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

(57) An aerosol generation device, a control method therefor, a control device, and a storage medium. The aerosol generation device is used for providing an aerosol when sucked by a user, and the aerosol generation device comprises: a heating element (110), which is used for heating an aerosol forming substrate to generate an aerosol; a power supply (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 supply (120); and a control assembly (140), which is used for acquiring an electrical parameter of the detection assembly (130) and identify a sucking action of a user according to the electrical parameter of the detection assembly (130). The aerosol generation device is able to accurately detect a sucking action.

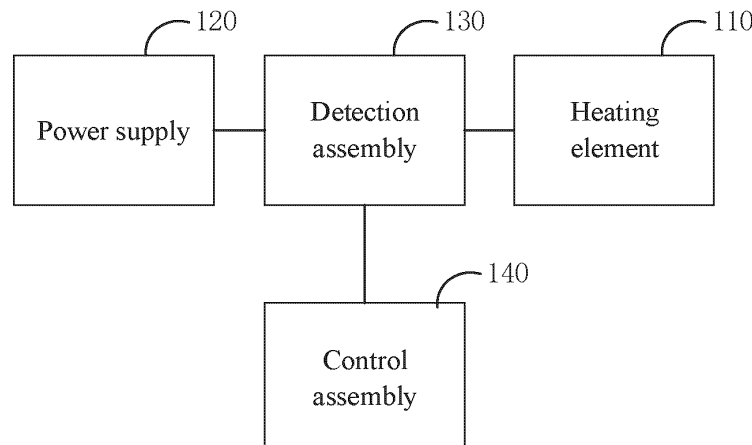


FIG. 1

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Description**CROSS-REFERENCE TO RELATED APPLICATION**

5 **[0001]** This application claims priority to Chinese Patent Application No. 202210044755.6, filed with the China National Intellectual Property Administration and entitled "Aerosol Generation Device, Control Method therefor, Control Device, and Storage Medium" on January 14, 2022, which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

10 **[0002]** The present invention relates to the field of atomization technology, and particularly to an aerosol generation device, a control method and a control apparatus thereof, and a storage medium.

BACKGROUND

15 **[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 the aerosol. For an aerosol generation device used for inhalation, a user inhales the aerosol generated by the aerosol generation device through an inhalation action.

20 **[0004]** Some aerosol generation devices used for inhalation are provided with a function of recording the number of times of inhalation, which can be used for analyzing usage habits, determining the remaining amount of the aerosol-forming substrate, etc. At present, a sensor is generally used for detecting whether the user performs an inhalation action by detecting the airflow, and counts are performed based on the detection results, but a special sensor needs to be provided to detect the inhalation action.

SUMMARY

25 **[0005]** 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 apparatus thereof, and a storage medium capable of accurately detecting the inhalation action.

30 **[0006]** An aerosol generation device is provided, for supplying an aerosol for inhalation by a user when the user inhales the aerosol through the aerosol generation device, the device includes:

35 a heating element, configured to heat an aerosol-forming substrate to generate the aerosol;
a power supply, electrically connected to the heating element and configured to output electric energy to the heating element to allow the heating element to generate heat;
a detection assembly, electrically connected to the heating element and the power supply;
a control assembly, electrically connected to the detection assembly, and configured to acquire an electrical parameter of the detection assembly and determine an inhalation action of the user according to the electrical
40 parameter of the detection assembly.

45 **[0007]** In an embodiment, the detection assembly is connected between the heating element and the power supply and is configured to divide a voltage value with the heating element, 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, and 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;
50 the electrical parameter includes voltage values at both terminals of 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 to identify the inhalation action according to changes in the first voltage value and the second voltage value, and is further configured to control the detection switch to be turned on or off to turn on or turn of a detection mode.
55

[0008] In an embodiment, the control assembly is configured to calculate an inhalation state quantity according to the first voltage value and the second voltage value, and determine that an inhalation action occurs at a current moment when an absolute value of a difference between the inhalation state quantity at the current moment and an inhalation state

quantity at a previous moment is greater than a preset threshold value.

[0009] In an embodiment, the inhalation state quantity is equal to a difference value between the first voltage value and the second voltage value multiplied by the second voltage value.

[0010] In an embodiment, the control assembly is further configured to update a record of the number of times of inhalation when determining that the inhalation action occurs.

[0011] In an embodiment, the aerosol generation device further includes:

a power switch, a first terminal of the power switch being connected to the heating element, a second terminal of the power switch being electrically connected to the power source, and a control terminal of the power switch being electrically connected to the control assembly;
the control assembly is configured to transmit a pulse width modulation (PWM) signal to control turn-on and turn-off of the power switch in a heating atomization mode, and is further configured to switch and control the turn-on of the power switch or the detection switch, to implement switching between the heating atomization mode and the detection mode.

[0012] A control method for an aerosol generation device is provided, the aerosol generation device is configured to provide an aerosol for inhalation by a user when the user inhales the aerosol through the aerosol generation device, 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 the aerosol, the detection assembly is electrically connected to the heating element and the power supply;

the control method includes:

acquiring an electrical parameter of the detection assembly;
determining an inhalation action of the user according to the electrical parameter of the detection assembly.

