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(54) ELECTRONIC CIGARETTE CONTROL CIRCUIT, ELECTRONIC CIGARETTE, AND CONTROL METHOD FOR ELECTRONIC CIGARETTE

(57) An electronic cigarette control circuit, an electronic cigarette, and a control method for the electronic cigarette. The electronic cigarette control circuit is used for controlling the electronic cigarette, comprising at least an airflow sensor, a control module, switch units and heating elements. The airflow sensor is used for collecting an airflow signal and transmitting the airflow signal to the control module. The control module is used for comparing the airflow signal with a predetermined value and selecting, on the basis of the comparison result, to transmit a conduction signal to the switch units. The switch units are used for being conducted when the conduction signal is received to allow the heating elements to heat up. The heating elements are used for atomizing cigarette oil. The present invention provides the beneficial effects of enhanced user experience by allowing changes to smoking taste on the basis of exerted smoking strength.

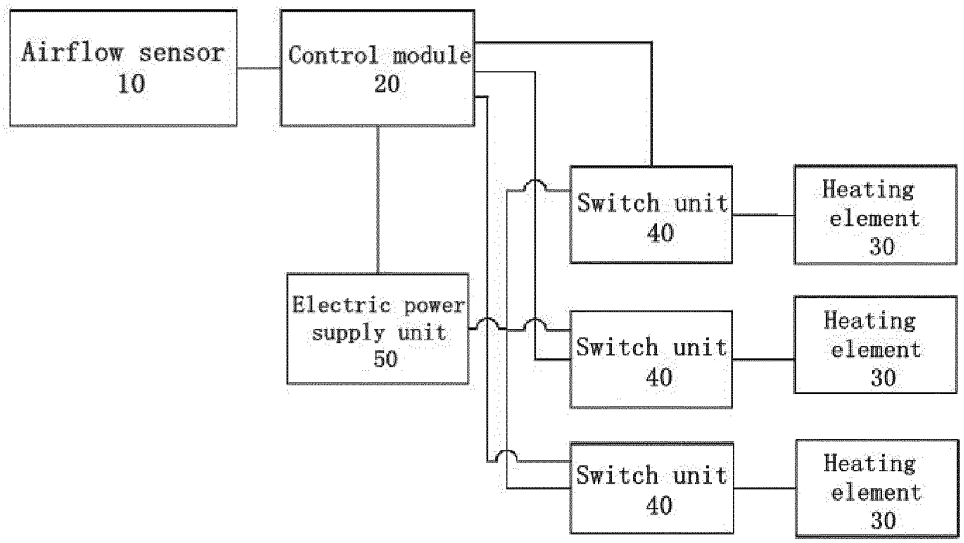

Fig.1

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Description

TECHNICAL FIELD

[0001] The present application relates to the technical field of electronic products, and more particularly, relates to electronic cigarette control circuit, electronic cigarette, and control method for electronic cigarette.

BACKGROUND

[0002] Normally, An electronic cigarette is comprised of an atomization assembly and a battery rod. The atomization assembly comprises an oil-storage component for storing oil and a heating component for heating oil. When the heating component heats, the oil in corresponding oil-storage component is atomized into smoke, then the smoke is exported from a nozzle to achieve the effect of smoking. The battery rod contains an air pressure driving switch and a power supply module. In response to the pressure produced by air flow when smoking, the power supply module is triggered to supply power to the heating component, then the heating element heats up the oil to generate smoke.

[0003] In the above technique, whatever smoking strength is used by users when smoking, the amount and taste of the smoke produced by the atomization assembly are the same. Therefore, users cannot experience a change of the amount of the smoke on the basis of a change of the exerted smoking strength when smoking a real cigarette, the taste remains the same, and cannot be changed by smoking habits of smokers, thus requirements of users cannot be satisfied by the prior art.

BRIEF SUMMARY

[0004] The objective of the present application is to provide an improved electronic cigarette control circuit, electronic cigarette, and control method for electronic cigarette, aiming at the drawbacks in the prior art that, it is difficult to achieve an experience that the amount and taste of smoke can be changed on the basis of the exerted smoking strength which can be satisfied when smoking a real cigarette.

[0005] In accordance with one aspect of the present application, the present application provides an electronic cigarette control circuit which is utilized for controlling an electronic cigarette, wherein, the control circuit comprises at least one airflow sensor, a control module, at least two switch units, and corresponding at least two heating components, and one of the at least two heating components is connected to one of the least two switch units correspondingly; the at least two switch units and the at least one airflow sensor are connected to the control module respectively;

[0006] The airflow sensor is used for collecting an airflow signal of each instance of inhalation of the electronic cigarette and for transmitting the airflow signal to the control module; the control module is used for comparing the value of the airflow signal of each instance with a predetermined value and for selecting, on the basis of a comparison result, to transmit a conduction signal to at least one switch unit of the at least two switch units; the at least one switch unit is turned on upon receiving the conduction signal to allow corresponding at least one heating component to heat up; the at least one heating component is used for heating up cigarette oil in corresponding at least one oil-storage component to atomize the cigarette oil.

[0007] Advantageously, in the electronic cigarette control circuit of the present application, the electronic cigarette control circuit further comprises an electric power supply module, and the electric power supply module is connected to the control module and each of the at least two switch units respectively; the electric power supply module is used to provide electric power to the control module, each of the at least two switch units and each of the at least two heating components.

[0008] Advantageously, in the electronic cigarette control circuit of the present application, the control module is a microprocessor, and the microprocessor comprises a memory unit, a comparing unit and a control unit; the comparing unit is connected to the airflow sensor and the control unit respectively, and the control unit is connected to the at least two switch units respectively; the memory unit is connected to the comparing unit;

[0009] the memory unit is used to store at least two predetermined values, and the comparing unit is used to compare the peak value of the airflow signal with each of the predetermined values, then select a maximum predetermined value from the at least two predetermined values, and the maximum predetermined value should be less than the peak value of the airflow signal; the comparing unit then transmits a signal of the comparison result to the control unit on the basis of the maximum predetermined value; according to the signal of comparison result, the control unit transmits the conduction signal to at least one switch unit of the at least two switch units.

[0010] Advantageously, in the electronic cigarette control circuit of the present application, the microprocessor further comprises a timing unit; the timing unit is connected to the control unit, and the control unit transmits a trigger signal to the timing unit when the control unit transmits the conduction signal; the timing unit receives the trigger signal and begins to time, and transmits a feedback signal to the control unit after timing a predetermined time; according to the feedback signal, the control unit transmits a close signal to the at least one switch unit which is in a conducting state; upon receiving the close signal, the at least one switch unit, is switched off to stop the corresponding at least one heating component from heating up.

[0011] Advantageously, in the electronic cigarette control circuit of the present application, the control module comprises at least two comparison control circuits, and an input terminal of each of the comparison control cir-

cuits is correspondingly connected to the airflow sensor; an output terminal of each of the comparison control circuits is correspondingly connected to one of the at least two switch units, and the predetermined values are set to increase successively by the at least two comparison control circuits, and then the airflow signal triggers the comparison control circuits whose predetermined values are smaller than the value of the airflow signal;

[0012] when one of the comparison control circuits is triggered, an output terminal of this triggered comparison control circuits outputs the conduction signal;

[0013] when more than one of the comparison control circuits are triggered, all the triggered comparison control circuits are arranged in an order of the predetermined values; between each two adjacent comparison control circuits, the comparison control circuit with a larger predetermined value suppresses and closes the comparison control circuit with a smaller predetermined value, and the comparison control circuit with the maximum predetermined value outputs the conduction signal.

