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

(11) EP 4 508 997 A1

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

(43) Date of publication:
19.02.2025 Bulletin 2025/08

(21) Application number: **23787374.0**

(22) Date of filing: **30.01.2023**

(51) International Patent Classification (IPC):
A24F 40/50 *(2020.01)* ***A24F 40/53*** *(2020.01)*
A24F 40/46 *(2020.01)* ***A24F 40/40*** *(2020.01)*
A24F 40/42 *(2020.01)*

(52) Cooperative Patent Classification (CPC):
A24F 40/40; A24F 40/42; A24F 40/46; A24F 40/50; A24F 40/51; A24F 40/53

(86) International application number:
PCT/CN2023/073850

(87) International publication number:
WO 2023/197726 (19.10.2023 Gazette 2023/42)

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

(30) Priority: **11.04.2022 CN 202210377157**

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

(72) Inventors:
- **DOU, Hengheng**
  Shenzhen, Guangdong 518105 (CN)
- **DENG, Yang**
  Shenzhen, Guangdong 518105 (CN)
- **DU, Jing**
  Shenzhen, Guangdong 518105 (CN)

(74) Representative: **Herrero & Asociados, S.L.**
Edificio Aqua - Agustín de Foxá, 4-10
28036 Madrid (ES)

(54) **ATOMIZATION MEDIUM INSERTION DETECTION METHOD AND ELECTRONIC ATOMIZATION DEVICE**

(57) An atomization medium insertion detection method and an electronic atomization device. The atomization medium insertion detection method comprises: step S11, inputting a microwave signal to an atomization cavity (10), and acquiring a feedback signal of the atomization cavity (10) for the microwave signal; step S12, determining a microwave characteristic value of the microwave signal on the basis of the microwave signal and the feedback signal; and step S13, on the basis of the microwave characteristic value, determining whether an atomization medium is inserted in the atomization cavity (10). The detection method outputs a microwave signal by using a microwave source (15) that an electronic atomization device itself has, so as to detect whether an atomization medium is inserted in the atomization cavity (10), thereby helping to reduce the structural complexity of the electronic atomization device and reduce the detection cost.

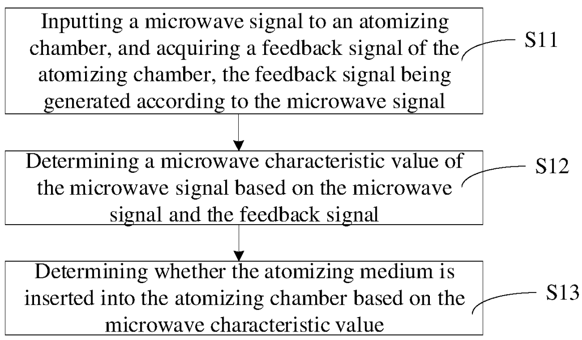

FIG. 1

Processed by Luminess, 75001 PARIS (FR)

Description

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to Chinese Patent Application No. 202210377157.0 filed April 11, 2022, the contents of which are herein incorporated by reference in their entirety.

TECHNICAL FIELD

[0002] The present application relates to the technical field of atomization, in particular to a method for detecting insertion of an atomizing medium and an electronic atomizing device.

BACKGROUND

[0003] With the improvement of living standards, a user has higher and higher requirements on an electronic atomizing device. In order to improve the user experience, it is necessary to detect an insertion state of an atomizing medium, so as to avoid the electronic atomizing device starting a heating function when the atomizing medium is not inserted, and improve a safety performance of the electronic atomizing device.

[0004] However, in the related art, a detection cost of the insertion state of the atomizing medium is high, and a structure of the electronic atomizing device is complicated.

SUMMARY

[0005] A method for detecting insertion of an atomizing medium and an electronic atomizing device are provided in the present disclosure to reduce detection cost and structural complexity of the electronic atomizing device.

[0006] In order to solve the above problems, in a first technical solution of the present disclosure, a method for detecting insertion of an atomizing medium is provided and include: inputting a microwave signal to an atomizing chamber, and acquiring a feedback signal of the atomizing chamber, the feedback signal being generated according to the microwave signal; determining a microwave characteristic value of the microwave signal based on the microwave signal and the feedback signal; and determining whether the atomizing medium is inserted into the atomizing chamber based on the microwave characteristic value.

[0007] In some embodiments, the microwave characteristic value includes one or two of following microwave characteristics: an amplitude of a reflected wave, an amplitude of an incident wave, a reflection coefficient, a S11 parameter, and a standing wave ratio.