[0013] In an embodiment, the detection assembly is connected between the heating element and the power supply, and includes a reference resistor and a detection switch, a first terminal of the reference resistor is electrically connected to the power supply via the detection switch, 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 and a second voltage value at the second terminal of the reference resistor;

determining the inhalation action of the user according to changes in voltage values at both terminals of the detection assembly includes:

calculating an inhalation state quantity according to the first voltage value and the second voltage value;
determining whether an absolute value of a difference between an inhalation state quantity at a current moment and an inhalation state quantity at a previous moment is greater than a preset threshold value;
determining that the inhalation action occurs at the current moment when the absolute value is greater than the preset threshold value.

[0014] In an embodiment, the inhalation state quantity is equal to a difference value between the first voltage value and the second voltage value multiplied by the second voltage value.

[0015] In an embodiment, the control method further includes:

updating a record of the number of times of inhalation when determining that the inhalation action occurs.

[0016] A control apparatus for an aerosol generation device is provided, the aerosol generation device is configured to provide the aerosol for inhalation by a user when the user inhales the aerosol through the aerosol generation device, 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 the aerosol, the detection assembly is electrically connected to the heating element and the power supply;

the control apparatus includes:

a parameter acquisition module, configured to acquire an electrical parameter of the detection assembly;
an inhalation action determination module, configured to determine an inhalation action of the user according to the electrical parameter of the detection assembly.

[0017] An aerosol generation device is provided, for supplying an aerosol for inhalation by a user when the user inhales the aerosol through the aerosol generation device, the aerosol generation device includes:

a heating element, configured to heat an aerosol-forming substrate to generate the aerosol;
a power source, electrically connected to the heating element, and configured to output electric energy to the heating

element to allow the heating element to generate heat;
a detection assembly, electrically connected to the heating element and the power supply;
a controller including a processor and a memory storing a computer program, the processor, when executing the
computer program, implements the steps of
5 acquiring voltage values at both terminals of the detection assembly;
determining an inhalation action of the user according to changes in the voltage values at the both terminals of the
detection assembly.

[0018] A computer-readable storage medium is provided, on which a computer program is stored. The computer
10 program, when executed by a processor, causes the processor to implement the steps of:

acquiring voltage values at both terminals of the detection assembly;
determining an inhalation action of the user according to changes in the voltage values at the both terminals of the
detection assembly.

[0019] In the above-mentioned aerosol generation device, control method and control apparatus 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. As the heating duration
20 increases, the heating temperature of the heating element tends to be stable, and the resistance value of the heating
element also tends to be stable. When the user inhales the aerosol through the aerosol generation device, the heat of the
heating element may decrease, causing the resistance value of the heating element to decrease. Therefore, it can be
determined whether the user performs the inhalation action according to the electrical parameter of the detection
assembly, thereby accurately detecting the inhalation action to implement accurate counting of the number of times of
25 inhalation, and the cost is lower.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] In order to describe the technical solution in the embodiments of the present invention or in the conventional
30 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
40 of the present invention.

FIG. 4 is a flow chart of a control method for an aerosol generation device according to an embodiment of the present
invention.

FIG. 5 is a structural block diagram of a control apparatus for an aerosol generation device according to an
embodiment of the present invention.

FIG. 6 is a schematic structure diagram of an aerosol generation device according to an embodiment of the present
45 invention.

FIG. 7 is a schematic structure diagram of an aerosol generation device according to another embodiment of the
present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0021] 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
55 to the embodiments described herein. Rather, these embodiments are provided to make the disclosure of the present
application more thorough and comprehensive.

[0022] Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly
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.

[0023] 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 assembly feature.

[0024] 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.

[0025] 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, assemblies, parts or combinations thereof, but do not exclude the possibility of the presence or addition of one or more other features, wholes, steps, operations, assemblies, parts or combinations thereof. Meanwhile, the term "and/or" used in the description includes any and all combinations of the relevant listed items.

[0026] As shown in FIG. 1, in an embodiment of the present invention, an aerosol generation device is provided, and the aerosol generation device is configured to provide an aerosol for inhalation by a user when the user inhales the aerosol through the aerosol generation device. The aerosol generation device includes a heating element 110, a power supply 120, a detection assembly 130, and a control assembly 140.

[0027] The heating element 110 is configured to heat the aerosol-forming substrate to generate the aerosol. The power supply 120 is electrically connected to the heating element 110, and is configured to supply 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. 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, and identify an inhalation action of the user according to the electrical parameter of the detection assembly 130.

[0028] 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 causing the electrical parameter of the detection assembly 130 electrically connected to the heating element to change. As the heating duration of the heating element 110 increases, the heating temperature tends to be stable, and thus the resistance value of the heating element 110 also tends to be stable. When the user inhales the aerosol through the aerosol generation device, the heat of the heating element 110 may decrease, which also causes the decrease of the resistance value of the heating element 110. Accordingly, it is possible to determine whether the user performs the inhalation according to the electrical parameter of the detection assembly, so that the inhalation action can be accurately detected.

[0029] In an embodiment, the electrical parameter of the detection assembly 130 may be the resistance value, a voltage value across both terminals of the detection assembly 30, a power, a current, etc. In the embodiment of the present invention, the voltage value across both terminals of the detection assembly 130 is taken as an example for illustration.

[0030] In an embodiment, the control assembly 140 may control the 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 continuous output, so that the heating element 110 is maintained at a temperature for stabilizing the atomization or generating the aerosol. It should be appreciated that the power supply 120 also has another connection path with the heating element 110, and when no detection is required, the power supply 120 supplies power to the heating assembly through this path.