[0014] Advantageously, in the electronic cigarette control circuit of the present application, each of the comparison control circuits comprises a first comparison control circuit and a second comparison control circuit, and a comparative voltage input terminal of the first comparison control circuit is connected to the airflow sensor; one of the predetermined values is taken as a reference voltage by a reference voltage terminal of the first comparison control circuit, and an output terminal of the first comparison control circuit with a larger predetermined value between the two adjacent comparison control circuits is connected to a reference voltage terminal of the second comparison control circuit which is corresponding to the first comparison control circuit with a smaller predetermined value; comparative voltage input terminal of the second comparison control circuit is connected to the output terminal of the first comparison control circuit; the first comparison control circuit is used to compare the value of the airflow signal with each of the predetermined values, and a second voltage is transmitted to the comparative voltage input terminal of the second comparison control circuit by an output terminal of the first comparison control circuit with a predetermined value less than the value of the airflow signal.

[0015] Advantageously, in the electronic cigarette control circuit of the present application, the control module further comprises at least two time delay units, and the at least two time delay units are connected between the at least two switch units and the second comparison control circuits respectively; the time delay units are used to continuously provide the conduction signal to the at least two switch units within the predetermined time for the at least two switch units to be continuously turned on within the predetermined time.

[0016] Advantageously, in the electronic cigarette control circuit of the present application, the electronic cigarette control circuit further comprises an amplify unit which is utilized to amplify the airflow signal, the amplify unit is connected between the airflow sensor and the control module.

[0017] Advantageously, in the electronic cigarette control circuit of the present application, the switch units are MOS tubes.

[0018] In accordance with another aspect of the present application, an electronic cigarette contains the electronic cigarette control circuit provided by the present application.

[0019] Advantageously, in the electronic cigarette of the present application, the electronic cigarette comprises at least two oil-storage components which are utilized to store different oil, and each of the heating components is placed in each of the oil-storage components respectively.

[0020] Advantageously, in the electronic cigarette of the present application, the electronic cigarette comprises at least two atomizers, and the at least two oil-storage components are placed in the at least two atomizers respectively.

[0021] Advantageously, in the electronic cigarette of the present application, wherein the electronic cigarette comprises an atomizer, and the at least two oil-storage elements are placed in the atomizer.

[0022] Advantageously, in the electronic cigarette of the present application, wherein the electronic cigarette comprises at least two airflow sensors, and each of the airflow sensors is set up in different working pressure sections, and transmits an airflow signal to the control module upon detecting the airflow signal in the working pressure section.

[0023] In accordance with further aspect of the present application, the present invention also provides a control method of an electronic cigarette, wherein, the control method comprises the following steps:

[0024] S1: an airflow sensor collects an airflow signal of each instance of inhalation of the electronic cigarette and transmits the airflow signal to a control module;

[0025] S2: the control module compares a value of the airflow signal of each instance with a predetermined value and selects, on the basis of a comparison result, to transmit a conduction signal to at least one switch unit of the at least two switch units; the at least one switch unit is turned on to allow the corresponding heating components to heat up upon receiving the conduction signal.

[0026] Advantageously, in the control method of an electronic cigarette of the present application, the step S2 further comprises the following steps:

[0027] S2.1: the control module is a microprocessor, which sets up at least two predetermined values being defined in the memory unit of the microprocessor;

[0028] S2.2: a comparing unit of the microprocessor compares the peak value of the airflow signal with each of the predetermined values respectively, and then selects a maximum predetermined value from the at least two predetermined values where the maximum predetermined value should be less than the peak value of the airflow signal, and the comparing unit then transmits a

signal of the comparison result to a control unit of the microprocessor on the basis of the maximum predetermined value;

[0029] S2.3: the control unit selects, on the basis of the comparison result, to transmit a conduction signal to a switch unit of the at least two switch units; the switch unit is turned on to allow the corresponding heating components to heat up upon receiving the conduction signal.

[0030] Advantageously, in the control method of an electronic cigarette of the present application, in S2.3, wherein the control unit transmits a trigger signal to a timing unit of the microprocessor when the control unit transmits the conduction signal to one switch unit of the at least two switch units; the timing unit receives the trigger signal and begins to time, and transmits a feedback signal to the control unit after timing a predetermined time; according to the feedback signal, the control unit transmits a close signal to the switch unit which is turned on; upon receiving the close signal, the switch unit switches off to stop the heating components from heating up.

[0031] Advantageously, in the control method of an electronic cigarette of the present application, the step S2 further comprises the following steps:

[0032] The predetermined values are set to increase successively in each comparison control circuit of the control module, and the airflow signal triggers the comparison control circuits whose predetermined values are smaller than the value of the airflow signal;

[0033] when one of the comparison control circuits is triggered, an output terminal of this triggered comparison control circuits outputs the conduction signal to the corresponding switch unit;

[0034] when more that one of comparison control circuits are triggered, all triggered comparison control circuits are arranged in an order of the predetermined values, and the predetermined values are compared between each two adjacent comparison control circuits; one of the two adjacent comparison control circuits with a larger predetermined value suppresses and closes s another comparison control circuit with a smaller predetermined value, and one of the triggered comparison control circuit with the maximum predetermined value outputs the conduction signal.

[0035] Advantageously, in the control method of an electronic cigarette of the present application, in the step S2, the comparison control circuits first transmit the conduction signal to time delay units, and upon receiving the conduction signal, the time delay units continuously provide the conduction signal to the at least two switch units within the predetermined time.

[0036] With application of the electronic cigarette control circuit, the electronic cigarette, and the control method for the electronic cigarette, the following advantages can be achieved: by providing the control module on the basis of the airflow signal, which is collected by the airflow sensor, to control corresponding one or more than one switch units to be turned on , it is possible to enable the heating components which are corresponding to the switch units to heat up the cigarette oil in different oil-storage components , thus, to achieve the technical objections of enhanced user experience by allowing changes to smoking taste and amount on the basis of the exerted smoking strength; additionally, it realizes a situation that users who has different smoking taste and exerted smoking strength can share a same electronic cigarette together, thus, it is more convenient in the case of travel or other situations that it is not convenient to bring too many items with smokers, especially convenient for a family which has multiple smokers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] For a better understanding of the aforementioned embodiments of the invention as well as additional embodiments thereof, reference should be made to the Description of Embodiments below, in conjunction with the following drawings in which like reference numerals refer to corresponding parts throughout the figures.

Fig. 1 is a principle block diagram of an electronic cigarette control circuit provided by a first embodiment of the present application;

Fig. 2 is a principle block diagram of a control module provided by a first embodiment of the present application;

Fig. 3 is a principle block diagram of an electronic cigarette control circuit provided by a second embodiment of the present application;

Fig.4 is a circuit schematic diagramof an electronic cigarette control circuit provided by a second embodiment of the present application;

Fig. 5 is a flow diagram of a control method of an electronic cigarette provided by a first embodiment of the present application

Fig. 6 is a detailed flow diagram of a step 2 in a control method of an electronic cigarette provided by a first embodiment of the present application.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0038] In order to solve the drawbacks in the prior art that, it is difficult to achieve an experience that the amount and taste of smoke can be changed on the basis of the exerted smoking strength which can be satisfied when smoking a real cigarette, creativity of the present invention is that, comparing airflow signals produced by strongly and lightly exerted smoking with predetermined values, switching corresponding switch units which are connected to heating elements, then controlling cigarette oil in different oil-storage elements which are corresponding to the switch units to achieve objects of changing smoking taste and amount on the basis of exerted smoking strength.