[0008] In some embodiments, the microwave characteristic value is the standing wave ratio; the determining whether the atomizing medium is inserted into the atomizing chamber based on the microwave characteristic value, includes: determining that the atomizing medium is inserted into the atomizing chamber, in response to the standing wave ratio being less than a preset standing wave ratio.

[0009] In some embodiments, the microwave characteristic value is the standing wave ratio; the determining whether the atomizing medium is inserted into the atomizing chamber based on the microwave characteristic value, includes: determining that the atomizing medium is inserted into the atomizing chamber, in response to a difference between the standing wave ratio and a standing wave ratio when the atomizing chamber is in a first state being greater than a threshold. When the atomizing chamber is in the first state, the atomizing medium is not inserted into the atomizing chamber.

[0010] In some embodiments, the inputting a microwave signal to an atomizing chamber, includes: inputting the microwave signal to the atomizing chamber, in response to receiving a moving action signal.

[0011] In some embodiments, the inputting the microwave signal to the atomizing chamber, in response to receiving a moving action signal, includes: determining a moving direction based on the moving action signal; and inputting the microwave signal to the atomizing chamber, in response to the moving direction being the same as a direction of the atomizing medium being inserted into the atomizing chamber.

[0012] In some embodiments, the inputting a microwave signal to an atomizing chamber, includes: inputting the microwave signal with a preset frequency to the atomizing chamber; or inputting the microwave signal with a preset frequency range to the atomizing chamber through a frequency sweeping manner.

[0013] In some embodiments, the method includes: acquiring the feedback signal of the atomizing chamber at a preset time interval, determining the microwave characteristic value, and determining whether the atomizing medium is inserted into the atomizing chamber; and stopping inputting the microwave signal to the atomizing chamber, in response to the atomizing medium being not inserted into the atomizing chamber within a preset duration.

[0014] In order to solve the above problems, in a second technical solution of the present disclosure, an electronic atomizing device is provided and includes: an atomizing chamber body, a microwave source, a detection mechanism, and a processor. The atomizing chamber body defines an atomizing chamber configured to accommodate an atomizing medium. The microwave source is configured to input a microwave signal to the atomizing chamber to heat the atomizing medium in the atomizing chamber. The detection mechanism is connected to the microwave source, is configured to acquire the microwave signal and a feedback signal of the atomizing chamber, and is configured to determine a microwave characteristic value of the microwave signal based on the microwave signal and the feedback signal, the feedback signal is generated according to the microwave signal. The processor is connected to the microwave source and the detection mechanism, respectively, is configured to control the microwave source to generate the microwave signal, and is configured to determine whether the atomizing medium is inserted in the atomizing chamber based on the microwave characteristic value.

[0015] In some embodiments, the detection mechanism includes a coupling module and a signal detection circuit. The coupling module is connected to the microwave source, and is configured to receive the feedback signal of the atomizing chamber. The signal detection circuit is connected to the coupling module, is configured to acquire the microwave signal and the feedback signal of the atomizing chamber, and is configured to determine the microwave characteristic value of the microwave signal based on the microwave signal and the feedback signal.

[0016] In some embodiments, the microwave characteristic value includes one or two of following microwave characteristics: an amplitude of a reflected wave, an amplitude of an incident wave, a reflection coefficient, a S11 parameter, and a standing wave ratio.

[0017] In some embodiments, the microwave characteristic value is the standing wave ratio; and the processor is configured to: determine that the atomizing medium is inserted into the atomizing chamber, in response to the standing wave ratio being less than a preset standing wave ratio; or determine that the atomizing medium is inserted into the atomizing chamber, in response to a difference between the standing wave ratio and a standing wave ratio when the atomizing chamber is in a first state being greater than a threshold; when the atomizing chamber is in the first state, the atomizing medium is not inserted into the atomizing chamber.

[0018] In some embodiments, the electronic atomizing device includes a moving sensor connected to the processor, the processor is configured to: control the microwave source to generate the microwave signal, in response to the moving sensor sensing a moving action signal.

[0019] In some embodiments, the electronic atomizing device includes a circuit board and a connector. The microwave source, the detection mechanism, and the processor are arranged on the circuit board, one end of the connector is connected to the microwave source, and the other end of the connector is connected to the atomizing chamber body.

