereby implementing the detection.

[0044] In an embodiment, the corresponding relationship is expressed as the following formulation:

$$T=K*V2\ (V1-V2)+b;$$

where, T represents the temperature of the heating element 110, K represents a preset temperature coefficient, V1 represents the first voltage value, V2 represents the second voltage value, and b represents a preset correction constant.

[0045] The temperature coefficient K and the correction constant *b* are preset by means of a pre-calibration and can be implemented in the production stage. Specifically, a plurality of temperature values of the heating element 110 in the heating process are measured, a first voltage value V1 and a second voltage value V2 corresponding to each temperature value are recorded, and the temperature coefficient K and the correction constant *b* are calculated according to the above relational expression, thereby implementing the presetting.

[0046] In an embodiment, as shown in FIG. 4, a control method for an aerosol generation device is provided. The aerosol generation device may include a heating element, a power supply, and a detection assembly. The heating element is configured to heat an aerosol-forming substrate to generate the aerosol. The detection assembly is electrically connected to the heating element and the power supply respectively.

[0047] The control method may include the following steps.

[0048] Step 401: an electrical parameter of the detection assembly is acquired.

[0049] Step 402: a temperature of the heating element is determined according to a preset corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element.

[0050] Step 403: electric energy provided by the power supply to the heating element is regulated according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the heating element within a target temperature range.

[0051] In an embodiment, the detection assembly may include a reference resistor. A first terminal of the reference resistor is electrically connected to the power supply, and a second terminal of the reference resistor is electrically connected to the heating element. A voltage value across the detection assembly may include a first voltage value at the first terminal of the reference resistor and a second voltage value at the second terminal of the reference resistor.

[0052] The step of determining the temperature of the heating element according to the preset corresponding relationship may include:

the temperature of the heating element is determined according to the first voltage value, the second voltage value and the corresponding relationship.

[0053] In an embodiment, the aerosol atomization device may further include a power switch. A first terminal of the power switch is connected to the heating element, and a second terminal of the power switch is electrically connected to the power supply.

[0054] The step of regulating the electric energy provided by the power supply to the heating element according to the temperature and the preset target temperature of the heating element may include:

a PWM signal is output to the power switch according to the temperature and the preset target temperature of the heating element.

[0055] The PWM signal is configured to control the power switch to periodically switch between on and off states to maintain the actual temperature of the heating

element within the target temperature range.

[0056] As shown in FIG. 5, in an embodiment, the detection assembly may further include a detection switch. A first terminal of the detection switch is electrically connected to the power supply, and a second terminal of the detection switch is electrically connected to the first terminal of the reference resistor.

[0057] Before acquiring the electrical parameter of the detection assembly, the control method may further include the following steps.

[0058] Step 501: it is determined whether the power switch is in the off state according to the PWM signal.

[0059] Step 502: when the power switch is in the off state, the detection switch is controlled to be turned on.

[0060] Step 503: when the power switch is in the on state, the detection switch is controlled to be turned off.

[0061] In an embodiment, the corresponding relationship is expressed as the following formulation:

$$T=K*V2\ (V1-V2)+b;$$

where T represents the temperature of the heating element, K represents the preset temperature coefficient, V1 represents the first voltage value, V2 represents the second voltage value, and b represents the preset correction constant.

[0062] For the specific limitations on the control method for the aerosol generation device, reference can be made to the limitations on the aerosol generation device above, which will not be repeated here.

[0063] It should be appreciated that, although the steps in the flow charts of FIG. 4 to FIG. 5 are displayed sequentially as indicated by arrows, these steps are not definitely executed sequentially in the order indicated by the arrows. Unless otherwise specified herein, there is no strict order limitation for the execution of these steps, and these steps may be executed in other orders. Moreover, at least part of the steps in FIGS. 4 to 5 may include multiple steps or multiple stages. These steps or stages are not definitely performed at the same time, but can be performed at different moments. The execution order of these steps or stages is not definitely sequential, but can be performed in turns or alternately with other steps or at least part of the steps or stages in other steps.

[0064] In an embodiment, as shown in FIG. 6, a control device 600 for an aerosol generation device is provided. The aerosol generation device may include a heating element, a power supply, and a detection assembly. The heating element is configured to heat an aerosol-forming substrate to generate aerosol. The detection assembly is electrically connected to the heating element and the power supply respectively.

[0065] The control device may include:

a parameter acquisition module 601, configured to acquire an electrical parameter of the detection assembly;

a temperature determination module 602, configured to determine a temperature of the heating element according to a preset corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element.

an electric energy regulation module 603, configured to regulate electric energy provided by the power supply to the heating element according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the heating element within the target temperature range.