[0039] The example embodiments of the present application will be further described with reference to the

accompanying drawings in order to have a clear understanding of the technical features, purposes and effects of the present invention. Obviously, the following example embodiments are only parts of the embodiments of the present application.

[0040] Refer to Fig. 1, Figure 1 illustrates an electronic cigarette control circuit which is utilized for controlling an electronic cigarette, wherein the control circuit comprises at least one airflow sensor 10, a control module 20, at least two heating components 30, at least two switch units 40 and an electric power supply module 50. The at least two switch units 40, the airflow sensor 10 and the electric power supply module 50 are all connected to the control module 20 respectively. Each of the switch units 40 is connected between each of the heating components 30 and the electric power supply module 50 respectively.

[0041] The airflow sensor 10 is used for collecting an airflow signal of each instance of inhalation into the electronic cigarette and for transmitting the airflow signal to the control module 20, and the control module20 is used for comparing a value of the airflow signal of each instance with a predetermined value and transmitting a conduction signal to one of the switch units 40 selectively according to a comparison result,; the selected switch unit 40 is turned on when the conduction signal is received to allow the corresponding heating component 30 to heat up, and the heating element30 is used for heating up cigarette oil in corresponding oil-storage component to atomize the cigarette oil. In the present embodiment, quantity of the switch units and the heating elements is three respectively. Number of the airflow sensor is one. The switch units 40 can be selected as commonly used switch circuits. Certainly, in other embodiments, multiple of the switch units 40 can be turned on simultaneously, or all of the switch units 40 can be turned on simultaneously as well to realize the object of automatically generating multiple tastes and changing the amount of smoke. Resistance values of the heating components can be identical or different, and can be set up as required with no limitation in this embodiment. For instance, in the present embodiment, the resistance values of the heating components are different, and are corresponding to different oil-storage components.

[0042] The electronic cigarette control circuit enables users to control the heating components 30 in the corresponding oil-storage components to heat up by changing the exerted smoking strength of each instance, so as to correspondingly change the smoking taste, and the smoke amount can be changed on the basis of the exerted smoking strength as well to make the electronics cigarette much like a real cigarette. Additionally, it realizes a situation that users with different smoking tastes and exerted smoking strength can share a same electronic cigarette together; thus it is more convenient in the case of travel or other situations, especially for a family with multiple smokers.

[0043] In a first embodiment, the control module 20 is a microprocessor. Figure 2 illustrates that the microprocessor comprises an analog-to-digital conversion unit 21, a memory unit 22, a comparing unit 23 and a control unit 24. The comparing unit 23 is connected to the airflow sensor 10 and the control unit 24 respectively, and the control unit 24 is connected to the at least two switch units 40 respectively; the memory unit 22 is connected to the comparing unit 23; the analog-to-digital conversion unit 21 is connected to the comparing unit 23.

[0044] The analog-to-digital conversion unit 21 is utilized to convert analog signals to digital signals, and the memory unit 22 is utilized to store at least two predetermined values; the comparing unit 23 is used to compare the peak value of the airflow signal with each of the predetermined values, then select a maximum predetermined value from the at least two predetermined values, and the maximum predetermined value should be less than the peak value of the airflow signal; the comparing unit 23 then transmits a signal of the comparison result to the control unit 24 on the basis of the maximum predetermined value; according to the signal of comparison result, the control unit 24 transmits the conduction signal to one switch unit 40 of the at least two switch units 40.

[0045] Understandably, the microprocessor can further comprise a timing unit 25, and the timing unit 25 is connected to the control unit 24; the control unit 24 transmits a trigger signal to the timing unit 25 when the control unit 24 transmits the conduction signal to the switch units 40. The timing unit 25 receives the trigger signal and begins to time, and transmits a feedback signal to the control unit 24 after timing a predetermined time; according to the feedback signal, the control unit 24 transmits a close signal to the one switch unit 40 that is turned on; upon receiving the close signal, the switch unit 40 is switched off to stop the corresponding heating components 30 from heating up.

[0046] The timing unit 25 controls conduction time of the switching unit 40 in response to each smoking time by setting a predetermined time, so as to more accurately control the amount of smoke during each smoking. Further, after the predetermined time, the switch units 24 are automatically closed, saving smoke oil and electric energy avoiding unnecessary waste.

[0047] When the comparing unit 23 receives the other airflow signal in the predetermined time, and generates a next comparison result signal and then transmits the next comparison result signal to the control unit 24, namely when the time interval of receiving the two airflow signals is less than the predetermined time set in the time unit 25:

[0048] If the next comparison result signal is identical with a previous comparison result, the control unit 24 transmits a triggering signal to the time unit 25; the time unit 25 resets after receiving this triggering signal, and begins to timing again, and then transmits the feedback signal to the control unit 24; the control unit 24 transmits a close signal to the switch unit 40 that is turned on to switch off.

[0049] If the next comparison result signal is different

with a previous comparison result, the control unit 24 transmits a close signal to the switch units 40 that is turned on to switch off, and simultaneously transmits a conduction signal to switch units which are corresponding to the next comparison result signal to make them conducted. Further, a triggering signal is transmitted to the time unit 25, the time unit 25 resets and times again, the feedback signal is transmitted to the control unit 24 after the predetermined time, then the control unit 24 transmits a close signal to the switch units 40 which are in a conducting state to switch off the switch units 40.

[0050] In a second embodiment, as shown in Fig. 4, the control module 20 comprises at least two comparison control circuits 20a, an input terminal of each of the comparison control circuits 20a is connected to the airflow sensor 10 respectively; an output terminal of each of the comparison control circuits 20a is connected to one of the switch units 40 respectively, the at least two predetermined values are set to increase successively by the at least two comparison control circuits 20a, and the airflow signal triggers the comparison control circuits 20a whose predetermined values are smaller than the value of the airflow signal. When only one of the comparison control circuits 20a is triggered, an output terminal of this triggered comparison control circuit 20a outputs the conduction signal. When more than one of comparison control circuits 20a are triggered, all triggered comparison control circuits 20a are arranged in an order of the predetermined values; between each two adjacent comparison control circuits 20a, the comparison control circuit 20a with a larger predetermined value suppresses and closes the comparison control circuit 20a with a smaller predetermined value, and the comparison control circuits 20a with the maximum predetermined value outputs the conduction signal.

[0051] Further, as shown in Fig. 4, each of the comparison control circuits 20a comprises a first comparison control circuit U2 and a second comparison control circuit U3. The first comparison control circuit U2 and the second comparison control circuit U3 are both provided with a comparative voltage input terminal, a reference voltage terminal and an output terminal. The working principle of the first comparison control circuit U2 and the second comparison control circuit U3 is that the output terminal outputs a voltage when a voltage of the comparative voltage input terminal is higher than a voltage of the reference voltage terminal. The first comparison control circuit U2 and the second comparison control circuit U3 are both operational amplifiers. One divider resistance is placed at a comparative voltage input terminal and a reference voltage terminal of each operational amplifiers. Understandably, the first comparison control circuit U2 and the second comparison control circuit U3 can be realized by other methods, for instance, chips and single chip microcomputers, etc.