[0031] The resistance value of the heating element 110 may change with the temperature. When the temperature rises, the resistance value of the heating element 110 also increases. The control assembly 140 can keep the resistance value of the detection assembly 130 unchanged by limiting a power-on duration of the detection assembly 130. Based on the voltage value division principle, the temperature change of the heating element 110 can be reflected by detecting the voltage value changes at both terminals of the assembly 130. When the temperature suddenly changes, it can be determined that the user performs an inhalation action on the aerosol generation device.

[0032] It should be noted that, in FIG. 1, the specific electrical connection mode of the detection assembly 130, the heating element 110 and the power supply 120 is that the detection assembly 130 is connected between the heating element 110 and the power supply 120. In this case, a voltage value at a terminal of the detection assembly 130 connected to the power supply 120 characterizes a magnitude of the voltage value of the power supply 120, and a voltage value at a terminal of the detection assembly 130 connected to the heating element 110 depends on the resistance value of the heating element 110 and the resistance value of the detection assembly 130. In some other embodiments, the electrical connection mode of the detection assembly 130, the heating element 110 and the power supply 120 may be that the heating element 110 is connected between the detection assembly 130 and the power supply 120. In this case, although the electrical connection mode is different, the voltage value across the detection assembly 130 still depends on the magnitude of the voltage value of the power supply 120, the resistance value of the heating element 110, and the resistance value of the detection assembly 130. It should be appreciated that the connection mode of the heating element

110 and the detection assembly 130 may also be other modes that can form a voltage value division structure.

[0033] In the above-mentioned aerosol generation device, the detection assembly 130 is electrically connected to the power supply 120 and the heating element 110. As the heating duration of the heating element 110 increases, the heating temperature tends to be stable, and thus the temperature of the heating element 110 also tends to be stable. When the user inhales the aerosol through the aerosol generation device, the heat of the heating element 110 decreases, which causes the decrease of the resistance value of the heating element 110. Accordingly, it can be determined whether the user performs the inhalation according to the voltage value changes at both terminals of the detection assembly 130, thereby accurately detecting the inhalation action to implement accurate counting of the number of times of inhalation. In addition, the addition of the sensor may increase the cost of the aerosol generation device and the circuit design may be more complicated. While in the embodiment of the present invention, the identification of the inhalation action can be implemented by only arranging the detection assembly 130 between the heating element 110 and the power supply 120, the circuit design is simple, and the cost of the aerosol generation device is reduced as well.

[0034] As shown in FIG. 2, in an embodiment, the detection assembly 130 is connected between the heating element 110 and the power supply 120. 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, a second terminal of the detection switch Q1 is electrically connected to a first terminal of the reference resistor RS, 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 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 identify an inhalation action according to changes in the first voltage value V1 and the second voltage value V2. The control assembly 140 is further configured to control the detection switch Q1 to be turned on or off to implement turn-on or turn-off the detection mode.

[0035] The voltage value outputted by the power supply 120 is represented as VS. In the embodiment, the electrical parameter of the detection assembly 130 may include voltage values at both terminals of the reference resistor RS. When detection is required, the control assembly 140 controls the detection switch Q1 to be turned on, and the power supply 120 supplies power to the reference resistor RS and the heating element 110 connected in series. In this process, the control assembly 140 acquires the voltage values at both terminals of the reference resistor RS, that is, 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 in a relatively stable voltage value range. 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. Accordingly, whether an inhalation action occurs can be identified by the changes in the first voltage value V1 and the second voltage value V2. 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. After maximum and minimum values of the first voltage values V1 and the second voltage values V2 are filtered out, an average value of the first voltage values V1 and an average value of the second voltage values V2 are finally adopted to determine whether the inhalation action occurs, thereby reducing the detection error and improving the accuracy of the identification.

[0036] 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 V1 are used together to identify the inhalation action, the accuracy of the identification can still be guaranteed.

[0037] When the detection mode needs to be turned off, the control assembly 140 controls the detection switch Q1 to be turned off, so that the branch where the reference resistor RS is located is cut off. At the moment, the power supply 120 supplies power to the heating element 110 through another branch.

[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).

[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] In an embodiment, the control assembly 140 controls the detection switch Q1 to be turned on for a preset duration according to the preset period. The detection switch Q1 is controlled to be turned off when the turn-on duration reaches a preset duration. The control assembly 140 acquires the first voltage value V1 and the second voltage value V2 when the detection switch Q1 is turned on. As an example, the preset period may be 10 ms, and the preset duration may be 250 μ s.

[0041] In an embodiment, the control assembly 140 is configured to calculate an inhalation state quantity according to the first voltage value V1 and the second voltage value V2, and determine that the inhalation action occurs when an absolute value of a difference between an inhalation state quantity at a current moment and an inhalation state quantity at a previous moment is greater than a preset threshold value.