[0066] For the specific limitations on the control device for the aerosol generation device, reference can be made to the limitations on the aerosol atomization device above, which will not be repeated here. The modules in the above-mentioned control device for the aerosol generation device may be implemented in whole or in part by software, hardware or a combination thereof. The above modules may be embedded in or independent of a processor in a computer device in the form of hardware, or may be stored in a memory in the computer device in the form of software, so that the processor can invoke and execute operations corresponding to the above modules. It should be noted that the division of modules in the embodiments of the present invention is schematic and is merely a logical function division. There may be other division modes in actual implementations.

[0067] In an embodiment, an aerosol atomization device is provided, which may include: a heating element, a power supply, a detection assembly, and a control assembly. The heating element is configured to heat an aerosol-forming substrate to generate aerosol. The power supply is electrically connected to the heating element. The detection assembly is electrically connected to the heating element and the power supply respectively. The control assembly may include a processor and a memory storing a computer program, and the processor, when executing the computer program, implements the following steps of:

acquiring an electrical parameter of the detection assembly;

determining a temperature of the heating element according to a preset corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element; and

regulating electric energy provided by the power supply to the heating element according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the heating element within a target temperature range.

[0068] In an embodiment, the processor, when executing the computer program, may further implement the

following step of:
determining the temperature of the heating element according to the first voltage value, the second voltage value and the corresponding relationship.

[0069] In an embodiment, the processor, when executing the computer program, may further implement the following step of:
outputting a PWM signal to the power switch according to the temperature and the preset target temperature of the heating element. The PWM signal is configured to control the power switch to periodically switch between on and off states to maintain the actual temperature of the heating element within the target temperature range.

[0070] In an embodiment, the processor, when executing the computer program, may further implement the following steps of:

determining whether the power switch is in an off state according to the PWM signal; and
when the power switch is in the off state, controlling the detection switch to be turned on.

[0071] In an embodiment, a computer-readable storage medium is provided, on which a computer program is stored. The computer program, when executed by a processor, may cause the processor to implement the following steps of:

acquiring an electrical parameter of the detection assembly;
determining a temperature of the heating element according to a preset corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element; and
regulating electric energy provided by the power supply to the heating element according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the heating element within a target temperature range.

[0072] In an embodiment, the computer program, when executed by the processor, may cause the processor to further implement the following step of:
determining the temperature of the heating element according to the first voltage value, the second voltage value and the corresponding relationship.

[0073] In an embodiment, the computer program, when executed by the processor, may cause the processor to further implement the following step of:
outputting a PWM signal to the power switch according to the temperature and the preset target temperature of the heating element. The PWM signal is configured to control the power switch to periodically switch between on and off states to maintain the actual temperature of the heating element within the target temperature range.

[0074] In an embodiment, the computer program, when executed by the processor, may cause the processor to further implement the following steps of:

determining whether the power switch is in an off state according to the PWM signal; and
when the power switch is in the off state, controlling the detection switch to be turned on.

[0075] A person of ordinary skill in the art can understand that all or part of the processes in the above-mentioned embodiment methods can be implemented by instructing related hardware through a computer program. The computer program can be stored in a non-transitory computer-readable storage medium. When the computer program is executed, the processes in the above-mentioned method embodiments may be included. Any reference to memory, storage, database or other media used in the embodiments provided in the present application may include at least one of a non-transitory memory and a transitory memory. The non-transitory memory may include a Read-Only Memory (ROM), a magnetic tape, a floppy disk, a flash memory or an optical storage, etc. The transitory memory may include a Random Access Memory (RAM) or an external cache memory. By way of illustration and not limitation, the RAM may be in various forms, such as a static random access memory (SRAM) or a dynamic random access memory (DRAM), etc.

[0076] As shown in FIG. 7, in an embodiment, the aerosol generation device may be a heat-not-burn electronic cigarette, and the aerosol-forming substrate may be a solid aerosol-forming substrate 200. The solid aerosol-forming substrate 200 is inserted into the aerosol generation device and heated to generate aerosol for inhalation by a user.

[0077] As shown in FIG. 8, in an embodiment, the aerosol generation device may be configured to use a liquid aerosol-forming substrate for atomization. A liquid storage chamber 150 configured to receive the aerosol-forming substrate may be provided in the aerosol generation device, and the heating element may heat the aerosol-forming substrate in the liquid storage chamber to generate the aerosol for inhalation by the user.

[0078] In the description of the present application, the description with reference to terms such as "some embodiments", "other embodiments", "ideal embodiments", etc., means that the specific features, structures, materials or characteristics described in conjunction with the embodiments or examples are included in at least one embodiment or example of the present invention. In the present application, the illustrative descriptions of the above terms do not definitely refer to the same embodiment or example.