[0052] A comparative voltage input terminal of the first comparison control circuit U2 is connected to the airflow sensor 10, and one of the predetermined values is taken as a reference voltage by a reference voltage terminal of the first comparison control circuit U2. The output terminal of the first comparison control circuit U2 with a larger predetermined value between the two adjacent comparison control circuits 20a is connected to a reference voltage terminal of the second comparison control circuit U3 which is corresponding to the first comparison control circuit U2 that has a smaller predetermined value. In the present invention, "adjacent" herein refers to the adjacent of the at least two comparison control circuit 20a, which are arranged by values of the predetermined values. A comparative voltage input terminal of the second comparison control circuit U3 is connected to an output terminal of the first comparison control circuit U2, the reference voltage terminal of the second comparison control circuit U3 is connected to the divider resistance, and then connected to ground. The first comparison control circuit U2 compares the value of the airflow signal with each of the predetermined values, and a second voltage is transmitted to the comparative voltage input terminal of the second comparison control circuit U3 by the output terminal of the first comparison control circuit U2 which has a predetermined value less than the value of the airflow signal.

[0053] When only one predetermined value of the first comparison control circuits U2 is smaller than the value of the air flow, an output terminal of the second comparison control circuit U3 outputs the conduction signal to a corresponding switch unit 40. When more than one predetermined values of the first comparison control circuits U2 are smaller than the value of the air flow, the second comparison control circuit U3 which is responding to the first comparison control circuits U2 that has the maximum predetermined value outputs the conduction signal to a corresponding switch unit 40, second comparison control circuits U3 which are responding to the rest first comparison control circuits U2 are closed by inhibition from the second voltage which are outputted by the output terminals of the first comparison control circuits U2 which are connected to the reference voltage terminals of the above second comparison control circuits U3.

[0054] As an optimization scheme of the present embodiment, the control module 20 further comprises at least two time delay units 200, and each of the time delay units 200 is connected between each of the second comparison control circuits U3 and the corresponding switch units 40 respectively. The time delay units 200 are used to continuously provide the conduction signal to the corresponding switch units 40 within the predetermined time so that the corresponding switch units 40 are continuously turned on within the predetermined time. After this predetermined time, the corresponding switch units 40 is switched off automatically, and the corresponding heating components 30 which are connected to the switch units 40 stop heating up.

[0055] Preferably, the electronic cigarette control circuit further comprises an amplify unit U1 which is connected between the airflow sensor 10 and each of the

first comparison control circuits U2. The amplify unit U1 is utilized to amplify the airflow signal which is detected by the airflow sensor 10, and then transmits the amplified airflow signal to each of the first comparison control circuits U2. The amplify unit U1 can be applied by an operational amplifier, and naturally it is also possible to adopt other conventional amplification circuits as well.

[0056] In the present embodiment, the switch units 40 are MOS tubes and other common switching circuits which are formed by a triode and so on.

[0057] The present invention further provides an electronic cigarette, wherein the electronic cigarette comprises the electronic cigarette control circuit provided by any one of the embodiments above mention. The electronic cigarette comprises at least two oil-storage components which are utilized to store different oil, and each of heating elements 30 is placed in each of the oil-storage elements respectively, and the electronic cigarette merely has one airflow sensor 10. The airflow sensor 10 is placed at the air inlet of the electronic cigarette.

[0058] Alternatively, the electronic cigarette comprises at least two atomizers, and the at least two oil-storage components are placed in the at least two atomizers respectively. Meanwhile, the quantity of the airflow sensor is at least two, preferably, three. Each of the airflow sensors 10 is set up in different working pressure sections. The airflow sensor 10 transmits an airflow signal to the control module 20 when the airflow signal around the working pressure sections is detected.

[0059] Furthermore, the present invention provides a control method of an electronic cigarette, as shown in Fig. 4, the first embodiment of the control method comprises the following steps:

S1: an airflow sensor 10 collects an airflow signal of each instance of inhalation of the electronic cigarette and transmits the airflow signal to a control module 20;

S2: the control module 20 compares the value of the airflow signal of each instance with a predetermined value and selects, on the basis of a comparison result, to transmit a conduction signal to at least one switch unit 40 of the at least two switch units 40; the at least one switch unit 40, is turned on to allow the corresponding heating components 30 to heat up upon receiving the conduction signal.

[0060] In this embodiment of the present invention, the airflow signal is a voltage signal produced by the airflow sensor 10 on the basis of the change of air flow, and the predetermined values are the voltage values which are set in response to the airflow signal.

[0061] As shown in Fig.4, step S2 further comprises the following steps:

S2.1: the control module 20 is a microprocessor, and an analog-to-digital conversion unit 21 of the microprocessor converts an airflow signal from an analog signal into a digital signal, and the microprocessor presets at least two predetermined values, and then stores the at least two predetermined values in the memory unit 22 of the microprocessor ;

S2.2: a comparing unit 23 of the microprocessor compares the peak value of the airflow signal which is changed into a digital signal with each of the predetermined values, and then selects a maximum predetermined value from the at least two predetermined values, and the maximum predetermined value should be less than the peak value of the airflow signal; the comparing unit 23 then transmits a signal of a comparison result to a control unit 24 of the microprocessor on the basis of the maximum predetermined value;

S2.3: the control unit 24 selects, on the basis of the signal of the comparison result, to transmit a conduction signal to one switch unit 40 of the at least two switch units 40; the one switch unit 40 receiving the conduction signal is turned on to allow the corresponding heating components 30 to heat up.

[0062] During the step S2.3, the control unit 24 transmits a trigger signal to a timing unit 25 of the microprocessor when the control unit 24 transmits the conduction signal to one switch unit 40 of the at least two switch units 40. The timing unit 25 receives the trigger signal and begins to time, and transmits a feedback signal to the control unit 24 after timing a predetermined time; according to the feedback signal, the control unit 24 transmits a close signal to the switch unit 40 that is turned on; after receiving the close signal, the switch unit 40 switches off to stop the heating components 30 from heating up.

[0063] Alternatively, when the control module 20 of the second embodiment is applied, the step S2 further comprises following steps:

the predetermined values are set to increase successively in each of comparison control circuits 20a of the control module 20, and the airflow signal triggers the comparison control circuits 20a whose predetermined values are smaller than the value of the airflow signal;

when one of the comparison control circuits 20a is triggered, an output terminal of this triggered comparison control circuits 20a outputs the conduction signal to the corresponding switch units 40 for the corresponding oil storage component to heat up;

when more that one of comparison control circuits 20a are triggered, all triggered comparison control circuits 20a are arranged in an order of the predetermined values, and the predetermined values are compared between each two adjacent comparison control circuits 20a; one of the two adjacent comparison control circuits 20a with a larger predetermined value suppresses and closes another comparison control circuit 20a with a smaller predetermined value, and one of the triggered comparison control cir-

cuits 20a with the maximum predetermined value outputs the conduction signal. The comparison control circuit 20a with the maximum predetermined value outputs the conduction signal to the control terminal of the switch units 40, and the rest of comparison control circuits 20a are closed by inhabition of comparison control circuits 20a that has higher and similar predetermined values respectively.

