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(54) **LIQUID SUPPLY METHOD AND APPARATUS**

(57) Disclosed are a liquid supply method and apparatus, belonging to the technical field of vaping simulation. The method is applied to an electronic cigarette, the electronic cigarette being provided with a micro-flow liquid supply assembly and a liquid storage assembly, wherein the liquid storage assembly is used for storing at least one liquid. The method comprises: acquiring a working parameter of an electronic cigarette, wherein the working parameter comprises at least one of an output power of an atomizer, the temperature in an atomizing chamber and an output voltage of the electronic cigarette

(110); determining the consumption rate of at least one liquid according to the working parameter, wherein the at least one liquid is an e-liquid or an e-liquid component (120); and according to the consumption rate of each liquid, controlling a micro-flow liquid supply assembly to use a micro-channel to supply each liquid to an atomization assembly for atomization (130). The method solves the problem in the related art of liquid leakage or dry burning being easily caused since it is difficult to balance e-liquid supply and e-liquid consumption in an actual use process of an electronic cigarette.

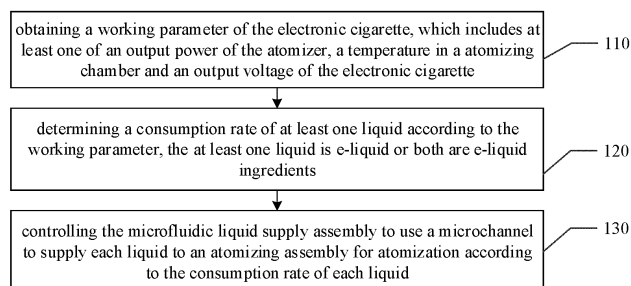


FIG.1

Description

TECHNICAL FIELD

[0001] The disclosure relates to the technical field of simulated smoking, in particular to a liquid supply method and apparatus.

BACKGROUND

[0002] As a substitute for cigarettes, e-cigarettes are becoming more and more popular in the market because they have the characteristics of safe, convenient, healthy and environmental protection to a certain extent.

[0003] At present, some electronic cigarettes supply e-liquid to the atomizing chamber by controlling the operation of the pump. However, in the actual use of this kind of electronic cigarette, it is difficult to balance the supply and consumption of e-liquid, which is easy to cause the problem of liquid leakage or dry burning.

SUMMARY

[0004] In order to solve the problem that in the actual use process of electronic cigarette in the prior art, it is difficult to reach a balance between the supply of e-liquid and the consumption of e-liquid, and it is easy to cause liquid leakage or dry burning, the embodiment of the present disclosure provides a liquid supply method and apparatus. The technical solution is as follows:

[0005] In a first aspect, a liquid supply method is provided, the method is applied to an electronic cigarette, the electronic cigarette is provided with a microfluidic liquid supply assembly and a liquid storing assembly; wherein: the liquid storing assembly is configured to store at least one liquid, the method includes:

obtaining a working parameter of the electronic cigarette, which includes at least one of an output power of the atomizer, a temperature in an atomizing chamber and an output voltage of the electronic cigarette; determining a consumption rate of at least one liquid in the electronic cigarette according to the working parameters; controlling the microfluidic liquid supply assembly to use a microchannel to supply each liquid to an atomizing assembly for atomization according to the consumption rate of each liquid; wherein, the liquid can be e-liquid, or, at least one of the liquid is e-liquid ingredient.

[0006] In one embodiment, the microchannel is provided with a microvalve, controlling the microfluidic liquid supply assembly to use a microchannel to supply each liquid to an atomizing assembly for atomization according to the consumption rate of each liquid, includes: controlling opening degree of the microvalve in the corresponding microchannel for transporting the liquid, ac-

cording to the consumption rate of each liquid, and supplying each liquid to the atomizing assembly through the corresponding microchannel for atomization.

[0007] In one embodiment, the microchannel is provided with a microflow sensor therein, controlling the microfluidic liquid supply assembly to use a microchannel to supply each liquid to an atomizing assembly for atomization according to the consumption rate of each liquid, further, includes:

obtaining a flow velocity value detected by the microflow sensor in each microchannel; adjusting the opening degree of the internal microvalve according to the flow velocity value of each microchannel and the consumption rate of the liquid transported by the microchannel.

[0008] In one embodiment, the electronic cigarette includes at least one guiding member, a groove communicated with the liquid storing assembly is defined on the guiding member, the grooves is the microchannels, a liquid outlet of each microchannel is provided with a microvalve, controlling the microfluidic liquid supply assembly to use a microchannel to supply each liquid to an atomizing assembly for atomization according to the consumption rate of each liquid, includes:

determining a liquid supply frequency of each liquid according to the consumption rate of each liquid and a volume of the groove; closing the microvalve at the outlet of the groove each time firstly, according to the liquid supply frequency of each groove, and filling the groove with the corresponding liquid and powering on the liquid in the groove, and then opening the microvalve; wherein, when the microvalve located at the outlet of each groove is opened, the liquid contained in the groove is transported to the atomizing assembly by the force between the charges.

[0009] In one embodiment, controlling the microfluidic liquid supply assembly to use a microchannel to supply each liquid to an atomizing assembly for atomization according to the consumption rate of each liquid, includes:

determining an injection frequency and single injection amount of each liquid according to the consumption rate of each liquid; for each liquid, according to the injection frequency of each liquid, injecting the liquid corresponding to a single injection amount into a liquid inlet of the microchannel corresponding to the liquid each time. injecting a separator after inject an injection amount liquid into each microchannel each time, wherein the injection amount corresponding to a single injection; wherein, the separator is a gas or the separator is a liquid, and the liquid is a e-liquid ingredient.

[0010] In one embodiment, determining a consumption rate of at least one liquid according to the working parameter, includes:

determining a heat generation rate of the electronic cigarette according to the output power or the output voltage of the atomizer;
determining the consumption rate of each of the liquids according to the heat generation rate.

[0011] In one embodiment, determine the consumption rate of the at least one liquid according to the heat generation rate, includes:

if the at least one liquid is the e-liquid ingredient, determining the rate of consumption of the liquid delivered by each microchannel according to the heat generation rate, an atomization ratio of the at least one liquid, and a consumption rate of the liquid corresponding to the unit output power or unit output voltage;
if the at least one liquid is e-liquid, determining a consumption rate of the e-liquid according to the heat generation rate.

[0012] In one embodiment, wherein a plurality of atomizing chambers are provided in the electronic cigarette, the microfluidic liquid supply assembly includes a plurality of microchannels, a liquid outlet of each microchannel extends into one atomizing chamber, determining a consumption rate of the at least one liquid according to the working parameter, includes:

determining the output power of the atomizing assembly in each atomizing chamber, according to the output power of the atomizer or the output voltage of the atomizer, an atomization ratio of the at least one liquid, and a type of liquid delivered to each atomization chamber;
determining the rate of consumption of liquid delivered to the atomizing chamber, according to an output power of the atomizing assembly in each atomization chamber and a consumption rate of the liquid corresponding to an unit output power.