[0079] The technical features in the above embodiments may be arbitrarily combined. In order to make the description concise, all possible combinations of the technical features in the above embodiments are not described. However, as long as there is no contradiction in the combinations of these technical features, these com-

binations should be considered to be within the scope of the present application.

[0080] The above-described embodiments only express several implementation modes of the present invention, and the descriptions are relatively specific and detailed, but should not be construed as limiting the scope of the present invention. It should be noted that, those of ordinary skill in the art can make several modifications and improvements without departing from the concept of the present invention, and these all fall within the protection scope of the present invention. Therefore, the protection scope of the present invention should be subject to the appended claims.

Claims

1. An aerosol generation device, **characterized by** comprising:

   a heating element, configured to heat an aerosol-forming substrate to generate aerosol;
   a power supply electrically connected to the heating element;
   a detection assembly electrically connected to the heating element and the power supply respectively; and
   a control assembly, electrically connected to the detection assembly and configured to acquire an electrical parameter of the detection assembly, determine a temperature of the heating element according to a preset corresponding relationship, and regulate electric energy provided by the power supply to the heating element according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the heating element within a target temperature range, wherein the corresponding relationship refers to a corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element.

2. The aerosol generation device according to claim 1, wherein the detection assembly comprises a reference resistor and a detection switch;

   a first terminal of the detection switch is electrically connected to the power supply, a second terminal of the detection switch is electrically connected to a first terminal of the reference resistor, a control terminal of the detection switch is electrically connected to the control assembly;
   a second terminal of the reference resistor is electrically connected to the heating element, the electrical parameter is a voltage value across the reference resistor; and
   the control assembly is configured to acquire a first voltage value at the first terminal of the reference resistor and a second voltage value at the second terminal of the reference resistor, and determine the temperature of the heating element according to the first voltage value, the second voltage value and the corresponding relationship, and is further configured to control the detection switch to be turned on or off to implement turn-on or turn-off of a detection mode.

3. The aerosol generation device according to claim 2, wherein the control assembly comprises:

   a power switch, wherein a first terminal of the power switch is connected to the heating element, and a second terminal of the power switch is electrically connected to the power supply; and
   a controller, electrically connected to the control terminal of the detection switch, the reference resistor, and the control terminal of the power switch respectively, and configured to acquire a first voltage value at the first terminal of the reference resistor and a second voltage value at the second terminal of the reference resistor, determine the temperature of the heating element according to the first voltage value, the second voltage value and the corresponding relationship, and output a pulse width modulation (PWM) signal to the power switch according to the temperature and the preset target temperature of the heating element, wherein the PWM signal is configured to control the power switch to periodically switch between on and off states to maintain the actual temperature of the heating element within the target temperature range.

4. The aerosol generation device according to claim 3, wherein the controller is configured to control the detection switch to be turned on when the PWM signal controls the power switch to be in the off state, and acquire the first voltage value and the second voltage value to determine the temperature of the heating element.

5. The aerosol generation device according to claim 3, wherein the corresponding relationship is expressed as the following formulation:

$$T=K*V2\ (V1-V2)+b,$$

   where T represents the temperature of the heating element, K represents a preset temperature coefficient, V1 represents the first voltage value, V2 represents the second voltage value, and b represents a preset correction constant.

6. A control method for an aerosol generation device, the aerosol generation device comprising a heating element, a power supply and a detection assembly, the heating element being configured to heat an aerosol-forming substrate to generate aerosol, the detection assembly being electrically connected to the heating element and the power supply respectively; the control method comprising:

   acquiring an electrical parameter of the detection assembly;
   determining a temperature of the heating element according to a preset corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element;
   regulating electric energy provided by the power supply to the heating element according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the heating element within a target temperature range.

7. The control method according to claim 6, wherein the detection assembly comprises a reference resistor, a first terminal of the reference resistor is electrically connected to the power supply, and a second terminal of the reference resistor is electrically connected to the heating element, and the electrical parameter of the detection assembly comprises a first voltage value at the first terminal of the reference resistor and a second voltage value at the second terminal of the reference resistor;
   wherein the determining the temperature of the heating element according to the preset corresponding relationship comprises:
   determining the temperature of the heating element according to the first voltage value, the second voltage value and the corresponding relationship.

8. The control method according to claim 7, wherein the aerosol atomization device further comprises a power switch, a first terminal of the power switch is connected to the heating element, and a second terminal of the power switch is electrically connected to the power supply;
   wherein the regulating the electric energy provided by the power supply to the heating element according to the temperature and the preset target temperature of the heating element comprises:

   outputting a PWM signal to the power switch according to the temperature and the preset target temperature of the heating element; and
   wherein the PWM signal is configured to control the power switch to periodically switch between on and off states to maintain the actual temperature of the heating element within the target temperature range.