[0064] Further, when only one predetermined value of the first comparison control circuits U2 of the comparison control circuits 20a is smaller than the value of the air flow, an output terminal of the second comparison control circuit U3 of the comparison control circuits 20a outputs the conduction signal to a corresponding switch unit 40. When more than one predetermined values of the first comparison control circuits U2 are smaller than the value of the air flow, the second comparison control circuit U3 which is corresponding to the first comparison control circuits U2 that has the comparative the maximum predetermined value outputs the conduction signal to a control terminal of a corresponding switch unit 40, second comparison control circuits U3 which are corresponding to the rest first comparison control circuits U2 are closed by inhibition from the second voltage which are outputted by the output terminals of the first comparison control circuits U2 which are connected to the reference voltage terminals of the second comparison control circuits U3. in the step S2.3, the comparison control circuits 20a first transmit the conduction signal to time delay units 200, and upon receiving the conduction signal, the time delay units 200 continuously provide the conduction signal to the switch units 40 within the predetermined time. The switch units 40 are continuously turned on in the predetermined time. When the switch units 40 do not receive the conduction signal, they are switched off automatically.

[0065] In general, by providing the control module 20 on the basis of the airflow signal, which is collected by the airflow sensor 10, to control corresponding one or more than one switch units to be conducted, it is possible to enable the heating elements 30 to heat the cigarette oil in corresponding oil-storage elements, thus, to achieve the technical objects of enhanced user experience by allowing changes to smoking taste and amount on the basis of exerted smoking strength; Additionally, the control module 20 can further control a predetermined time of the heating of the heating elements 30, thus to precisely control smoke amount of each instance of inhalation. According to various smokers smoking habits and preferences, the smoke amount of each instance of inhalation during smoking is more reasonably configured to achieve the best effect. Moreover, the electronic cigarette saves smoke oil and electricity, and terminates the electronic cigarette's working condition when users forget to turn off the electronic cigarette.

[0066] The above disclosed embodiments are only some preferable embodiments of the present invention and cannot be utilized to limit the claim scope of the present invention. It should be understood that, in the inspiration of the present application, those skilled in the art who appreciate and realize all or part of the process in above embodiments may make many modifications or alternatives, without going beyond the purpose and the scope the claims intend to protect of the present application. All these belong to the protection of the present application.

Claims

1. An electronic cigarette control circuit which is utilized for controlling the electronic cigarette, wherein the control circuit comprises at least one airflow sensor (10), a control module (20), at least two switch units (40), and at least two heating components (30), one of the at least two heating components(30) is connected to one of the least two switch units (40) correspondingly; the at least two switch units (40) and the at least one airflow sensor (10) are electrically connected to the control module (20) respectively;
   wherein airflow sensor (10) is used for collecting an airflow signal of each instance of inhalation of the electronic cigarette and for transmitting the airflow signal to the control module (20);
   the control module (20) is used for comparing a value of the airflow signal of each instance with a predetermined value and for selecting, on the basis of a comparison result, to transmit a conduction signal to at least one switch unit (40) of the at least two switch units (40);
   the at least one switch unit (40) is used for being turned on upon receiving the conduction signal to allow corresponding at least one heating component (30) to heat up;
   the at least one heating component (30) is used for heating up cigarette oil in corresponding at least one oil-storage component to atomize the cigarette oil.

2. The electronic cigarette control circuit according to claim 1, wherein the electronic cigarette control circuit further comprises an electric power supply module (50), and the electric power supply module (50) is electrically connected to the control module (20) and each of the at least two switch units (40) respectively;
   the electric power supply module (50) is used to provide electric power to the control module (20), each of the at least two switch units (40) and each of the at least two heating components (30).

3. The electronic cigarette control circuit according to claim 2, wherein the control module (20) is a microprocessor, and the microprocessor comprises a memory unit(22), a comparing unit (23) and a control unit (24);

the comparing unit (23) is electrically connected to the airflow sensor (10) and the control unit (24) respectively, and the control unit (24) is electrically connected to the at least two switch units (40) respectively; the memory unit (22) is electrically connected to the comparing unit (23);
the memory unit (22) is used to store at least two predetermined values;
the comparing unit (23) is used to compare a peak value of an airflow signal with each of the predetermined values, and then select a maximum predetermined value from the at least two predetermined values, and the maximum predetermined value should be less than the peak value of the airflow signal, then transmits a signal of the comparison result to the control unit (24) on the basis of the maximum predetermined value;
the control unit (24) is used to transmit the conduction signal to the at least one switch unit (40) of the at least two switch units(40) according to the signal of the comparison result.

4. The electronic cigarette control circuit according to claim 3, wherein the microprocessor further comprises a timing unit (25), and the timing unit (25) is electrically connected to the control unit (24); the control unit (24) is further used to transmit a trigger signal to the timing unit (25) when the control unit (24) transmits the conduction signal;
the timing unit (25) is used to receive the trigger signal and begin to time, and transmit a feedback signal to the control unit (24) after timing a predetermined time;
the control unit (24) is further used to transmit a close signal to the at least one switch unit (40) which is in a conducting state, according to the feedback signal;
the at least one switch unit (40) is further used to switch off to stop the corresponding at least one heating component (30) from heating up after receiving the close signal.

5. The electronic cigarette control circuit according to claim 1, wherein the control module (20) comprises at least two comparison control circuits (20a), and an input terminal of each of the comparison control circuits (20a) is correspondingly connected to the airflow sensor (10); an output terminal of each of the comparison control circuits (20a) is correspondingly connected to one of the at least two switch units (40), and the predetermined values are set to increase successively by the at least two comparison control circuits (20a), the airflow signal triggers the comparison control circuits (20a) whose predetermined values are smaller than the value of the airflow signal;
wherein when one of the comparison control circuits (20a) is triggered, an output terminal of this triggered comparison control circuit (20a) is used to output the conduction signal;
wherein when more than one of the comparison control circuits (20a) are triggered, all triggered comparison control circuits (20a) are arranged in an order of the predetermined values; the predetermined values are compared between each two adjacent comparison control circuits (20a), one of the two adjacent comparison control circuits (20a) with a larger predetermined value suppresses and closes another comparison control circuit (20a) with a smaller predetermined value, and one of the triggered comparison control circuits (20a) with the maximum predetermined value outputs the conduction signal.

6. The electronic cigarette control circuit according to claim 5, wherein each of the comparison control circuits (20a) comprises a first comparison control circuit (U2) and a second comparison control circuit (U3);
wherein a comparative voltage input terminal of the first comparison control circuit (U2) is electrically connected to the airflow sensor (10); one of the predetermined values is taken as a reference voltage by a reference voltage terminal of the first comparison control circuit (U2); an output terminal of the first comparison control circuit (U2) with a larger predetermined value between the two adjacent comparison control circuits (20a) is electrically connected to a reference voltage terminal of the second comparison control circuit (U3) which is corresponding to the first comparison control circuit (U2) with a smaller predetermined value;
a comparative voltage input terminal of the second comparison control circuit (U3) is electrically connected to the output terminal of the first comparison control circuit (U2);
the first comparison control circuit (U2) is used to compare the value of the airflow signal with each of the predetermined values, and a second voltage is transmitted to the comparative voltage input terminal of the second comparison control circuit (U3) by an output terminal of the first comparison control circuit (U2) with a predetermined value less than the value of the airflow signal.