[0013] In one embodiment, wherein a liquid inlet of each microchannel is communicated with a liquid storage member, a liquid outlet of each of the microchannels extends into the atomizing chamber, the atomizing assembly is arranged in the atomizing chamber; or, the liquid inlet of each microchannel is communicated with the liquid storing member, the middle part of the microchannel or one end of the microchannel away from the liquid inlet opens a plurality of ventilation holes, the microchannel is communicated with a cigarette holder through the ventilation hole; the microchannel is a heating member of the atomizing assembly; when the microchannel is heated, a atomized aerosol flows out of the

microchannel through at least one of the ventilation holes, but any liquid in the microchannel is difficult to overflow from the ventilation holes.

[0014] In one embodiment, the atomizing assembly includes heating member, can atomize at least one described liquid when described heating member is heated; and/or,

the atomizing assembly includes ceramic atomizing sheet, the ceramic atomizing sheet can atomize at least one liquid when it resonates at a predetermined frequency, and/or
the atomizing assembly includes at least one nozzle and air supply device, each nozzle is in communication with the liquid outlet of a microchannel; the air supply device is configured to apply high pressure air flow to the nozzle side to atomize the liquid sprayed from the nozzle.

[0015] In a second aspect, a computer-readable storage medium is provided, one or more instructions are stored in the computer-readable storage medium, when the one or more instructions are executed by the processor in the electronic cigarette, the liquid supply method involved in any of the foregoing embodiments is implemented.

[0016] A third aspect, a liquid supply device apparatus is provided, the apparatus includes:

a memory and a processor;
at least one program instruction is stored in the memory;
the processor, by loading and executing the at least one program instruction, implements the liquid supply method involved in any of the foregoing embodiments.

[0017] The beneficial effect that the technical solutions that the embodiment of the present disclosure provides brings is:

By obtaining the working parameters of the electronic cigarette. The working parameter includes at least one of the output power of the atomizer, the temperature in the atomizing chamber, and the output voltage of the electronic cigarette. The consumption rate of at least one liquid of the electronic cigarette is determined according to the working parameter. The at least one liquid is either a e-liquid or a e-liquid ingredient. According to the consumption rate of each liquid, the microfluidic liquid supply assembly is controlled to supply each liquid to the atomizing assembly for atomization through the microchannel. It solves the problem in the related art that in the actual use of electronic cigarettes, it is difficult to achieve a balance between the supply and consumption of e-liquid, which can easily cause liquid leakage or dry burning; the effect of reducing leakage and avoiding dry burning is achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. 1 is the method flow chart of the liquid supply method that one embodiment of the present disclosure provides;

FIG. 2 is the schematic diagram of the microchannel provided by an embodiment of the present disclosure;

FIG. 3 is the schematic diagram of the microchannel provided by another embodiment of the present disclosure;

FIG. 4 is the working flow chart when the electronic cigarette provided by one embodiment of the present disclosure detects the cigarette lighting signal;

FIG. 5 is the working flow chart when the electronic cigarette provided by another embodiment of the present disclosure detects the cigarette lighting signal;

FIG. 6 is a schematic diagram of the flow of e-liquid or e-liquid ingredients in an electronic cigarette provided by an embodiment of the present disclosure.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0019] The present disclosure provides an electronic cigarette, which is provided with a liquid storing assembly and a microfluidic liquid supply assembly; wherein: the liquid storing assembly is configured to store at least one liquid. The liquid can be e-liquid, or can be different e-liquid ingredients. The e-liquid ingredients include basic e-liquid, and can also include at least one selected from nicotine, flavors and fragrances. In actual implementation, the e-liquid ingredient can also be other liquids in the e-liquid that are not shown in this application, this application will not repeat them one by one. Wherein, in this embodiment, the main ingredients of the basic e-liquid are propylene glycol and glycerol. It can be understood that, in other embodiments, the basic e-liquid can be other ingredients without limitation. The e-liquid ingredient stored in the liquid storing assembly can be mixed to form e-liquid. In one of the embodiments, the liquid storing assembly includes at least one liquid storing member, one liquid storing member stores a liquid.

[0020] Wherein, the microfluidic liquid supply assembly includes at least one microchannel and at least one micropump, the liquid inlet of each microchannel is communicated with the liquid outlet of a micropump, the liquid inlet of the micropump is communicated with a liquid storing member.

[0021] Take the liquid storing assembly of an electronic cigarette used to store e-as an example. The liquid storing assembly consists of only one liquid storing member, the liquid storing member is communicated with the liquid inlet of a micropump, the liquid outlet of the micropump is in communication with the liquid inlet of a microchannel.

The micropump is configured to pump e-liquid from the liquid storing member, the e-liquid pumped by the micropump can be transported to the microchannel. In practical implementation, the electronic cigarette is provided with a plurality of microchannels. The liquid inlet of a microchannel is in communication with the liquid outlet of a micropump, and the micropump is configured to pump and deliver the e-liquid in the liquid storing member to the microchannel. It can be understood that in other embodiments not shown, the liquid storing assembly can also include two or more liquid storing members, each of which is configured to store different types of e-liquid. For example, for e-liquid with different concentrations of active ingredients, the active ingredient can be nicotine. The e-liquid in different liquid storing members can be transported to different microchannels by different micropumps.

[0022] Take the liquid storing assembly of the electronic cigarette used to store e-liquid as an example. The liquid storing assembly includes a plurality of liquid storing members, for example, it includes two or more liquid storing members, each liquid storing member is configured to store different types of e-liquid. The liquid stored in different liquid storing members can be transported to different microchannels through different micropumps. For example, the liquid storing assembly includes three liquid storing members, which are respectively configured to store nicotine, basic e-liquid and essence, the nicotine is extracted by the micropump A1 and transported to the microchannel A2, the basic e-liquid is extracted by the micropump B1 and transported to the microchannel B2, the essence is extracted from nicotine by micropump C1 and delivered to microchannel C2.

[0023] In one embodiment, each liquid storing member and the liquid inlet of the microchannel is provided with a gas-liquid separation device therebetween, the gas-liquid separation device filters the gas in the liquid, the filtered liquid is transported to the microchannel. Optionally, a solenoid valve is provided between the liquid outlet of the gas-liquid separation device and the liquid inlet of the microchannel. By controlling the switch of the solenoid valve, whether to supply liquid to the microchannel can be controlled. For example, the gas-liquid separation device is arranged between the micropump and the solenoid valve. In one embodiment, when the electronic cigarette needs to provide the liquid in a liquid storing member to the atomizing chamber, the micropump and solenoid valve located between the liquid storing member and the microchannel can be opened at the same time; when stopping supplying the liquid contained in the liquid storing member to the atomizing chamber, the micropump and solenoid valve located between the liquid storing member and the microchannel can be closed at the same time.

[0024] In one embodiment, the electronic cigarette is provided with only one atomizing chamber therein. The liquid outlets of microchannels of the microfluidic liquid supply assembly are in communication with the atomiz-

ing chamber. In one embodiment, the liquid outlets of the microchannels extend into the atomizing chamber so that the liquid outlets of the microchannels are in communication with the atomizing chamber; the atomizing member of the atomizing chamber is configured to atomize the liquid in the atomizing chamber, the aerosol generated after atomization flows to the outside for user in-
 5 takes. In one embodiment, the electronic cigarette is provided with a cigarette holder, the electronic cigarette is also provided with an air inlet channel and a smoke outlet channel, the smoke outlet channel is communicated with the atomizing chamber and the cigarette holder, the air inlet channel is communicated with the outside and the atomizing chamber respectively. When the user sucks, the external air enters the atomizing chamber through the air inlet channel, mixes with the aerosol in the atom-
 10 izing chamber, and then flows out via the smoke outlet channel and cigarette holder for the user to inhales.