9. The control method according to claim 8, wherein the detection assembly further comprises a detection switch, a first terminal of the detection switch is electrically connected to the power supply, and a second terminal of the detection switch is electrically connected to the first terminal of the reference resistor;
   wherein the control method further comprises:

   before acquiring the electrical parameter of the detection assembly,
   determining whether the power switch is in the off state according to the PWM signal; and
   controlling the detection switch to be turned on when the power switch is in the off state.

10. The control method according to claim 8 or 9, wherein the corresponding relationship is expressed as the following formulation:

$$T=K*V2\ (V1-V2)+b,$$

   where T represents the temperature of the heating element, K represents a preset temperature coefficient, V1 represents the first voltage value, V2 represents the second voltage value, and b represents a preset correction constant.

11. A control device for an aerosol generation device, the aerosol generation device comprising a heating element, a power supply, and a detection assembly, the heating element being configured to heat an aerosol-forming substrate to generate aerosol, the detection assembly being electrically connected to the heating element and the power supply respectively; the control device comprising:

   a parameter acquisition module, configured to acquire an electrical parameter of the detection assembly;
   a temperature determination module, configured to determine a temperature of the heating element according to a preset corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element; and
   an electric energy regulation module, configured to regulate electric energy provided by the power supply to the heating element according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the heating element within the target temperature range.

12. An aerosol atomization device, **characterized by**

comprising:

a heating element, configured to heat an aerosol-forming substrate to generate aerosol;
a power supply electrically connected to the heating element;
a detection assembly electrically connected to the heating element and the power supply respectively; and
a control assembly comprising a processor and a memory storing a computer program, wherein the processor, when executing the computer program, implements the steps of any one of claims 6 to 10.

13. A computer-readable storage medium, on which a computer program is stored, wherein the computer program, when executed by a processor, causes the processor to implement the steps of any one of claims 6 to 10.

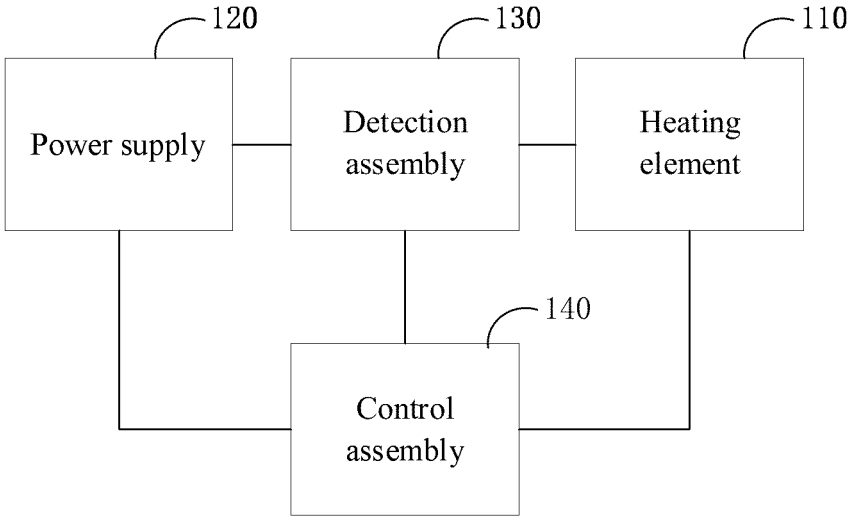
120
130
110
Power supply
Detection assembly
Heating element
140
Control assembly