[0042] The suction state quantity is a physical quantity for characterizing changes in the voltage values at both terminals

of the reference resistor RS. The preset threshold value is a reference value reflecting changes in the voltage values at both terminals of the reference resistor RS when no inhalation action occurs and the heating element 110 is in a heating state. If the inhalation action is directly determined according to the first voltage value V1 and the second voltage value V2, there may exist a large error, and due to the power of the power supply 120 or other reasons, the first voltage value V1 and the second voltage value V2 may have abnormal changes. Accordingly, it is possible to calculate the inhalation state quantity according to the first voltage value V1 and the second voltage value V2, and calculate the absolute value of the difference between the inhalation state quantity at the current moment and the inhalation state quantity at the previous moment. When the absolute value of the difference between the inhalation state quantities is greater than the preset threshold value, it is determined that an inhalation action occurs at the current moment. For example, the inhalation state quantity may be a difference value between the first voltage value V1 and the second voltage value V2, or a change rate of the difference value between the first voltage value V1 and the second voltage value V2. It should be appreciated that the current moment and the previous moment refer to two consecutive detection moments, but do not necessarily have continuity in time. As an example, the preset threshold value may be equal to 0.08.

[0043] In an embodiment, the inhalation state quantity is equal to the difference value between the first voltage value V1 and the second voltage value V2 multiplied by the second voltage value V2. As an example, assuming that the inhalation state quantity is K, and $K=V2(V1-V2)$.

[0044] Table 1 shows an embodiment, in an inhalation period, the inhalation state quantity K is calculated by the MCU according to the collected first voltage value V1 and second voltage value V2, and the absolute value ΔK of the difference between the inhalation state quantities at two adjacent moments changes with time.

Table 1

t(s)	V1	V2	$K=V2(V1-V2)$	$\Delta K= K_t-K(t-1) $
0	1.250V	1.160V	0.1125	0
1	1.249V	1.155V	0.1086	0.0039
2	1.250V	1.149V	0.1160	0.0074
3	3.016V	2.909V	0.3113	0.1953
4	1.439V	1.328V	0.1474	0.1639
5	1.268V	1.166V	0.1189	0.0285
6	1.241V	1.150V	0.1047	0.0142
7	1.247V	1.156V	0.1052	0.0005
8	1.248V	1.157V	0.1053	0.0001

[0045] Specifically, when no inhalation action occurs, ΔK is stabilized below a preset reference value, such as 0.01. And after one inhalation action occurs, the resistance value of the heating element may gradually increase as heating up and return to a steady-state value, during which ΔK may remain greater than the preset reference value. Therefore, after it is determined that the inhalation action occurs, it is determined that the inhalation action occurs again only when ΔK increases again to exceed the preset threshold value after the ΔK is identified to be lower than the preset reference value, and then it is determined that the inhalation action occurs again. For example, in Table 1, at $t=3$, ΔK exceeds the preset threshold value of 0.08, and it is determined that an inhalation action occurs; at $t=4$, ΔK is still greater than the preset threshold value of 0.08, but the resistance value of the heating element changes continuously, so that it cannot be determined that the inhalation action occurs for the second time. After $t=7$, if it is identified that ΔK exceeds the preset threshold value of 0.08 again, then it is determined that the inhalation action occurs again.

[0046] In an embodiment, the control assembly 140 is further configured to update the record of the number of times of inhalation when it is determined that an inhalation action occurs.

[0047] When determining that the inhalation action occurs, the control assembly 140 adds 1 to the number of times of inhalation and update the record of the number of times of inhalation.

[0048] As shown in FIG. 3, in an embodiment, the aerosol generation device may further include a power switch Q2. A first terminal of the power switch Q2 is connected to the heating element 110, a second terminal of the power switch Q2 is electrically connected to the power supply 120, and a control terminal of the power switch Q2 is electrically connected to the control assembly 140. The control assembly 140 is configured to transmit a PWM signal to control turn-on and turn-off of the power switch Q2 in a heating atomization mode, and is further configured to switch and control the power switch Q2 or the detection switch Q1 to be turned on, to implement the switching between the heating atomization mode and the detection mode.

[0049] The control assembly 140 controls the turn-on and turn-off of the power switch Q2 by transmitting a PWM signal, to implement the power control of the heating element 110, i.e., the temperature control of the heating element 110. When the aerosol generation device is in the turned-on state or triggered to heat, the control assembly 140 outputs a PWM signal to the power switch Q2 to control the turn-on or turn-off of the power switch Q2, to regulate the power outputted to the heating element 110 and implement the temperature control. Specifically, the temperature control can be performed according to a preset temperature curve. When it is necessary to switch to the detection mode to detect the inhalation action, the control assembly 140 controls the power switch Q2 to be turned off, and controls the detection switch Q1 to be turned on. After the detection is completed, the control assembly 140 controls the detection switch Q1 to be turned off, and continues to control the operation of the power switch Q2 by transmitting a PWM signal.

[0050] In the embodiment, it is possible to flexibly switch between the detection mode and the heating atomization mode, thereby avoiding affecting the normal operation of the aerosol generation device due to the detection.

[0051] As shown in FIG. 4, in the embodiment of the present invention, a control method for an aerosol generation device is further provided, which is applied to the control assembly for the aerosol generation device as an example for description. The control method may include the following steps.

[0052] Step 410: an electrical parameter of a detection assembly is acquired.

[0053] Step 420: an inhalation action of a user is determined according to the electrical parameter of the detection assembly.

[0054] In an embodiment, the detection assembly is connected between the heating element and the power supply. The detection assembly may include a reference resistor and a detection switch. A first terminal of the reference resistor is electrically connected to the power supply via the detection switch, and a second terminal of the reference resistor is electrically connected to the heating element. The voltage values at both terminals of the detection assembly includes a first voltage value at the first terminal and a second voltage value at the second terminal of the reference resistor.