[0025] In another example, a plurality of atomizing chambers are provided in the electronic cigarette, the microfluidic liquid supply assembly includes a plurality of microchannels, one liquid outlet of one microchannel is communicated with an atomizing chamber. In one em-
 15 bodiment, the liquid outlet of a microchannel extends into an atomizing chamber to communicate with the liquid outlet with the corresponding atomizing chamber. It can be understandable that each atomizing chamber can be provided with a microchannel outlet, each atomizing chamber can also be provided with a plurality of micro-
 20 channels of liquid outlet. The air outlet ends of the plurality of atomizing chambers are in communication with the mixing chamber. The aerosol formed after atomization in the plurality of atomizing chambers flows out for user inhales after mixing in the mixing chamber. In one em-
 25 bodiment, the electronic cigarette is provided with a cigarette holder, the electronic cigarette is also provided with an air inlet channel and a smoke outlet channel, the smoke outlet channel is in communication with the mixing chamber and the cigarette holder respectively, the air inlet channel is in communication with the outside and the mixing chamber respectively. When the user sucks, the external air enters the mixing chamber via the air inlet channel and flows out via the smoke outlet channel and the cigarette holder after mixing with the aerosol in the mixing chamber. In another embodiment, the air inlet channel is communicated with the atomizing chamber, the external air enters each atomizing chamber via the air inlet channel, carries the aerosol in each atomizing chamber into the mixing chamber, and then flows out successively through the smoke outlet channel and cig-
 30 arette holder for the user to inhales.

[0026] Please refer to FIG. 6, in implementation A, the electronic cigarette is provided with only one atomizing chamber. The liquid storing assembly in the electronic cigarette is configured to store the e-liquid. The electronic cigarette pumps the e-liquid to a microchannel by a mi-
 35 cropump. The e-liquid flows to the atomizing chamber through the microchannel, and the atomizing member in

the atomizing chamber atomizes the e-liquid. In imple-
 40 mentation B, the electronic cigarette is provided with only one atomizing chamber. The liquid storing assembly in the electronic cigarette is configured to store the e-liquid, the electronic cigarette uses a micropump to extract e-liquid from a plurality of microchannels, the e-liquid flows to the atomizing chamber through the plurality of micro-
 45 channels, the atomizing member in the atomizing chamber atomizes e-liquid. In implementation C, a plurality of atomizing chambers, a plurality of microchannels, a plurality of micropumps and a plurality of liquid storing members are provided in the electronic cigarette. The number of atomizing chambers, microchannels, micropumps and liquid storage members in the electronic cigarette is the same (e.g. a) and correspond one by one, the number of the e-liquid transmission path provided in the electronic cigarette is a. Each micropump extracts and delivers e-liquid to the corresponding microchannels, and each mi-
 50 crochannel delivery different types of e-liquid ingredient to different atomizing chambers for separate atomization. In implementation D, a plurality of atomizing chambers, a plurality of microchannels, a plurality of micropumps and a plurality of liquid storing members are arranged in the electronic cigarette. The number of atomizing cham-
 55 bers, microchannels, micropumps and liquid storing members in the electronic cigarette is the same (e.g. a) and correspond one by one, the number of the e-liquid transmission path provided in the electronic cigarette is a. Each micropump extracts and delivers e-liquid to the corresponding microchannel, each microchannel deliv-
 60 ery different types of e-liquid ingredient to the same atomizing chamber for mixing, the mixture is atomized in the atomizing chamber.

[0027] Please refer to FIG. 1, which shows a method flow chart of a liquid supply method provided by an em-
 65 bodiment of the present disclosure. In this embodiment, the liquid supply method is used in electronic cigarette as an example. As shown in FIG. 1, the liquid supply method can include:

[0028] Step 110, obtaining a working parameter of the electronic cigarette, which includes at least one of an output power of the atomizer, a temperature in a atom-
 70 izing chamber and an output voltage of the electronic cigarette.

[0029] In one embodiment, when the cigarette lighting signal is detected, several steps as shown in FIG. 1 are performed.

[0030] Step 120: determining a consumption rate of at least one liquid according to the working parameter, the at least one liquid is e-liquid or both are e-liquid ingredi-
 75 ents.

[0031] This step can be realized in the following ways: In the first way, the liquid storing assembly in the elec-
 80 tronic cigarette is configured to store the e-liquid, the aerosol generated by the atomizing of e-liquid is for users to inhales, the realization of this step can be as follows: the consumption rate of e-liquid is determined according to the working parameters of electronic cigarette. Spe-

cifically, the electronic cigarette can store the corresponding relationship between the working parameters and the consumption rate of e-liquid. The corresponding relationship can be stored in the electronic cigarette in the form of data, such as charts and codes are not limited. The electronic cigarette can obtain the current working parameters of the electronic cigarette and query the consumption rate of the e-liquid corresponding to the working parameters.

[0032] In the second way, determining the heat generation rate of electronic cigarette according to the output power or output voltage of the atomizer; the consumption rate of each liquid is determined according to the heat generation rate.

[0033] In one embodiment, the liquid storing assembly in the electronic cigarette is configured to store the e-liquid, and the aerosol generated after the atomization of the e-liquid is for the user to inhales, then the electronic cigarette can determine the heat generation rate of the electronic cigarette according to the output power or output voltage of the atomizer; the consumption rate of e-liquid is determined according to the heat generation rate. For example, the heat generated by the electronic cigarette in unit time is determined according to the output power of the atomizer; the consumption rate of e-liquid is obtained by determining the volume of e-liquid that can be atomized by the heat.

[0034] In one embodiment, the liquid storing assembly in the electronic cigarette is configured to store the e-liquid ingredient. In the process of atomization, the electronic smoke transports different e-liquid ingredient to the same atomizing chamber through different microchannels, and the heat generation rate of the electronic cigarette can be determined according to the output power or output voltage of the atomizer; the consumption rate of the liquid conveyed by each microchannel is determined according to the heat generation rate and the atomization proportion of the at least one liquid.

[0035] Specifically, the heat generated by the electronic cigarette per unit time is determined according to the output power or output voltage of the atomizer; determine the volume of e-liquid that can be atomized by the heat; the consumption rate of each liquid is determined according to the atomization ratio of the at least one liquid and the volume of the e-liquid. Wherein, the atomization ratio of the at least one liquid is the consumption ratio of each liquid during the use of the electronic cigarette, the atomization ratio of the at least one liquid can be the mixing ratio when the at least one liquid can be mixed to form e-liquid. The atomization ratio can be set by the system developer, or can be customized by the user according to his own smoking taste, and can also be determined for the electronic cigarette according to the smoking taste set by the user. For example, if e-cigarette users like a lighter smoke taste, the atomization ratio of the basic e-liquid can be larger, and the atomization ratio of nicotine can be smaller.

[0036] For example, if the volume of the e-liquid that

can be atomized by the heat generated by the electronic cigarette per unit time is A, the mixing ratio of basic e-liquid, flavor and fragrances, and nicotine in the liquid storing assembly is x:y:z, then the volume consumed by

the basic e-liquid in unit time is $\frac{x \cdot A}{x+y+z}$, the volume of flavors and fragrances consumed per unit of time is $\frac{y \cdot A}{x+y+z}$, the volume of nicotine consumed per unit time is $\frac{z \cdot A}{x+y+z}$.