FIG. 1

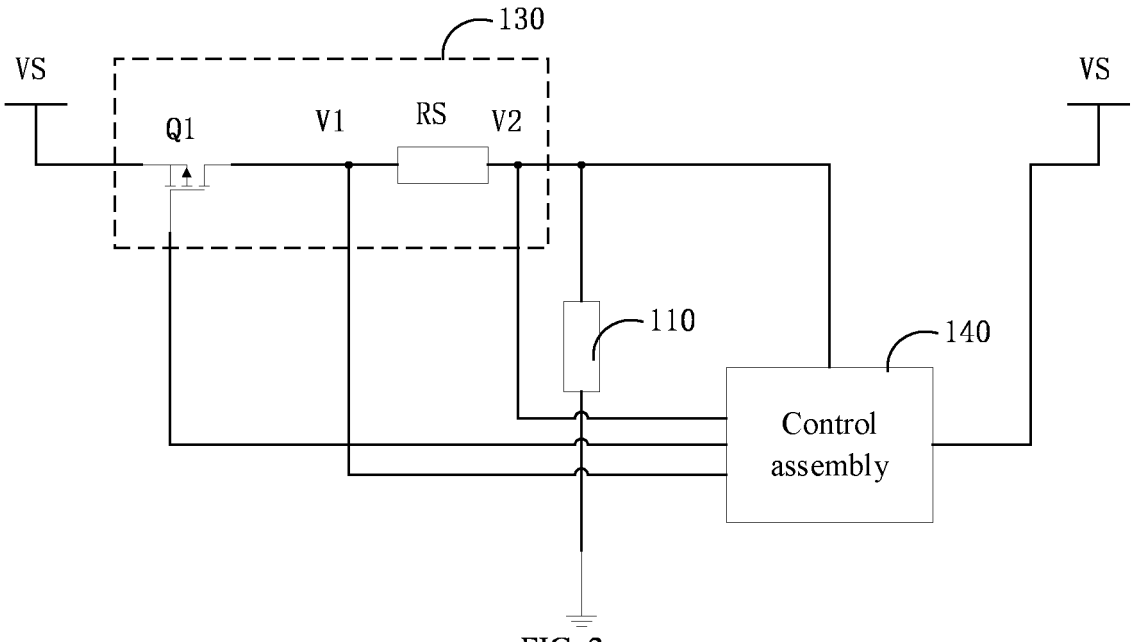
130
VS
VS
Q1
V1
RS
V2
110
140
Control assembly

FIG. 2

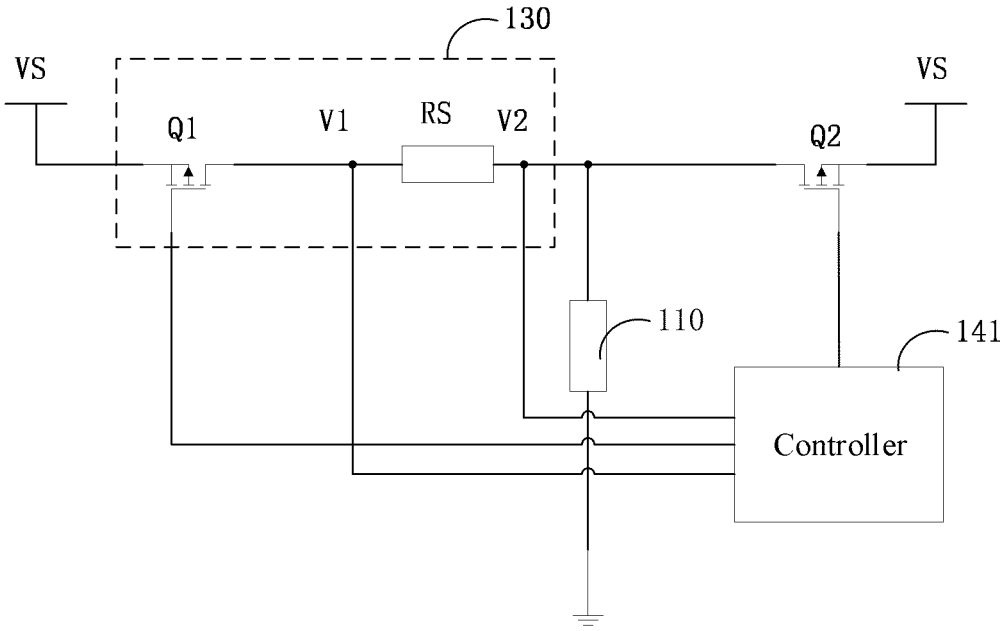
130
VS
VS
Q1
V1
RS
V2
Q2
110
141
Controller

FIG. 3

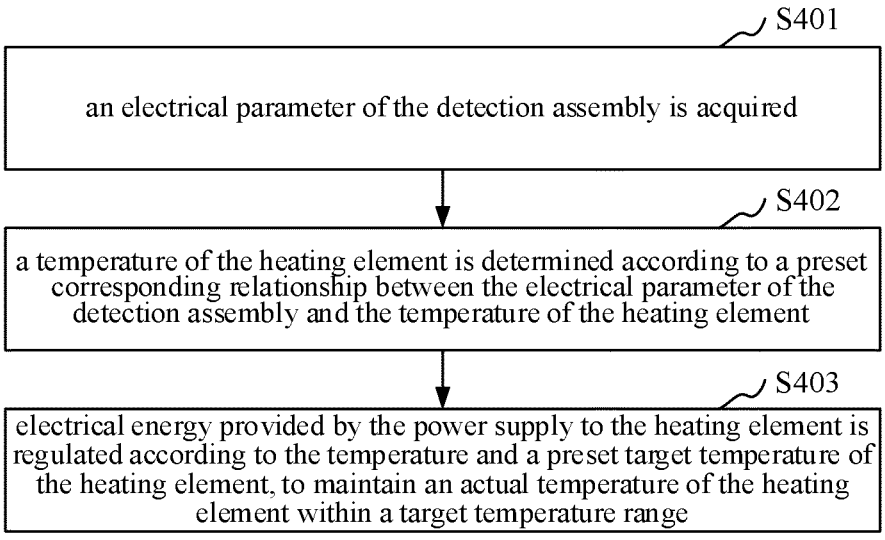
S401
an electrical parameter of the detection assembly is acquired
S402
a temperature of the heating element is determined according to a preset corresponding relationship between the electrical parameter of the detection assembly and the temperature of the heating element
S403
electrical energy provided by the power supply to the heating element is regulated according to the temperature and a preset target temperature of the heating element, to maintain an actual temperature of the heating element within a target temperature range