[0055] In an embodiment, the step of determining the inhalation action of the user according to the changes in the voltage values at both terminals of the detection assembly may include:

an inhalation state quantity is calculated according to the first voltage value and the second voltage value;
it is determined whether an absolute value of a difference between an inhalation state quantity at a current moment and an inhalation state quantity at a previous moment is greater than a preset threshold value;
when the absolute value is greater than the preset threshold value, it is determined that the inhalation action occurs at the current moment.

[0056] In an embodiment, the inhalation state quantity may be equal to the difference value between the first voltage value and the second voltage value multiplied by the second voltage value.

[0057] In an embodiment, the control method may further include:

when it is determined that the inhalation action occurs, a record of the times of inhalation is updated.

[0058] 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.

[0059] It should be appreciated that, although the steps in the flow chart of FIG. 4 are displayed sequentially as indicated by the 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 FIG. 4 may include multiple steps or multiple stages. These steps or stages are not definitely executed at the same time, but can be executed at different moments. The execution order of these steps or stages is not definitely sequential, but can be executed in turns or alternately with other steps or at least part of the steps or stages in other steps.

[0060] In an embodiment, as shown in FIG. 5, a control apparatus 500 for an aerosol generation device is provided. The control apparatus may include:

a parameter acquisition module 510 configured to acquire an electrical parameter of the detection assembly;
an inhalation action determination module 520 configured to determine an inhalation action of a user according to the electrical parameter of the detection assembly.

[0061] In an embodiment, the inhalation action determination module 520 may include:

a calculation unit, configured to calculate an inhalation state quantity according to a first voltage value and a second voltage value;
a determination unit, configured to determine whether an absolute value of a difference between an inhalation state quantity at a current moment and an inhalation state quantity at a previous moment is greater than a preset threshold value;

an inhalation determination unit, configured to determine that the inhalation action occurs at the current moment when the absolute value of the difference between the inhalation state quantity at the current moment and the inhalation state quantity at the previous moment is greater than the preset threshold value.

[0062] In an embodiment, the control apparatus may further include:

a counting module configured to update a record of the number of times of inhalation when it is determined that the inhalation action occurs.

[0063] For the specific limitations on the control apparatus for the aerosol generation device, reference can be made to the limitations on the aerosol generation device above, which will not be repeated here. Modules in the above control apparatus can be fully or partially implemented 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 a 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 exist other division modes in actual implementations.

[0064] In an embodiment, an aerosol generation device is provided. The aerosol generation device is configured to provide an aerosol when the user inhales the aerosol through the aerosol generation device. The aerosol generation device may include:

a heating element configured to heat an aerosol-forming substrate to generate the aerosol;
a power supply electrically connected to the heating element;
a detection assembly electrically connected to the heating element and the power supply;
a controller including a processor and a memory storing a computer program, in which the processor, when executing the computer program, may implement the following steps of:

acquiring an electrical parameter of the detection assembly;
determining an inhalation action of a user according to the electrical parameter of the detection assembly.

[0065] In an embodiment, the processor, when executing the computer program, may further implement the following steps of:

calculating an inhalation state quantity according to a first voltage value and a second voltage value;
determining whether an absolute value of a difference between an inhalation state quantity at a current moment and an inhalation state quantity at a previous moment is greater than a preset threshold value;
when the absolute value is greater than the preset threshold value, determining that the inhalation action occurs at the current moment.

[0066] In an embodiment, the processor, when executing the computer program, may further implement the following step of:

updating a record of the number of times of inhalation when determining that the inhalation action occurs.

[0067] 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 an inhalation action of a user according to the electrical parameter of the detection assembly.

[0068] In an embodiment, the computer program, when executed by the processor, may cause the processor to further implement the following steps of:

calculating an inhalation state quantity according to a first voltage value and a second voltage value;
determining whether an absolute value of a difference between an inhalation state quantity at a current moment and an inhalation state quantity at a previous moment is greater than a preset threshold value;
when the absolute value is greater than the preset threshold value, determining that the inhalation action occurs at the current moment.

[0069] In an embodiment, the computer program, when executed by the processor, may cause the processor to further implement the following step of:

updating a record of the number of times of inhalation when determining that the inhalation action occurs.

[0070] 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 are included. Any reference to memory, storage, database or other media used in the embodiments provided in the present invention may include at least one of non-transitory memory and 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).

[0071] As shown in FIG. 6, 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 the aerosol for inhalation by the user.

[0072] As shown in FIG. 7, 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 is provided in the aerosol generation device. The heating element heats the aerosol-forming substrate in the liquid storage chamber to generate the aerosol for inhalation by the user.

[0073] In the description of this specification, 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 description, the illustrative descriptions of the above terms do not definitely refer to the same embodiment or example.

[0074] 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 combinations should be considered to be within the scope of the present application.

[0075] 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, for supplying an aerosol for inhalation by a user when the aerosol generation device is inhaled by the user, the device comprising:

a heating element, configured to heat an aerosol-forming substrate to generate the aerosol;
a power supply, electrically connected to the heating element and configured to output electric energy to the heating element to allow the heating element to generate heat;
a detection assembly, electrically connected to the heating element and the power supply;
a control assembly, electrically connected to the detection assembly, and configured to acquire an electrical parameter of the detection assembly and determine an inhalation action of the user according to the electrical parameter of the detection assembly.