7. The electronic cigarette control circuit according to claim 6, wherein the control module (20) further comprises at least two time delay units (200), and the at least two time delay units (200) are electrically connected between the at least two switch units (40) and the second comparison control circuits (U3) respectively;
wherein the at least two time delay units (200) are used to continuously provide the conduction signal to the at least two switch units (40) within the predetermined time for the at least two switch units (40) to be continuously turned on within the predetermined time.

8. The electronic cigarette control circuit according to claim 7, wherein the electronic cigarette control circuit further comprises an amplify unit (U1) which is utilized to amplify the airflow signal, and the amplify unit (U1) is electrically connected between the airflow sensor (10) and the control module (20).

9. The electronic cigarette control circuit according to claim 8, wherein the switch units (40) are MOS tubes (Q1).

10. An electronic cigarette, wherein the electronic cigarette comprises the electronic cigarette control circuit provided by claim 1.

11. The electronic cigarette according to claim 10, wherein the electronic cigarette comprises at least two oil-storage components which are utilized to store different oil, and each of at least two heating components (30) is defined in each of the oil-storage elements respectively.

12. The electronic cigarette according to claim 11, wherein the electronic cigarette comprises at least two atomizers, and the at least two oil-storage components are defined in the at least two atomizers respectively.

13. The electronic cigarette according to claim 11, wherein the electronic cigarette comprises an atomizer, and the at least two oil-storage elements are defined in the atomizer.

14. The electronic cigarette according to claim 12, wherein the electronic cigarette comprises at least two airflow sensors (10), and each of the airflow sensors (10) is set up in different working pressure sections; each of the airflow sensors transmits an airflow signal to the control module (20) upon detecting the airflow signal in a working pressure section.

15. A control method of an electronic cigarette, wherein the control method comprises the following steps:

S1: an airflow sensor (10) collects an airflow signal of each instance of inhalation of the electronic cigarette and transmits the airflow signal to a control module (20);
S2: the control module (20) compares a value of the airflow signal of each instance with a predetermined value and selects, on the basis of a comparison result, to transmit a conduction signal to at least one switch unit (40) of at least two switch units (40); the at least one switch unit (40) is turned on to allow corresponding at least one heating component (30) to heat up upon receiving the conduction signal.

16. The control method of an electronic cigarette according to claim 15, wherein the step S2 further comprises following steps:

S2.1: the control module (20) is a microprocessor, at least two predetermined values are defined in a memory unit (22) of the microprocessor;
S2.2: a comparing unit (23) of the microprocessor compares a peak value of the airflow signal with each of the at least two predetermined values respectively, and then selects a maximum predetermined value from the at least two predetermined values, where the maximum predetermined value should be less than the peak value of the airflow signal; then transmits a signal of a comparison result to a control unit (24) of the microprocessor on the basis of the maximum predetermined value;
S2.3: the control unit (24) selects, on the basis of the signal of the comparison result, to transmit a conduction signal to at least one switch unit (40) of the at least two switch units (40); the at least one switch unit (40) is turned on to allow the corresponding at least one heating component (30) to heat up upon receiving the conduction signal.

17. The control method of an electronic cigarette according to claim 16, wherein in step S2.3, the control unit (24) transmits a trigger signal to a timing unit (25) of the microprocessor when the control unit (24) transmits the conduction signal to the at least one switch unit (40); the timing unit (25) receives the trigger signal and begins to time, and transmits a feedback signal to the control unit (24) after timing a predetermined time; according to the feedback signal, the control unit (24) transmits a close signal to the at least one switch unit (40) which is in a conducting state; upon receiving the close signal, the at least one switch unit (40) switches off to stop the corresponding at least one heating component (30) from heating up.

18. The control method of an electronic cigarette according to claim 15, wherein the step S2 further comprises the following steps:

the at least two predetermined values are set to increase successively in each comparison control circuit (20a) of the control module (20), and the airflow signal trigger comparison control circuits (20a) whose predetermined values are smaller than the value of the airflow signal;
when one of the comparison control circuits (20a) is triggered, an output terminal of this triggered comparison control circuit (20a) outputs the conduction signal to a corresponding switch

unit (40);
when more that one of comparison control circuits (20a) are triggered, all triggered comparison control circuits (20a) are arranged in an order of the predetermined values, and the predetermined values are compared between each two adjacent comparison control circuits (20a); one of the two adjacent comparison control circuits (20a) with a larger predetermined value suppresses and closes another comparison control circuit (20a) with a smaller predetermined value, and one of the triggered comparison control circuits (20a) with the maximum predetermined value outputs the conduction signal.

19. The control method of an electronic cigarette according to claim 18, wherein in the step S2, the comparison control circuits (20a) first transmit the conduction signal to time delay units (200), and upon receiving the conduction signal, the time delay units (200) continuously provide the conduction signal to the switch units (40) within the predetermined time.

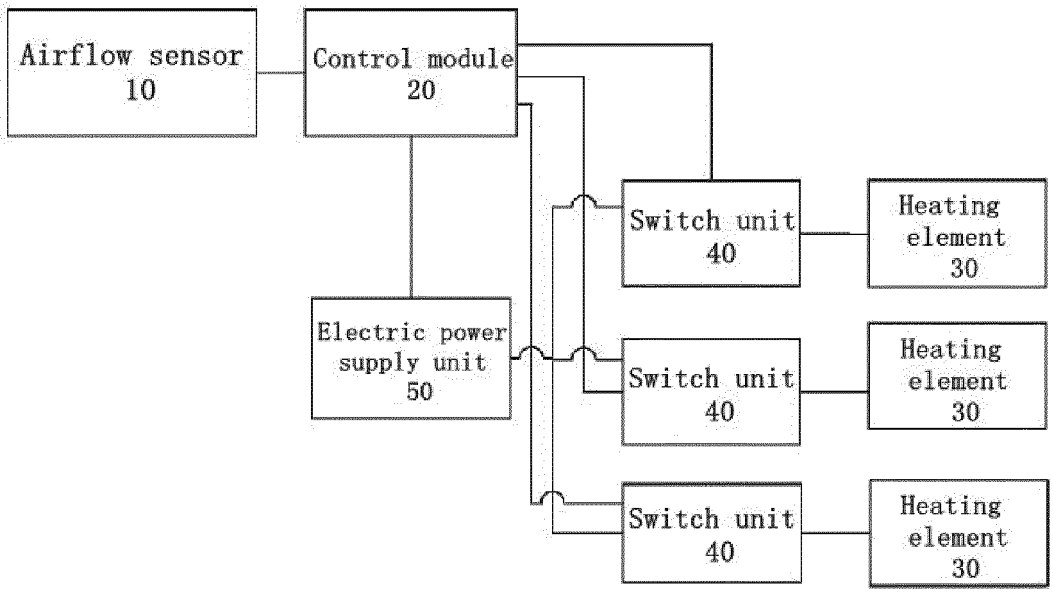
Airflow sensor
10
Control module
20
Switch unit
40
Heating
element
30
Electric power
supply unit
50
Switch unit
40
Heating
element
30
Switch unit
40
Heating
element
30