FIG. 4

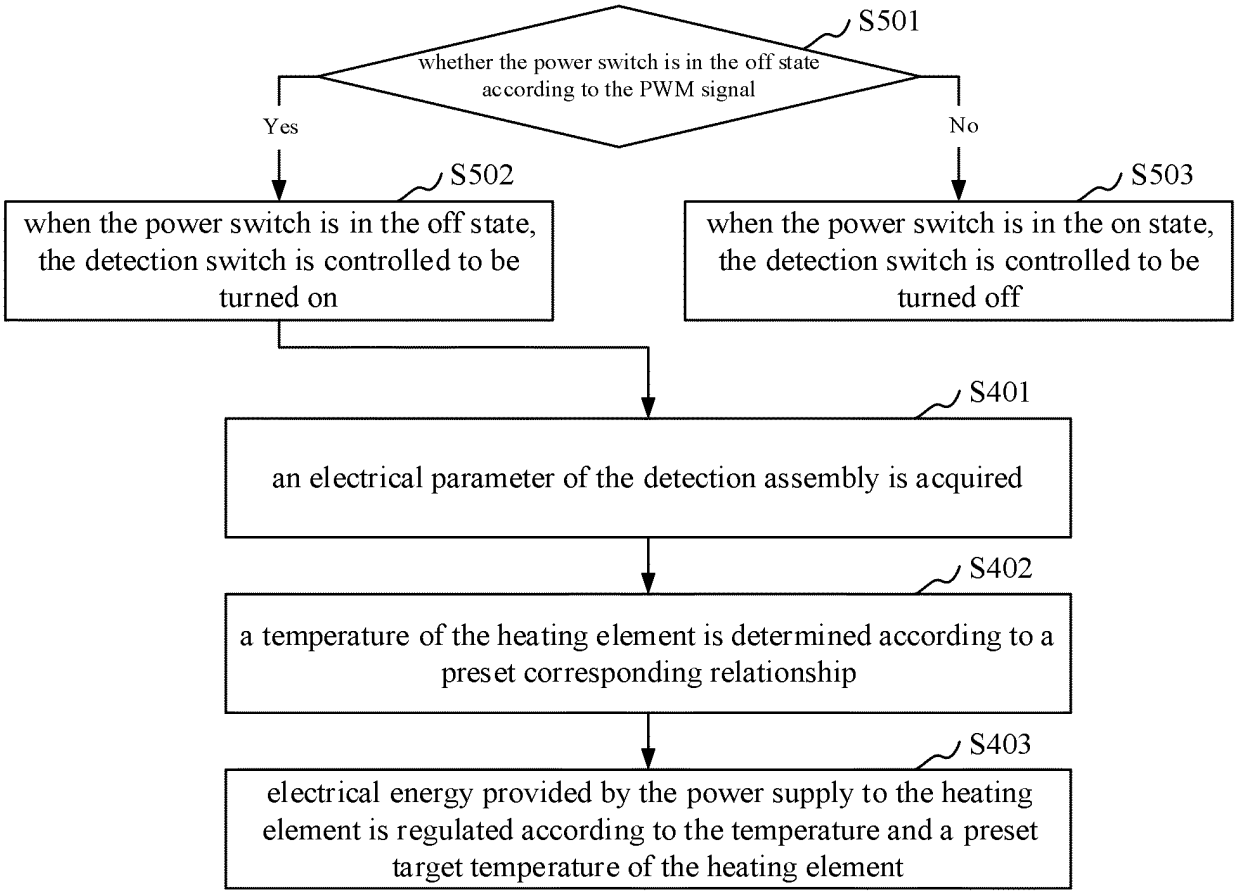
S501
whether the power switch is in the off state according to the PWM signal
Yes
No
S502
when the power switch is in the off state, the detection switch is controlled to be turned on
S503
when the power switch is in the on state, the detection switch is controlled to be turned off
S401
an electrical parameter of the detection assembly is acquired
S402
a temperature of the heating element is determined according to a preset corresponding relationship
S403
electrical energy provided by the power supply to the heating element is regulated according to the temperature and a preset target temperature of the heating element