2. The aerosol generation device according to claim 1, wherein the detection assembly is connected between the heating element and the power supply and is configured to divide a voltage value with the heating element, and 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, and 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 comprises voltage values at both terminals of 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 to identify the inhalation action according to changes in the first voltage value and the second voltage value, and is further configured to control the detection switch to be turned on or off to turn on or turn off a detection mode.

3. The aerosol generation device according to claim 2, wherein the control assembly is configured to calculate an inhalation state quantity according to the first voltage value and the second voltage value, and determine that an inhalation action occurs at a current moment when an absolute value of a difference between the inhalation state quantity at the current moment and an inhalation state quantity at a previous moment is greater than a preset threshold value.
4. The aerosol generation device according to claim 3, wherein the inhalation state quantity is equal to a difference value between the first voltage value and the second voltage value multiplied by the second voltage value.
5. The aerosol generation device according to claim 3, wherein the control assembly is further configured to update a record of the number of times of inhalation when determining that the inhalation action occurs.
6. The aerosol generation device according to any one of claims 2 to 5, further comprising:
 - a power switch, wherein a first terminal of the power switch is connected to the heating element, a second terminal of the power switch is electrically connected to the power source, and a control terminal of the power switch is electrically connected to the control assembly;
wherein the control assembly is configured to transmit a pulse width modulation (PWM) signal to control turn-on and turn-off of the power switch in a heating atomization mode, and is further configured to switch and control the turn-on of the power switch or the detection switch, to implement switching between the heating atomization mode and the detection mode.
7. A control method for an aerosol generation device, the aerosol generation device being configured to provide the aerosol for inhalation by a user when inhaled by the user, 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 the aerosol, the detection assembly being electrically connected to the heating element and the power supply;
the control method comprising:
 - acquiring an electrical parameter of the detection assembly;
determining an inhalation action of the user according to the electrical parameter of the detection assembly.
8. The control method according to claim 7, wherein the detection assembly is connected between the heating element and the power supply, and comprises a reference resistor and a detection switch, a first terminal of the reference resistor is electrically connected to the power supply via the detection switch, 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 and a second voltage value at the second terminal of the reference resistor;
determining the inhalation action of the user according to changes in voltage values at both terminals of the detection assembly comprises:
 - calculating an inhalation state quantity according to the first voltage value and the second voltage value;
determining whether an absolute value of a difference between an inhalation state quantity at a current moment and an inhalation state quantity at a previous moment is greater than a preset threshold value;
determining that the inhalation action occurs at the current moment when the absolute value is greater than the preset threshold value.
9. The control method according to claim 8, wherein the inhalation state quantity is equal to a difference value between the first voltage value and the second voltage value multiplied by the second voltage value.
10. The control method according to claim 8, further comprising:
updating a record of the number of times of inhalation when determining that the inhalation action occurs.
11. A control apparatus for an aerosol generation device, the aerosol generation device being configured to provide the aerosol for inhalation by a user when inhaled by the user, 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 the aerosol, the detection assembly being electrically connected to the heating element and the power supply;

the control apparatus comprising:

a parameter acquisition module, configured to acquire an electrical parameter of the detection assembly;
an inhalation action determination module, configured to determine an inhalation action of the user according to
the electrical parameter of the detection assembly.

12. An aerosol generation device, for supplying an aerosol for inhalation by a user when the user inhales the aerosol through the aerosol generation device, the aerosol generation device comprising:

a heating element, configured to heat an aerosol-forming substrate to generate the aerosol;
a power source, electrically connected to the heating element, and configured to output electric energy to the heating element to allow the heating element to generate heat;
a detection assembly, electrically connected to the heating element and the power supply;
a controller comprising a processor and a memory storing a computer program, wherein the processor, when
executing the computer program, implements the steps of the method according to any one of claims 7 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 the method of any one of claims 7 to 10.