[0037] The third implementation, the liquid storing assembly in the electronic cigarette is configured to store the e-liquid ingredient. During the atomization process, the electronic cigarette transports different e-liquid ingredients to a plurality of atomizing chambers through different microchannels for separate atomization. The realization of this step can be: determine the output power or output voltage of the atomizing assembly in each atomizing chamber according to the output power or output voltage of the atomizer, the atomization ratio of the at least one liquid, and the type of liquid delivered to each atomizing chamber. The consumption rate of the liquid delivered to the atomizing chamber is determined according to the output power or output voltage of the atomizing assembly in each atomizing chamber. Among them, it should be noted that each atomizing chamber in this method is only used to atomize one kind of e-liquid ingredient, and the consumption rate of liquid corresponding to unit output power or unit output voltage is known. It can be understood that the liquid consumption rate corresponding to the unit output power or the unit output voltage refers to the consumption rate corresponding to each output power of 1W, the unit of consumption rate is ml/sec. The consumption rate of liquid corresponding to unit output power or unit output voltage can be stored in the electronic cigarette. When determining the consumption rate of the liquid delivered to the atomizing chamber according to the output power or output voltage of the atomizing assembly in each atomizing chamber, calculate the consumption rate of the liquid according to the output power of the atomizing assembly in the atomizing chamber and the consumption rate of the liquid corresponding to the unit output power, calculate the liquid consumption rate according to the output voltage of the atomizing assembly in the atomizing chamber and the liquid consumption rate corresponding to the unit output voltage. Among them, the consumption rate of the liquid corresponding to the unit output power or corresponding to the unit output voltage can be set by the system developer. For example, the system developer may perform a plurality of trial determinations.

[0038] In step 130, controlling the microfluidic liquid supply assembly to use a microchannel to supply each

liquid to an atomizing assembly for atomization according to the consumption rate of each liquid.

[0039] This step can be realized by following several ways:

The first implementation, each microchannel is provided with a microvalve, according to the consumption rate of each liquid, the opening degree of the microvalve in the corresponding microchannel for transporting the liquid is controlled, and each liquid is supplied to the atomizing assembly through the corresponding microchannel for atomization. In actual implementation, the liquid outlets of all the microchannels may be communicated with the same atomizing chamber, or the liquid outlets of each microchannel may be communicated with a unique corresponding atomizing chamber.

[0040] In practical implementation, a liquid can be delivered to the atomizing chamber through one or more microchannels. When a liquid is delivered to the atomizing chamber through only one microchannel, the flow velocity of the liquid in the channel is equal to or close to the consumption rate of the liquid by controlling the microvalve in the microchannel. When a liquid is delivered to the atomizing chamber through a plurality of microchannels, the sum of the flow velocities of the liquid in the plurality of channels is equal to or close to the consumption rate of the liquid by controlling the microvalve in each of the microchannels.

[0041] Optionally, a microflow sensor can also be arranged in each microchannel to obtain the flow velocity value detected by the microflow sensor in each microchannel. According to the flow velocity value of each microchannel and the consumption rate of the liquid transported by the microchannel, the opening degree of the internal microvalve is adjusted. Among them, the microflow sensor is an accurate measurement of microfluid, which can be divided into three types: thermal type (including thermal conduction type and thermal time-of-flight type), mechanical type and resonance type according to the working principle. This embodiment does not specifically limit the selection of the microflow sensor.

[0042] The specific implementation can be: when a liquid is transported to the atomizing chamber through only one microchannel, the opening degree of the internal microvalve is adjusted according to the relationship between the flow velocity value of the microchannel and the consumption rate of the liquid transported by the microchannel; when one liquid corresponds to a plurality of microchannels, the opening degree of the microvalves in the a plurality of microchannels is adjusted according to the relationship between the sum of the liquid flow velocities in the a plurality of channels and the corresponding consumption rate of the liquid.

[0043] The second implementation, determine the injection frequency and single injection amount of each liquid according to the consumption rate of each liquid, and the liquid supply rate of liquid supply according to the injection frequency and single injection amount of each liquid is equal to its consumption rate. For each

liquid, according to the injection frequency of each liquid, inject the liquid corresponding to a single injection amount into the liquid inlet of the microchannel corresponding to the liquid each time. A separator is injected after each injection of liquid corresponding to a single injection amount into each microchannel, wherein, the separator is a gas or the separator is a liquid, and the liquid is a e-liquid ingredient. In actual implementation, the liquid outlets of all the microchannels can be communicated with the same atomizing chamber, alternatively, the liquid outlet of each microchannel is communicated with a unique corresponding atomizing chamber.

[0044] Optionally, the separator can be a gas mass having fixed volume, the electronic cigarette is provided with an air pump. The air pump can pump air from the outside to the gas-solid separation device to filter the solid impurities in the air, so as to improve the suction taste of the aerosol of electronic cigarette. The filtered gas can flow to the liquid inlet of each microchannel through the airflow channel, a solenoid valve is arranged in the airflow channel between the air outlet of the gas-solid separation device and the liquid inlet of each microchannel. The amount of gas injected into the microchannel is controlled by controlling the switch of the solenoid valve.

[0045] When the separator is a gas mass having a fixed volume, the gas mass separates the liquid in the microchannel. That is to say, after the liquid is input into the microchannel, the gas mass can be injected again, and after the gas mass is injected, the liquid is injected, and so on and so forth. For example, after the solenoid valve located between the microchannel and the liquid storage member is opened and the solenoid valve in the airflow channel is closed for 0.5 seconds; the solenoid valve connected between the microchannel and the liquid storing member is closed and the solenoid valve in the airflow channel is opened for 0.2 seconds; the solenoid valve connected between the microchannel and the liquid storage member is opened and the solenoid valve in the airflow channel is closed for another 0.5 seconds; the solenoid valve connected between the microchannel and the liquid storing member is closed, and the solenoid valve in the airflow channel is opened for another 0.2 seconds, and the cycle is repeated.

[0046] In actual implementation, when the separator is a liquid, the separator will also be atomized by the atomizing assembly, consuming the heat generated by the electronic cigarette, and easily causing waste of heat. Optionally, the separator can use basic e-liquid to avoid waste of heat generated in the electronic cigarette.

[0047] Optionally, the separator can be a e-liquid ingredient, for each microchannel, controlling the injection rate of the liquid transported by the microchannel is different from the injection rate of the separator, so that part of the liquid in the microchannel is mixed with the separator. For each microchannel, the flow of liquid in the microchannel that is not contaminated by the separator (ie, a portion of the liquid that is not mixed with the sep-

arator) is controlled to the liquid storing member for storing the liquid.

[0048] Taking the separator as the base e-liquid to illustrate, the injection rate of nicotine and flavors and fragrances is different from that of the basic liquid, resulting in the flow velocity of nicotine in one microchannel being different from the flow velocity of the basic liquid, and the flow velocity of flavors and fragrances in another microchannel is different from the flow velocity of the basic liquid. After the basic e-liquid is injected into the microchannel, the nicotine or flavors and fragrances are impacted, the basic e-liquid part injected into the microchannel at one time is mixed with nicotine or flavor and fragrance.