FIG. 5

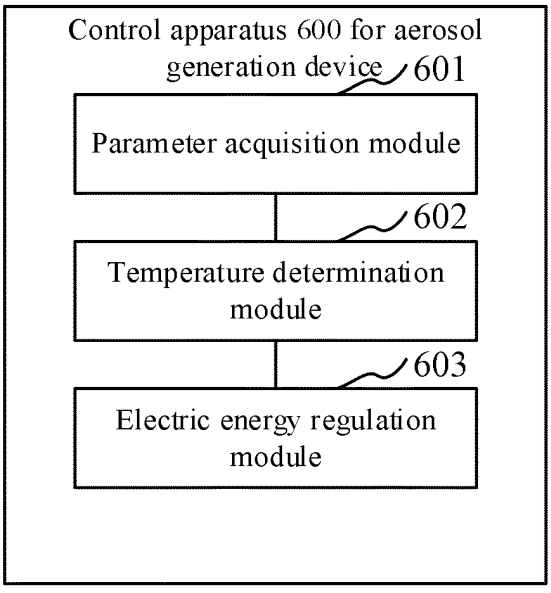
Control apparatus 600 for aerosol generation device
601
Parameter acquisition module
602
Temperature determination module
603
Electric energy regulation module

FIG. 6

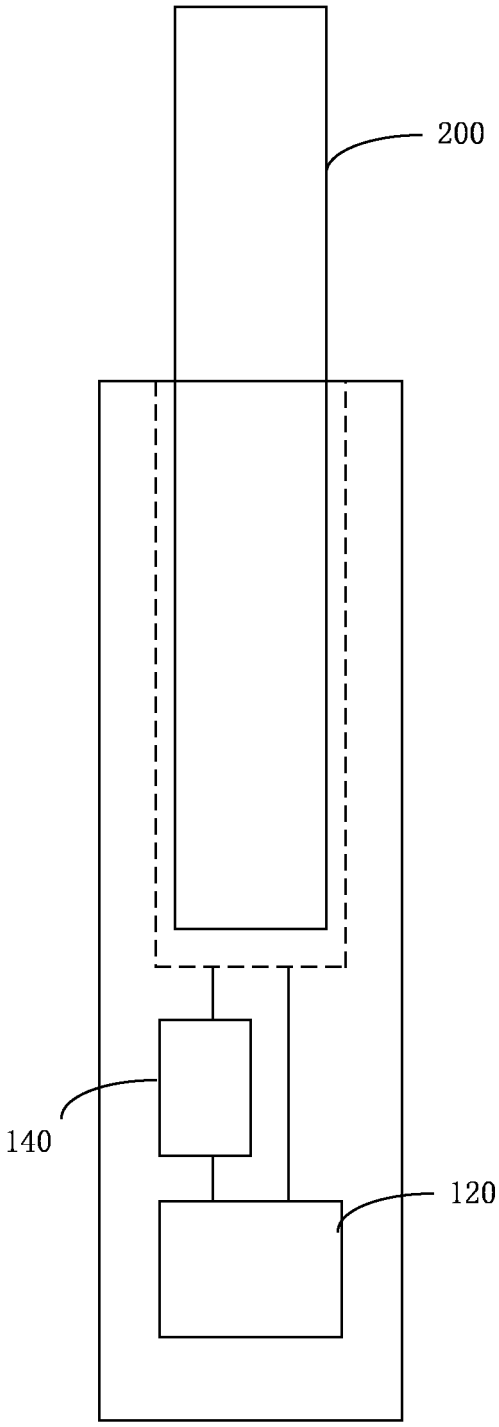

FIG. 7

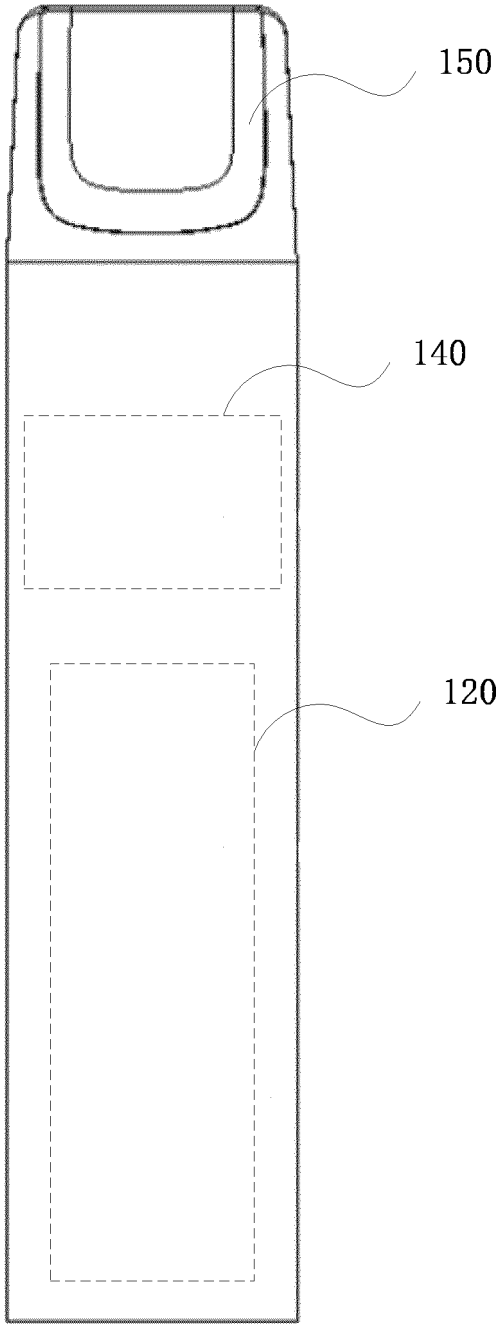

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/133129

A. CLASSIFICATION OF SUBJECT MATTER

A24F 40/57(2020.01)i; A24F 40/53(2020.01)i; A24F 40/40(2020.01)i

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 40/-; A24F 47/-

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)

CNTXT, ENTXTC, VEN: 电子烟, 雾化, 电阻, 参考, 采样, 电压, 温度, e-cigarette, atomiz+, resistance, reference, sampl+, voltage, temperature

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 114376275 A (SHENZHEN MAISHI TECHNOLOGY CO., LTD.) 22 April 2022 (2022-04-22) claims 1-13	1-13
X	CN 113508933 A (JAPAN TOBACCO INC.) 19 October 2021 (2021-10-19) description, paragraphs 0049-0119, and figures 1-10	1-13
X	CN 112704265 A (JAPAN TOBACCO INC.) 27 April 2021 (2021-04-27) description, paragraphs 0019-0127, and figures 1-7	1-13
X	CN 112704266 A (JAPAN TOBACCO INC.) 27 April 2021 (2021-04-27) description, paragraphs 0021-0121, and figures 1-7	1-13
X	CN 113349464 A (JAPAN TOBACCO INC.) 07 September 2021 (2021-09-07) description, paragraphs 0027-0080, and figures 1-6	1-13
X	JP 2021065220 A (JAPAN TOBACCO INC.) 30 April 2021 (2021-04-30) description, paragraphs 0010-0093, and figures 1-7	1-13
A	CN 214229854 U (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 21 September 2021 (2021-09-21) entire document	1-13

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"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