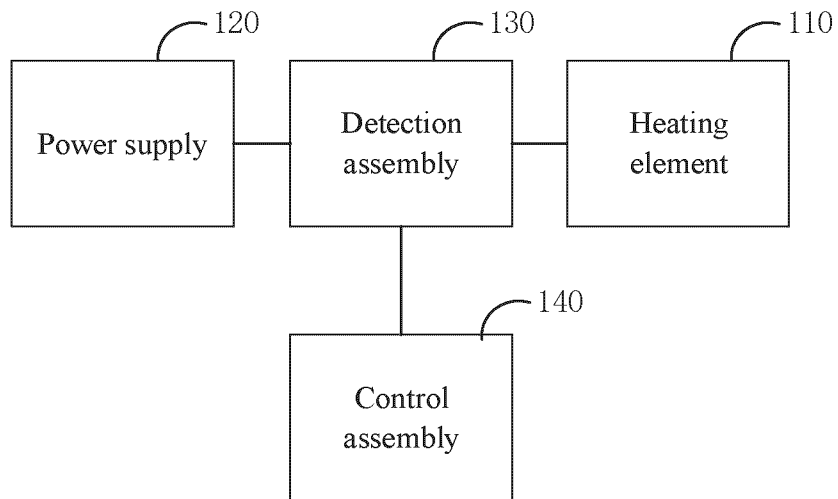


FIG. 1

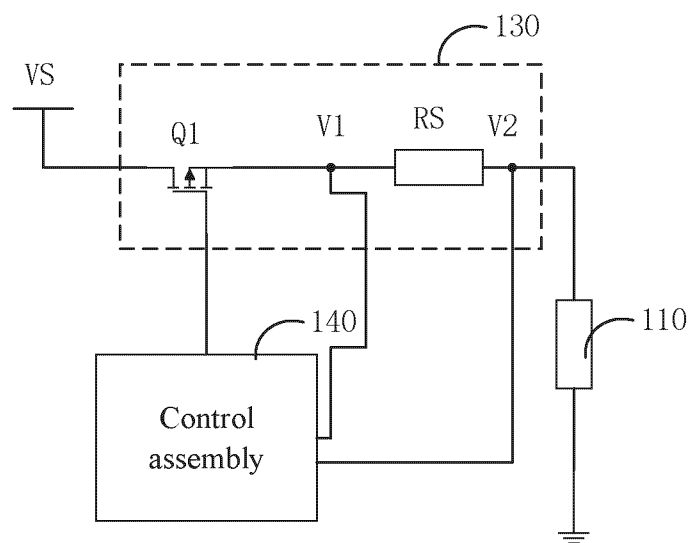


FIG. 2

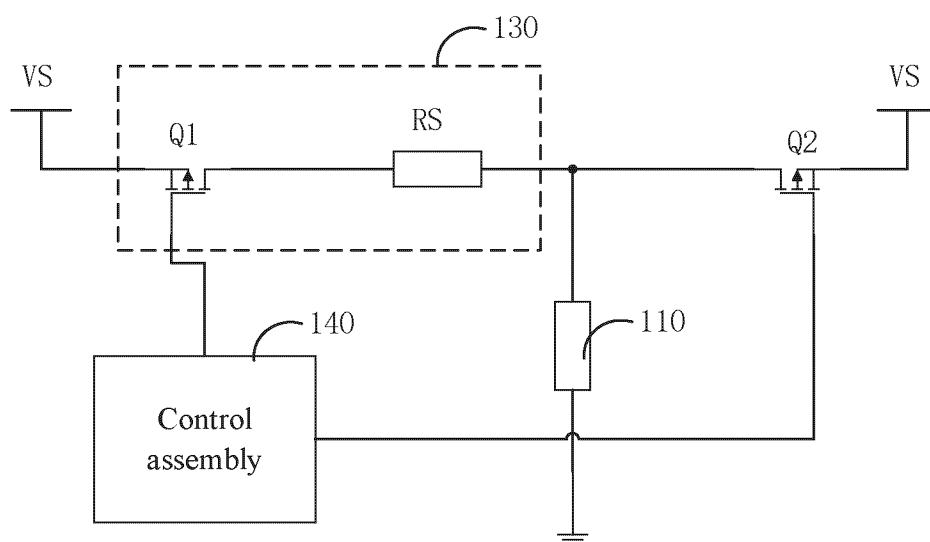


FIG. 3

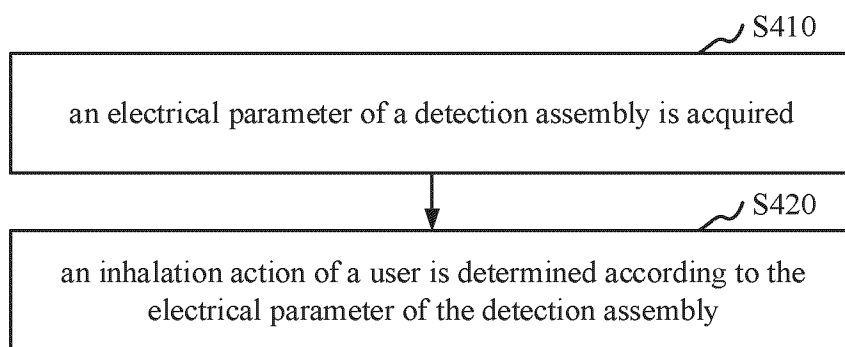


FIG. 4

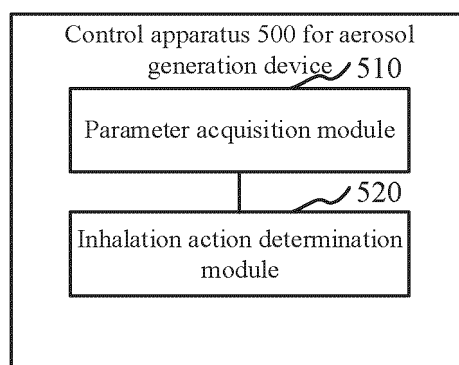


FIG. 5

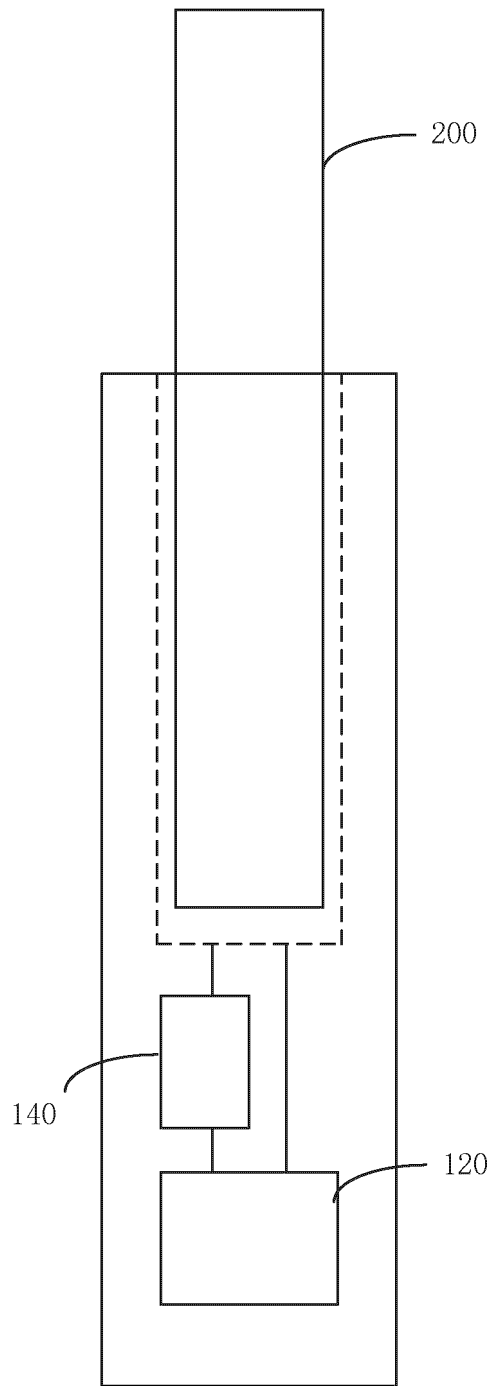


FIG. 6

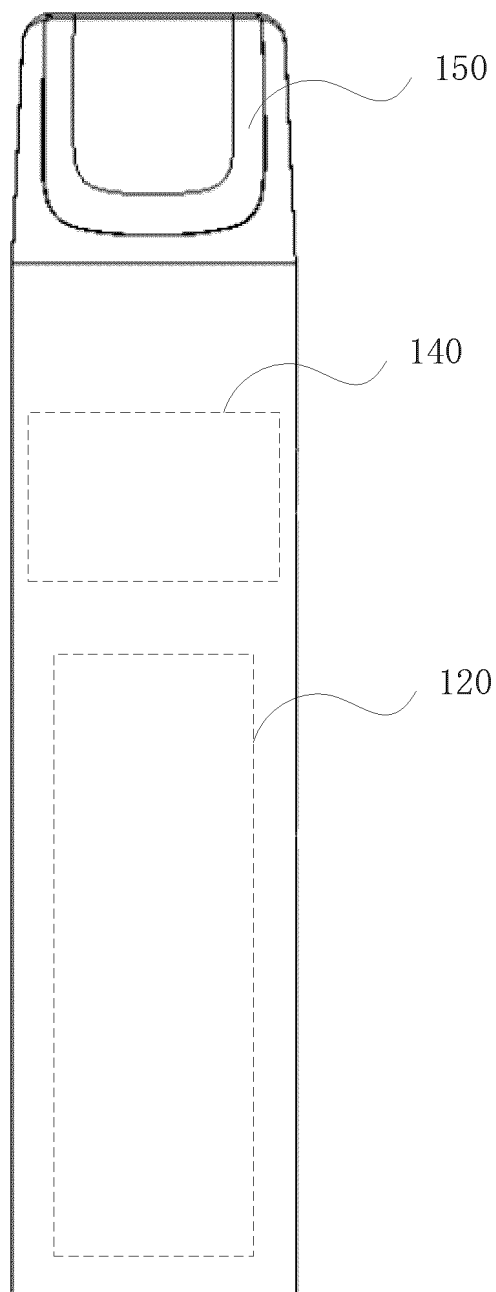


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/138393

5	A. CLASSIFICATION OF SUBJECT MATTER		
	A24F40/40(2020.01);A24F40/50(2020.01);A24F40/53(2020.01);A24F40/46(2020.01);		
	According to International Patent Classification (IPC) or to both national classification and IPC		
10	B. FIELDS SEARCHED		
	Minimum documentation searched (classification system followed by classification symbols) A24F40/-,A24F47/-(IPC)		
	Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNTXT, ENTXTC, VEN: 电子烟, 气溶胶, 加热, 电源, 电池, 检测, 电性参数, 电压, 抽吸, electronic cigarette, e-cigarette, aerosol, heat+, source, power, battery, detect+, electrical, parameter, voltage+, smok+		
20	C. DOCUMENTS CONSIDERED TO BE RELEVANT		
	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	PX	CN 114376274 A (SHENZHEN MAISHI TECHNOLOGY CO., LTD.) 22 April 2022 (2022-04-22) claims 1-13, description, paragraphs 0060-0135, and figures 1-7	1-13
25	X	CN 109907371 A (CHINA TOBACCO HENAN INDUSTRIAL CO., LTD.) 21 June 2019 (2019-06-21) description, paragraphs 0014-0027, and figures 1-6	1-13
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35	A	CN 113080525 A (SHENZHEN SMOORE TECHNOLOGY LTD.) 09 July 2021 (2021-07-09) entire document	1-13
	☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
40	* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "D" document cited by the applicant in the international application "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
45	Date of the actual completion of the international search 24 February 2023		Date of mailing of the international search report 28 February 2023
50	Name and mailing address of the ISA/CN China National Intellectual Property Administration (ISA/CN) China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088		Authorized officer
55	Facsimile No. (86-10)62019451		Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	US 2015189917 A1 (KIMREE HI-TECH INC.) 09 July 2015 (2015-07-09) entire document	1-13

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				AR	071040	A1	19 May 2010	
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