[0049] The third implementation, a groove communicated with the liquid storing assembly is defined on the guiding member, the grooves serve as microchannels. The liquid outlet of each microchannel is provided with a microvalve, the liquid supply frequency of each liquid is determined according to the consumption rate of each liquid and the volume of the groove. For example, calculate the quotient of the consumption rate of each liquid and the volume of the groove to obtain the liquid supply frequency of each liquid; according to the liquid supply frequency of each groove, close the microvalve at the outlet of the groove each time, fill the groove with the corresponding liquid and power on the liquid in the groove (positive or negative charge), and open the microvalve. Wherein, when the microvalve located at the outlet of each groove is opened, the liquid contained in the groove is transported to the atomizing assembly by the force between the charges. In actual implementation, the liquid outlets of the microchannels can be communicated with the same atomizing chamber, or the liquid outlets of each microchannel can be communicated with a unique corresponding atomizing chamber.

[0050] In actual implementation, a plurality of microchannels of the electronic cigarette is defined on the same guiding member, or can be defined on different guiding members.

[0051] In summary, the method provided by the embodiment of the present disclosure obtains the working parameters of the electronic cigarette. The working parameter includes at least one of the output power of the atomizer, the temperature in the atomizing chamber, and the output voltage of the electronic cigarette. The consumption rate of at least one liquid of the electronic cigarette is determined according to the working parameter. The at least one liquid is either a e-liquid or a e-liquid ingredient. According to the consumption rate of each liquid, the microfluidic liquid supply assembly is controlled to supply each liquid to the atomizing assembly for atomization through the microchannel. It solves the problem in the related art that in the actual use of electronic cigarettes, it is difficult to achieve a balance between the supply and consumption of e-liquid, which can easily cause liquid leakage or dry burning; the effect of reducing leakage and avoiding dry burning is achieved.

[0052] In an example, the liquid inlet of each microchannel in the electronic cigarette can be communicated with a liquid storing member through a corresponding micropump, the liquid outlet of each microchannel is communicated with the atomizing chamber, the atomizing assembly is located in the atomizing chamber, the liquid flowing out through the liquid outlet of the microchannel is atomized by the atomizing assembly.

[0053] Optionally, about above-mentioned atomizing assembly can be realized by following several ways:

[0054] The first implementation, the atomizing assembly includes heating member. When the heating member generates heat, it can atomize at least one liquid. The heating member can be a heating sheet, a heating wire or a heating rod.

[0055] The second implementation, atomizing assembly includes ultrasonic atomizing sheet. For example, the ultrasonic atomizing sheet is a piezoelectric ceramic atomizing sheet, and the piezoelectric ceramic atomizing sheet can atomize at least one liquid when it resonates at a predetermined frequency. Among them, the predetermined frequency is usually set by the system developer so that the ultrasonic nebulizer can resonate at high frequency.

[0056] The third implementation, atomizing assembly comprises at least one nozzle and air supply device, each nozzle is in communication with the liquid outlet of a microchannel. The air supply device is configured to apply high pressure air flow to the nozzle side to atomize the liquid sprayed from the nozzle. Optionally, as shown in FIG. 4, when the electronic cigarette detects the cigarette lighting signal, it controls each micropump in the electronic cigarette to extract liquid from the liquid storing member to the corresponding microchannel, and the liquid flows to the nozzle through the microchannel. According to the microflow sensor in the microchannel, when it is determined that the microchannel is supplied by the corresponding micropump (for example, when the flow velocity value detected by the microflow sensor in the microchannel is greater than 0), activate the air supply device to apply high pressure air flow to the nozzle side to atomize the liquid sprayed from the nozzle.

[0057] In another embodiment, the liquid inlet of each microchannel can be communicated with a liquid storing member through the corresponding micropump, the microchannel is provided with a plurality of ventilation holes, the microchannel communicates with the cigarette holder through the ventilation hole. The microchannel is the heating member of the atomizing assembly. When the microchannel is heated, the atomized aerosol flows out of the microchannel through at least one of the ventilation holes, but any liquid in the microchannel (including e-liquid ingredients, separators, and e-liquid) is difficult to overflow from the ventilation holes. For example, the pore size of the ventilation holes may be in the order of millimeters.

[0058] For example, as shown in FIG. 2, the middle part of the microchannel or the side wall of one end of

the microchannel away from the liquid inlet opens a plurality of ventilation holes. The ventilation holes can be round, diamond, square, etc., this embodiment does not specifically limit the shape of the ventilation hole.

[0059] Optionally, as shown in FIG. 3, the inside of the microchannel can be a groove 31, and the groove 31 is provided with a wire mesh 32, the mesh holes on the steel mesh 32 serve as ventilation holes for ventilation.

[0060] When actually realized, as shown in FIG. 5, when the electronic cigarette involved in the application detects the cigarette lighting signal, each micropump in the electronic cigarette can be controlled to pump liquid from the liquid storing member to the corresponding microchannel, the liquid is supplied to the atomizing assembly through the microchannel; at the same time, the atomizing assembly in the electronic cigarette can be controlled to work to atomize the liquid provided by the microchannel.

[0061] Optionally, the micropump involved in the application refers to a small liquid driver for the purpose of directional pipetting. The micropump can be selected from any one of positive displacement pump, rotary pump, peristaltic pump, electro-hydraulic actuated pump, etc. which are classified by the way they work. According to the driving method, the micropump can be divided into piezoelectric driven pump, electrostatic driven pump, thermal driven pump, electromagnetic driven pump, bi-metal driven pump, shape memory alloy driven pump, optical driven pump, pneumatic pump, and so on. According to the driving principle, the micropump can be divided into membrane driven pump, electro-hydraulic power pump, magneto-hydraulic power pump, traveling wave transfer liquid pump, gel driven pump, etc.. The micropump can be divided into valve pumps and valveless pumps according to the state of the fluid inlet and outlet (with or without movable valve plates); this embodiment does not specifically limit the selection of the micropump.

[0062] Optionally, the microvalve involved in the application is an element that switches and controls the flow of fluid. The microvalve is selected from any one of an active valve, a passive one-way valve and a passive shut-off valve, and so on. This embodiment does not specifically limit the selection of the microvalve.

[0063] Optionally, the microchannels involved in the present application are microchannels fabricated on silicon wafers and thin plastic sheets using modern micro-fabrication techniques.

[0064] Optionally, electronic cigarette also obtains the resistance value of heating element in each atomizing chamber; determine whether the resistance of each heating element is within the preset range. If the resistance of any heating element exceeds the preset range, a prompt message for prompting the resistance of the heating element to exceed the preset range will be displayed, and several steps as shown in FIG. 1 will be stopped. If the resistance of any heating element is within the preset range, when a cigarette lighting signal is detected, sev-

eral steps as shown in FIG. 1 are performed, and the atomizing assembly in the electronic cigarette are controlled to work.

[0065] Wherein, the prompt information can be prompted with buzzer prompts, indicator light prompts, text prompts, voice prompts, etc., this embodiment does not specifically limit this, the preset range is the resistance range of the heating element supported by the electronic cigarette hardware.

[0066] An embodiment of the present disclosure also provides a computer-readable storage medium, one or more instructions are stored in the computer-readable storage medium, when the one or more instructions are executed by the processor in the electronic cigarette, the liquid supply method involved in any of the foregoing embodiments is implemented.