Fig.1

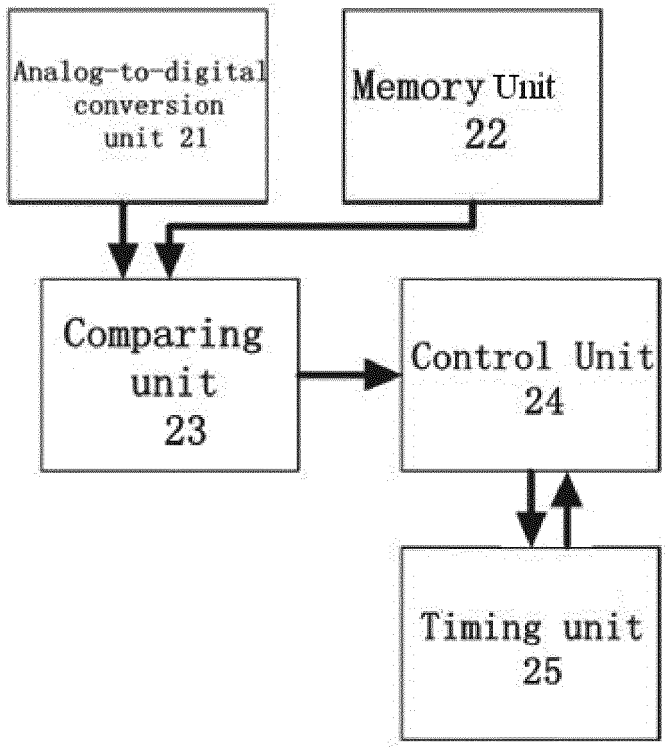
Analog-to-digital
conversion
unit 21
Memory Unit
22
Comparing
unit
23
Control Unit
24
Timing unit
25

Fig.2

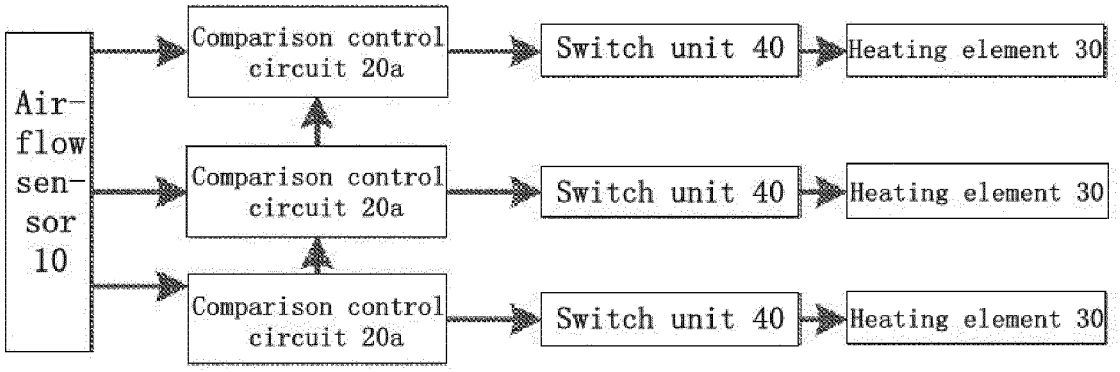
Air-flow sen-sor 10
Comparison control circuit 20a
Comparison control circuit 20a
Comparison control circuit 20a
Switch unit 40
Switch unit 40
Switch unit 40
Heating element 30
Heating element 30
Heating element 30

Fig. 3

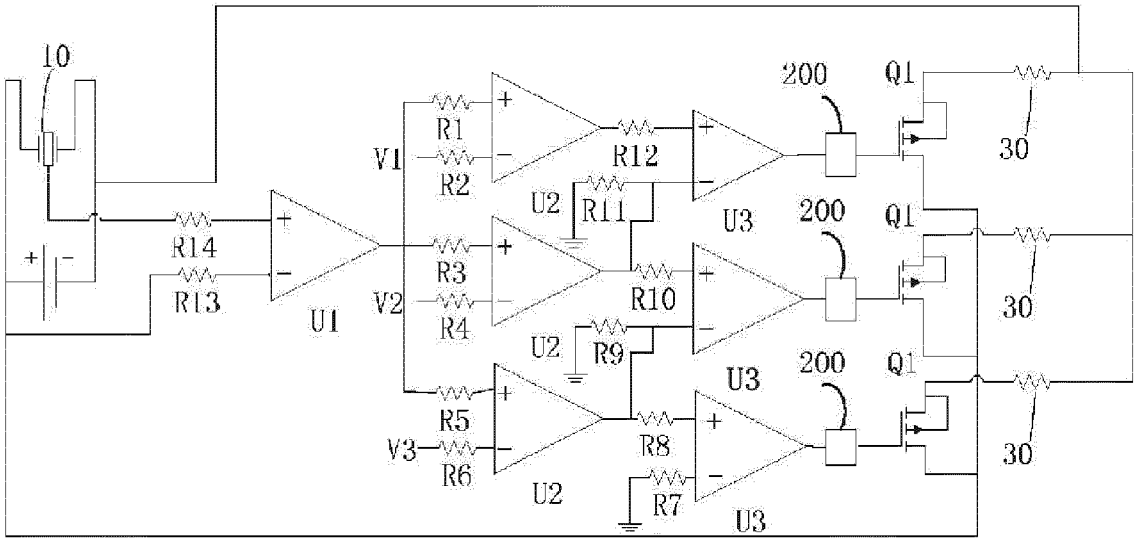
10
R14
R13
U1
V1
V2
V3
R1
R2
R3
R4
R5
R6
U2
R12
R11
R10
R9
R8
R7
U3
200
Q1
30

Fig.4

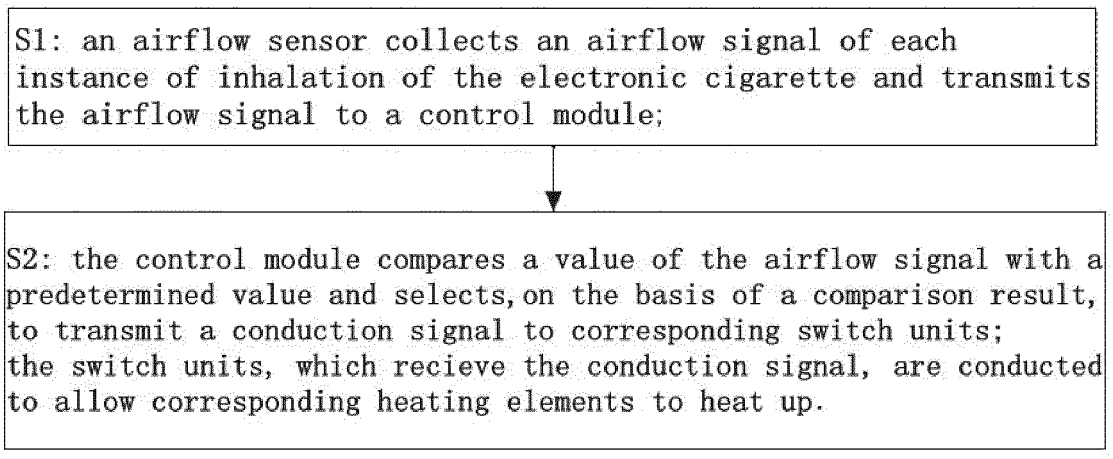
S1: an airflow sensor collects an airflow signal of each instance of inhalation of the electronic cigarette and transmits the airflow signal to a control module;
S2: the control module compares a value of the airflow signal with a predetermined value and selects, on the basis of a comparison result, to transmit a conduction signal to corresponding switch units; the switch units, which recieve the conduction signal, are conducted to allow corresponding heating elements to heat up.