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 January 2023	**16 January 2023**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China**	
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/133129

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 208523769 U (HESTIA SHENZHEN BIOTECHNOLOGY CO., LTD.) 22 February 2019 (2019-02-22) entire document	1-13
A	CN 110074465 A (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 02 August 2019 (2019-08-02) entire document	1-13

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/133129

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	114376275	A	22 April 2022	None			
CN	113508933	A	19 October 2021	US	2021307406	A1	07 October 2021
				EP	3890433	A1	06 October 2021
				RU	2760406	C1	24 November 2021
				JP	6785391	B1	18 November 2020
CN	112704265	A	27 April 2021	US	2021120881	A1	29 April 2021
				JP	6667709	B1	18 March 2020
				RU	2747604	C1	11 May 2021
				EP	3813484	A1	28 April 2021
				KR	20210049001	A	04 May 2021
CN	112704266	A	27 April 2021	RU	2746988	C1	23 April 2021
				KR	20210049000	A	04 May 2021
				US	2022079246	A1	17 March 2022
				JP	6667708	B1	18 March 2020
				US	2021120882	A1	29 April 2021
				EP	3811799	A1	28 April 2021
CN	113349464	A	07 September 2021	JP	6899012	B1	07 July 2021
				RU	2753877	C1	24 August 2021
				US	2021274853	A1	09 September 2021
				EP	3874974	A1	08 September 2021
JP	2021065220	A	30 April 2021	None			
CN	214229854	U	21 September 2021	None			
CN	208523769	U	22 February 2019	WO	2019196517	A1	17 October 2019
CN	110074465	A	02 August 2019	None			

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 202210044758X **[0001]**