[0067] An embodiment of the present disclosure also provides a control device for an electronic cigarette, the control device includes: a memory and a processor; at least one program instruction is stored in the memory; the processor, by loading and executing the at least one program instruction, implements the liquid supply method involved in any of the foregoing embodiments.

[0068] The terms "first" and "second" are only used for descriptive purposes, and should not be understood as indicating or implying relative importance or implying the number of technical features indicated. Thus, a feature defined as "first", "second" may expressly or implicitly include one or more of that features. In the description of the present disclosure, unless otherwise specified, "plurality" means two or more.

[0069] Those of ordinary skill in the art can understand that all or part of the steps of implementing the above embodiments can be completed by hardware, it can also be completed by instructing the relevant hardware through the program, the described program can be stored in a computer-readable storage medium, the above-mentioned storage medium can be a read-only memory, a magnetic disk or an optical disk, and the like.

Claims

1. A liquid supply method, wherein the method is applied to an electronic cigarette, the electronic cigarette is provided with a microfluidic liquid supply assembly and a liquid storing assembly, the liquid storing assembly is configured to store at least one liquid, the method comprises:

obtaining a working parameter of the electronic cigarette, wherein the working parameter of the electronic cigarette comprise at least one of an output power of an atomizer, a temperature in an atomizing chamber and an output voltage of the electronic cigarette;

determining a consumption rate of at least one liquid according to the working parameter;

- controlling the microfluidic liquid supply assembly to use a microchannel to supply each liquid to an atomizing assembly for atomization according to the consumption rate of each liquid; wherein, at least one of the liquid can be e-liquid, or, at least one of the liquid are e-liquid ingredient.
2. The liquid supply method according to claim 1, wherein the microchannel is provided with a microvalve, controlling the microfluidic liquid supply assembly to use a microchannel to supply each liquid to an atomizing assembly for atomization according to the consumption rate of each liquid, comprises: controlling opening degree of the microvalve in the corresponding microchannel for transporting the liquid, according to the consumption rate of each liquid, and supplying each liquid to the atomizing assembly through the corresponding microchannel for atomization.
3. The liquid supply method according to claim 2, wherein the microchannel is provided with a microflow sensor therein, controlling the microfluidic liquid supply assembly to use a microchannel to supply each liquid to an atomizing assembly for atomization according to the consumption rate of each liquid, further comprises:
- obtaining a flow velocity value detected by the microflow sensor in each microchannel;
adjusting the opening degree of the internal microvalve according to the flow velocity value of each microchannel and the consumption rate of the liquid transported by the microchannel.
4. The liquid supply method according to claim 1, wherein the electronic cigarette comprises at least one guiding member, a groove communicated with the liquid storing assembly is defined on the guiding member, the grooves is the microchannel, a liquid outlet of each microchannel is provided with a microvalve, controlling the microfluidic liquid supply assembly to use a microchannel to supply each liquid to an atomizing assembly for atomization according to the consumption rate of each liquid, comprises:
- determining a liquid supply frequency of each liquid according to the consumption rate of each liquid and a volume of the groove;
closing the microvalve at the outlet of the groove each time firstly, according to the liquid supply frequency of each groove, and filling the groove with the corresponding liquid and powering on the liquid in the groove, and then opening the microvalve.
wherein, when the microvalve located at the outlet of each groove is opened, the liquid contained
- in the groove is transported to the atomizing assembly by the force between the charges.
5. The liquid supply method according to claim 1, wherein controlling the microfluidic liquid supply assembly to use a microchannel to supply each liquid to an atomizing assembly for atomization according to the consumption rate of each liquid, comprises:
- determining an injection frequency and single injection amount of each liquid according to the consumption rate of each liquid;
for each liquid, according to the injection frequency of each liquid, injecting the liquid corresponding to a single injection amount into a liquid inlet of the microchannel corresponding to the liquid each time.
injecting a separator after inject an injection amount liquid into each microchannel each time, wherein the injection amount corresponding to a single injection;
wherein, the separator is a gas or the separator is a liquid, and the liquid is a e-liquid ingredient.
6. The liquid supply method according to claim 1, wherein determining a consumption rate of at least one liquid according to the working parameter, comprises:
- determining a heat generation rate of the electronic cigarette according to the output power or the output voltage of the atomizer;
determining the consumption rate of each of the liquids according to the heat generation rate.
7. The liquid supply method according to claim 1, wherein determining the consumption rate of each of the liquids according to the heat generation rate, comprises:
- if the at least one liquid is the e-liquid ingredient, determining the rate of consumption of the liquid delivered by each microchannel according to the heat generation rate, an atomization ratio of the at least one liquid, and a consumption rate of the liquid corresponding to the unit output power or unit output voltage;
if the at least one liquid is e-liquid, determining a consumption rate of the e-liquid according to the heat generation rate.
8. The liquid supply method according to claim 1, wherein a plurality of atomizing chambers are provided in the electronic cigarette, the microfluidic liquid supply assembly comprises a plurality of microchannels, a liquid outlet of each microchannel extends into one atomizing chamber, determining a consumption rate of the at least one liquid according

to the working parameter, comprises:

determining the output power of the atomizing assembly in each atomizing chamber, according to the output power of the atomizer or the output voltage of the atomizer, an atomization ratio of the at least one liquid, and a type of liquid delivered to each atomization chamber; 5
determining the rate of consumption of liquid delivered to the atomizing chamber, according to an output power of the atomizing assembly in each atomization chamber and a consumption rate of the liquid corresponding to an unit output power. 10

9. The liquid supply method according to claim 1, wherein a liquid inlet of each microchannel is communicated with a liquid storage member, a liquid outlet of each of the microchannels extends into the atomizing chamber, the atomizing assembly is arranged in the atomizing chamber; or, 20
the liquid inlet of each microchannel is communicated with the liquid storing member, the middle part of the microchannel or one end of the microchannel away from the liquid inlet opens a plurality of ventilation holes, the microchannel is communicated with a cigarette holder through the ventilation hole; the microchannel is a heating member of the atomizing assembly; when the microchannel is heated, a atomized aerosol flows out of the microchannel through at least one of the ventilation holes, but any liquid in the microchannel is difficult to overflow from the ventilation holes. 25

10. The liquid supply method according to claim 10, wherein the atomizing assembly comprises a heating member, can atomize at least one described liquid when the heating member is heated; and/or, 30

the atomizing assembly comprises ceramic atomizing sheet, the ceramic atomizing sheet can atomize at least one liquid when it resonates at a predetermined frequency, and/or 40
the atomizing assembly comprises at least one nozzle and air supply device, each nozzle is in communication with the liquid outlet of a microchannel; the air supply device is configured to apply high pressure air flow to the nozzle side to atomize the liquid sprayed from the nozzle. 45

11. A computer-readable storage medium, one or more instructions are stored in the computer-readable storage medium, when the one or more instructions are executed by the processor in the electronic cigarette, the liquid supply method involved in any one of claims 1 to 10 is implemented. 50 55

12. A liquid supply device apparatus, comprising:

a memory and a processor;
at least one program instruction is stored in the memory;
the processor, by loading and executing the at least one program instruction, implements the liquid supply method involved in any one of claims 1 to 10.