Fig.5

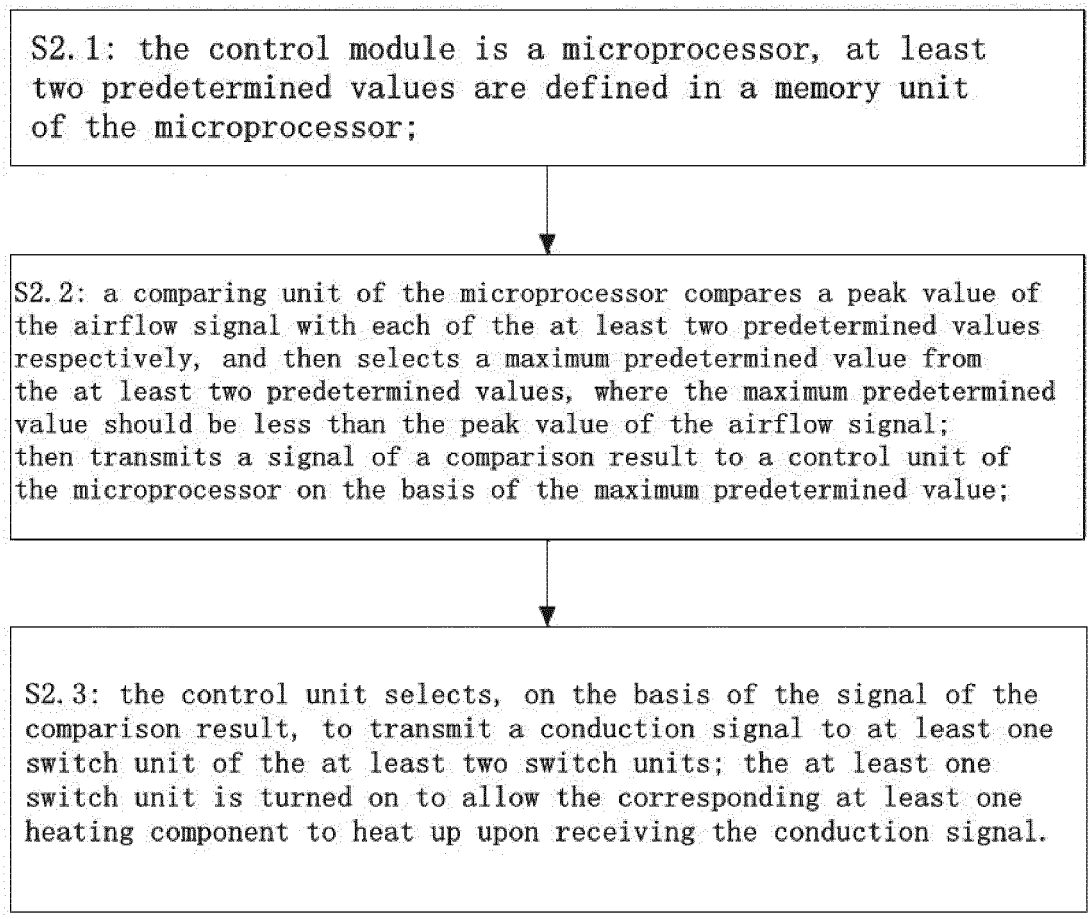
S2.1: the control module is a microprocessor, at least two predetermined values are defined in a memory unit of the microprocessor;
S2.2: a comparing unit of the microprocessor compares a peak value of the airflow signal with each of the at least two predetermined values respectively, and then selects a maximum predetermined value from the at least two predetermined values, where the maximum predetermined value should be less than the peak value of the airflow signal; then transmits a signal of a comparison result to a control unit of the microprocessor on the basis of the maximum predetermined value;
S2.3: the control unit selects, on the basis of the signal of the comparison result, to transmit a conduction signal to at least one switch unit of the at least two switch units; the at least one switch unit is turned on to allow the corresponding at least one heating component to heat up upon receiving the conduction signal.

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/089566

A. CLASSIFICATION OF SUBJECT MATTER

A24F 47/00 (2006.01) 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 A61M

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

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

CNABS; VEN: control circuit, electronic, electric, atomize, imitate, simulate, substitute, cigar, cigarette, tobacco, circuit

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 101518361 A (BEIJING GREENWORLD TECHNOLOGIES, LTD.), 02 September 2009 (02.09.2009), description, page 5, and figure 1	1, 2, 10-15
Y	CN 202738816 U (XIE, Yongping), 20 February 2013 (20.02.2013), description, pages 1 and 2, and figures 1 and 2	1, 2, 10-15
Y	CN 202445135 U (CHINA TOBACCO HUBEI INDUSTRIAL CO., LTD. et al.), 26 September 2012 (26.09.2012), description, pages 1 and 2, and figures 1 and 2	1, 2, 10-15
Y	CN 103415222 A (CAPUANO, S.), 27 November 2013 (27.11.2013), description, pages 2 and 3	1, 2, 10-15
A	CN 103054196 A (SHENZHEN FIRSTUNION TECHNOLOGY CO., LTD.), 04 April 2013 (24.04.2013), the whole document	1-19
A	CN 201869778 U (LIU, Qiuming), 22 June 2011 (22.06.2011), the whole document	1-19
A	US 8499766 B1 (NEWTON, K.D.), 06 August 2013, (06.08.2013), the whole document	1-19

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

* Special categories of cited documents:

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"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
12 September 2014 (12.09.2014)	**09 October 2014 (09.10.2014)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **ZHANG, Yucui** Telephone No.: (86-10) **62084123**

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/089566

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2013040193 A2 (PERRIGO L CO. et al.), 21 March 2013 (21.03.2013), the whole document	1-19
A	CN 103237468 A (PHILIP MORRIS PRODUCTS S.A.), 07 August 2013 (07.08.2013), the whole document	1-19

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/089566

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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		DE 102010012600 A1	30 September 2010
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		GB 2468932 B	10 August 2011
		CN 101518361 B	06 October 2010
		US 8205622 B2	26 June 2012
CN 202738816 U	20 February 2013	None	
CN 202445135 U	26 September 2012	None	
CN 103415222 A	27 November 2013	US 2013319440 A1	05 December 2013
		WO 2012109371 A3	08 November 2012
		WO 2012109371 A2	16 August 2012
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		EP 2672848 A2	18 December 2013
		JP 2014504886 A	27 February 2014
CN 103054196 A	24 April 2013	None	
CN 201869778 U	22 June 2011	None	
US 8499766 B1	06 August 2013	US 2013284194 A1	31 October 2013
WO 2013040193 A2	21 March 2013	WO 2013040193 A3	30 May 2013
CN 103237468 A	07 August 2013	US 2013340750 A1	26 December 2013
		JP 2013545474 A	26 December 2013
		SG 190110 A1	28 June 2013
		MX 2013006195 A	04 November 2013
		WO 2012072790 A1	07 June 2012
		EP 2460423 A1	06 June 2012
		KR 20130139276 A	20 December 2013
		CA 2818076 A1	07 June 2012
		EA 201390818 A1	28 February 2014
		EP 2645892 A1	09 October 2013
		AR 084096 A1	17 April 2013
		IL 226009 D0	27 June 2013

Form PCT/ISA/210 (patent family annex) (July 2009)