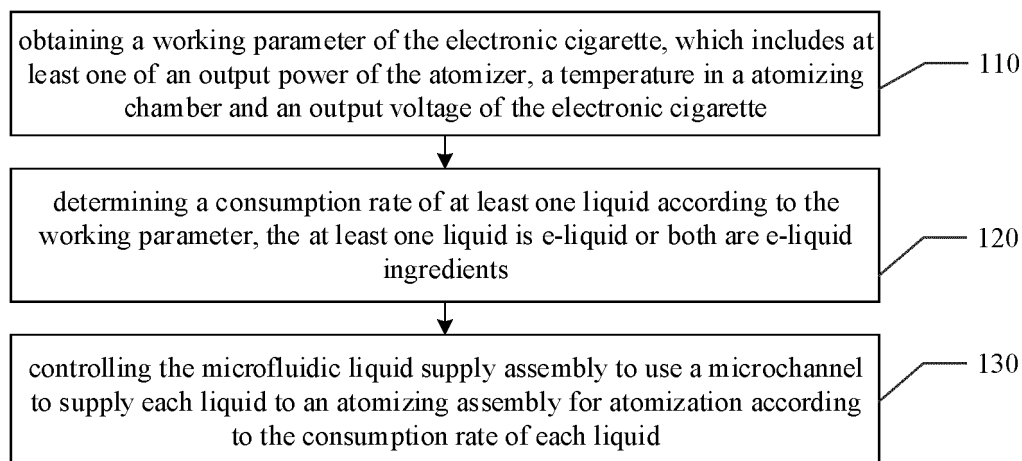


FIG. 1

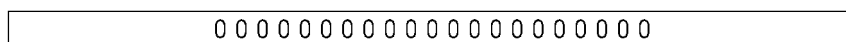


FIG. 2

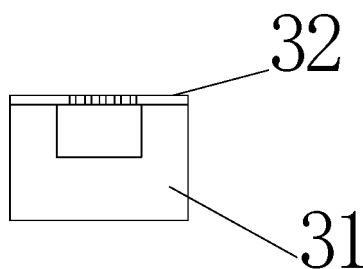


FIG. 3

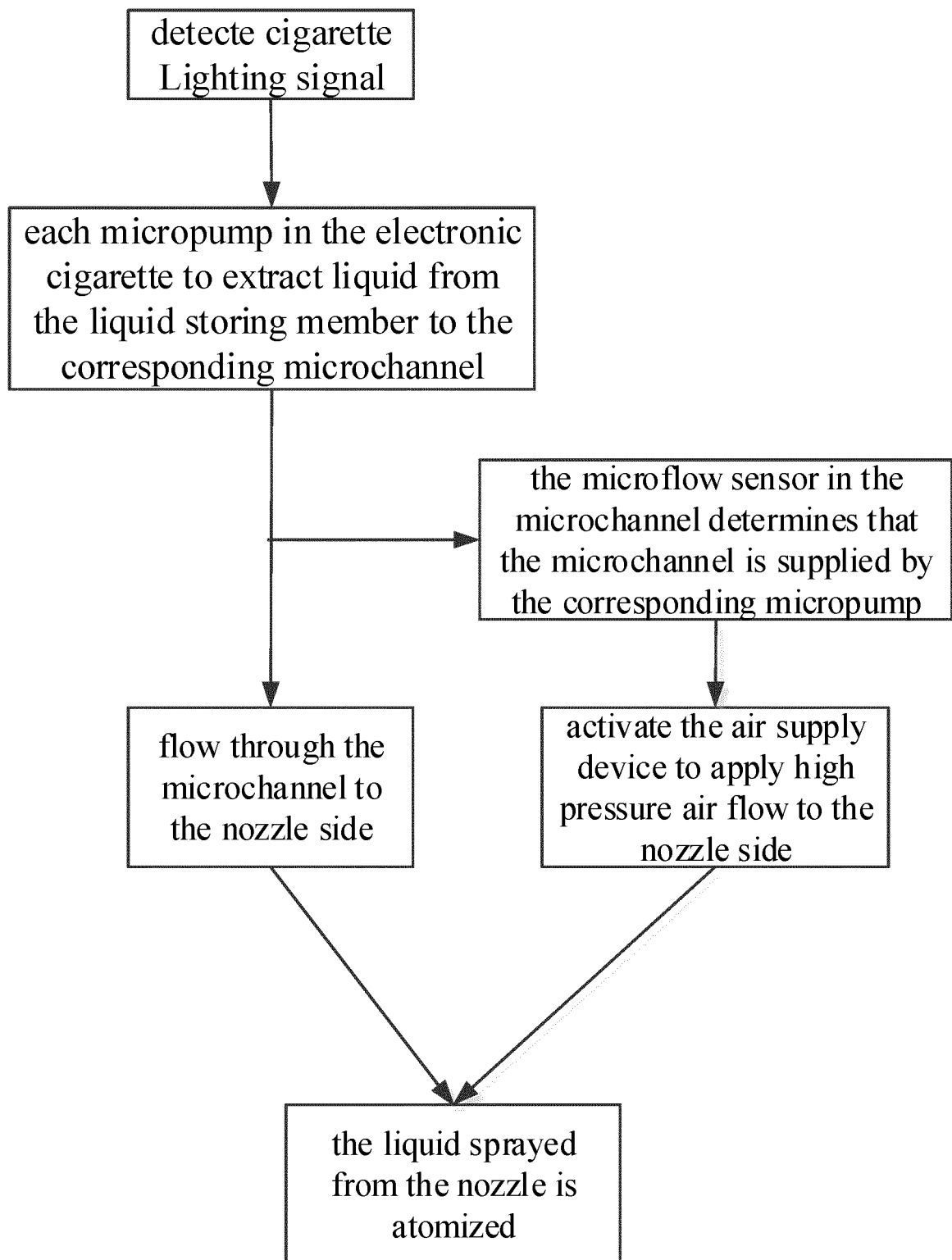


FIG.4

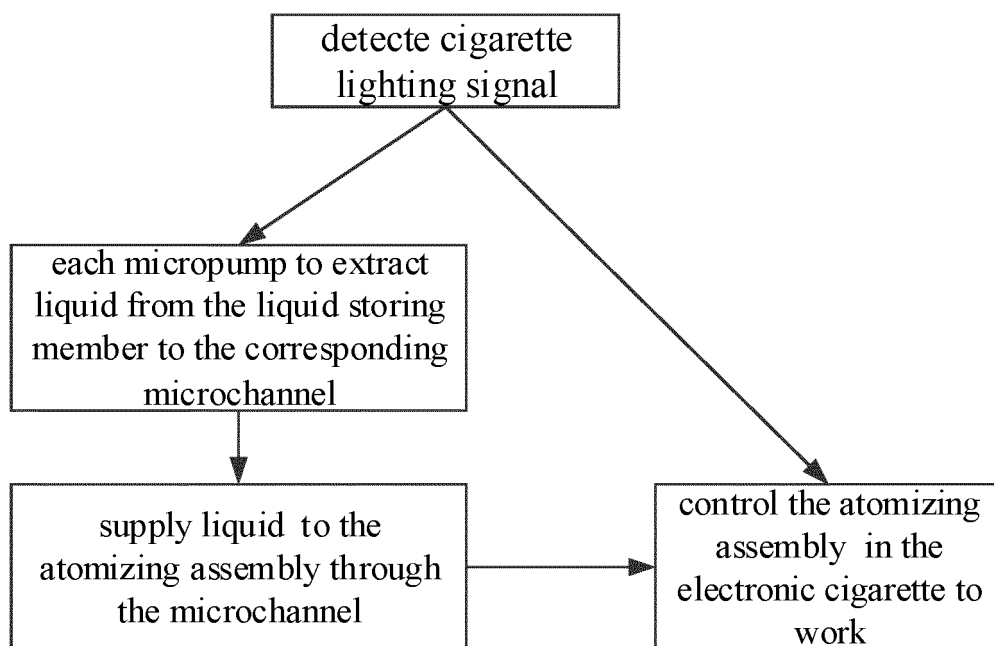


FIG.5

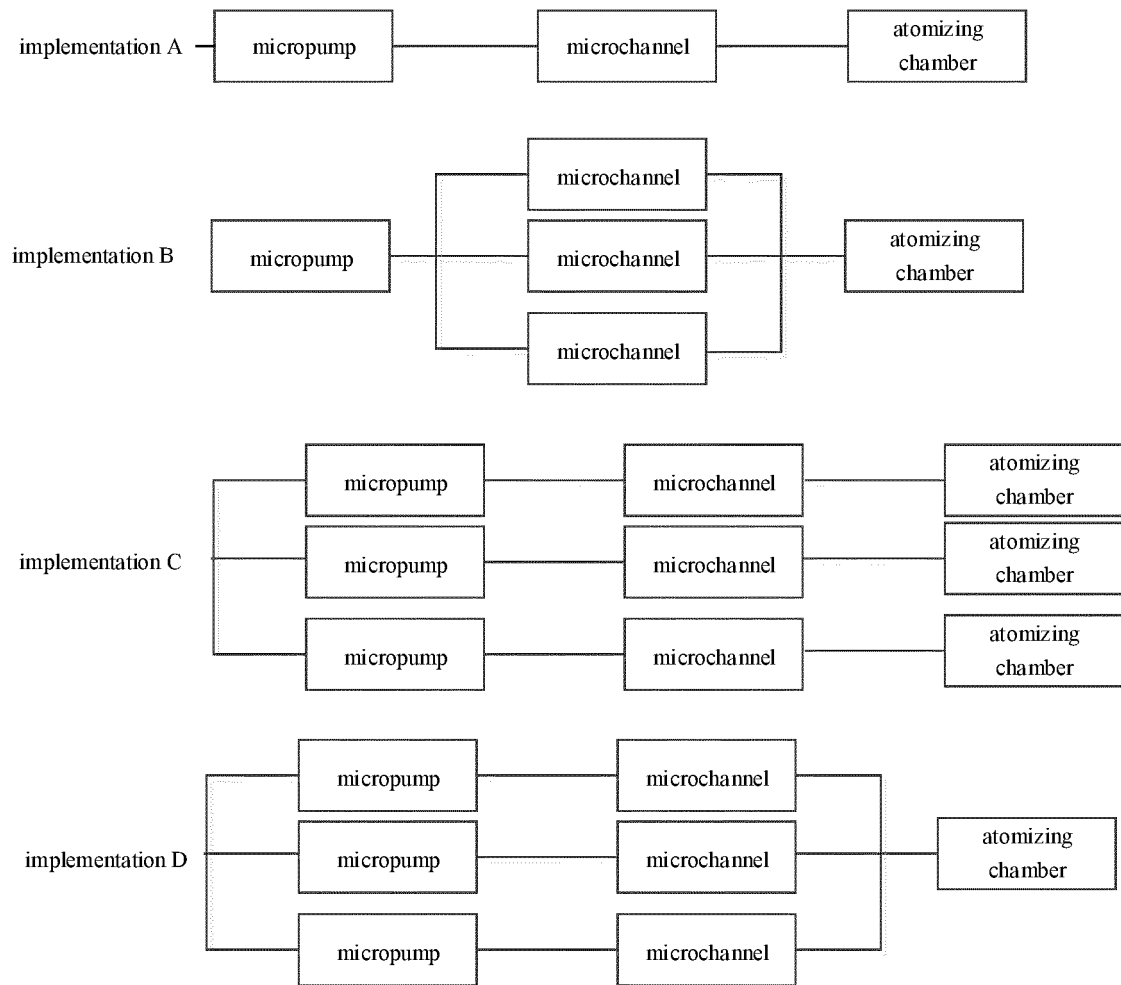


FIG.6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/108146

A. CLASSIFICATION OF SUBJECT MATTERA24F 40/48(2020.01)i; A24F 40/51(2020.01)i; A24F 40/40(2020.01)i; A24F 40/50(2020.01)i; A24F 40/00(2020.01)i;
A24F 47/00(2020.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A24F

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)

CNPAT, WPI, EPODOC, CNKI: 电子烟, 供液, 液体, 雾化, 泵, 腔, 多个, 两个, 功率, 速率, 速度, 调整, 调节, 调变, elec+
cigarette, liquid, supply, bump, multi+, atomiz+, speed, rate, velocity, power**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 110839966 A (CHANGZHOU PAITENG ELECTRONIC TECHNOLOGY SERVICE CO., LTD.) 28 February 2020 (2020-02-28) claims 1-12, description, paragraphs [0045]-[0100], figures 1-6	1-12
X	CN 109674088 A (CHANGZHOU VITO FLUID TECHNOLOGY CO., LTD.) 26 April 2019 (2019-04-26) description paragraphs [0002]-[0003], [0022]-[0032], figures 1-4	1-3, 5-7, 9-12
Y	CN 109674088 A (CHANGZHOU VITO FLUID TECHNOLOGY CO., LTD.) 26 April 2019 (2019-04-26) description paragraphs [0002]-[0003], [0022]-[0032], figures 1-4	4, 8
Y	CN 108685180 A (NOHKEN TECHNOLOGY CO., LTD.) 23 October 2018 (2018-10-23) description paragraphs [0011]-[0031], figures 1-12B	4
Y	CN 207590078 U (ZHONGSHAN YIDA E-BUSINESS CO., LTD.) 10 July 2018 (2018-07-10) description, paragraphs [0018]-[0028], figure 1	8
A	CN 106579566 A (CHANGZHOU PAITENG ELECTRONIC TECHNOLOGY SERVICE CO., LTD.) 26 April 2017 (2017-04-26) entire document	1-12



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

10 September 2020

Date of mailing of the international search report

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Name and mailing address of the ISA/CN

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Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2020/108146

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 2019116880 A1 (ALTRIA CLIENT SERVICES L.L.C.) 25 April 2019 (2019-04-25) entire document	1-12

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2020/108146

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	110839966	A	28 February 2020	None			
CN	109674088	A	26 April 2019	None			
CN	108685180	A	23 October 2018	CN	108685180	B	16 June 2020
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CN	106579566	A	26 April 2017	WO	2018127121	A1	12 July 2018
				EP	3566594	A1	13 November 2019
				US	2018279688	A1	04 October 2018
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CN	208160048	U	30 November 2018	None			
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				KR	20200074146	A	24 June 2020
				US	2019246702	A1	15 August 2019
				WO	2019077121	A1	25 April 2019

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