[0020] Technical effects of the present disclosure are as follows. Different from the related art, the present disclosure provides an atomization medium insertion detection method and an electronic atomization device, and the method includes: inputting a microwave signal to an atomizing chamber, and acquiring a feedback signal of the atomizing chamber, the feedback signal being generated according to the microwave signal; calculating a standing wave ratio of the microwave signal based on the microwave signal and the feedback signal; and determining whether the atomizing medium is inserted into the atomizing chamber based on the standing wave ratio, the reflected wave, or the reflection coefficient. The electronic atomizing device use its own microwave source to output the microwave signal, so as to detecting whether the atomizing medium is inserted in the atomizing chamber, thereby reducing the structural complexity of the electronic atomizing device and the detection cost.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] In order to make the technical solutions described in embodiments of the present disclosure more clearly, the drawings configured to description of some embodiments are described. Apparently, the drawings in the following description only illustrate some embodiments of the present disclosure. For the skilled person, other drawings may be acquired according to the drawings without any creative work.

FIG. 1 is a flowchart of a first embodiment of a method for detecting insertion of an atomizing medium according to the present disclosure.

FIG. 2 is a flowchart of a second embodiment of a method for detecting insertion of an atomizing medium according to the present disclosure.

FIG. 3 is a flowchart of a third embodiment of a method for detecting insertion of an atomizing medium according to the present disclosure.

FIG. 4 is a structural schematic view of an electronic atomizing device according to some embodiments of the present disclosure.

FIG. 5 is a structural schematic diagram of an electronic atomizing device according to some embodiments of the present disclosure.

FIG. 6 is a structural schematic diagram of an electronic atomizing device according to some embodiments of the present disclosure.

FIG. 7 is a structural schematic view of an embodiment of an atomizing chamber body of the electronic atomizing device shown in FIG. 4 according to the present disclosure.

FIG. 8 is a structural schematic view of an assembly structure of the atomizing chamber body and a connector shown in FIG. 7.

FIG. 9 is a structural schematic view of another embodiment of an atomizing chamber body of the electronic atomizing device shown in FIG. 4 according to the present disclosure.

DETAILED DESCRIPTIONS

[0022] The technical solutions in embodiments of the present disclosure are clearly and completely described in conjunction with the drawings in the embodiments of the present disclosure. It is obvious that the described embodiments are only some embodiments of the present disclosure, and not all embodiments. All other embodiments acquired by the skilled person based on the embodiments in the present disclosure without the creative work are all within the scope of the present disclosure.

[0023] In the following description, specific details such as a specific system structure, an interface, and a technology, etc. are provided for illustration and not for limitation, so as to thoroughly understand the present disclosure.

[0024] The terms "first", "second" and "third" in embodiments of the present disclosure are only configured to description purposes and cannot be understood as indicating or implying relative importance or implicitly indicating the number of technical features indicated. Thus, features defined as "first", "second", and "third" may explicitly or implicitly include at least one of the features. In embodiments of the present disclosure, "multiple" means at least two, such as two, or three, etc., unless otherwise specifically defined. All directional indications (such as up, down, left, right, front, back...) used in embodiments of the present disclosure are only used to explain relative position relationship, motion situation, etc. between components in a specific posture (as shown in the drawings). When the specific posture changes, the directional indication also changes accordingly. The terms "including" and "having", and any modification thereof are intended to cover un-exclusive inclusion. For example, a process, method, system, product, or device that includes a series of operations or units is not limited to the listed operations or units, but optionally also includes operations or units not listed, or optionally includes other operations or units inherent to the process, method, product, or device.

[0025] "Embodiment" mentioned in the present disclosure means that a specific feature, structure, or characteristics described in conjunction with embodiments may be included in at least one embodiment of the present disclosure. Some embodiments including a phrase appearing in various positions in the specification does not necessarily refer to the same embodiment, and does not independents or alternative embodiment that are mutually exclusive with other embodiments. The skilled person explicitly and implicitly understands that the embodiments described in the present disclosure may be combined with other embodiments.

[0026] The present disclosure is described in detail below in combination with the drawings and some embodiments.

[0027] For an electronic atomizing device using low-temperature baking heating, there are two frequently-used ways to detect an insertion state of an atomizing medium.

[0028] In the first way, an atomizing chamber configured to be inserted by the atomizing medium is designed to be a movable form. When the atomizing medium is inserted into the atomizing chamber, the chamber defined in the atomizing chamber body moves accordingly, and the detection of insertion of the atomizing medium is implemented by detecting chamber movement or chamber position change. For example, the detection of the chamber movement or the chamber position change may be implemented through a travel switch or a Hall switch. However, designing the atomizing chamber to be movable increases the structural complexity and the cost. In addition, when the atomizing medium is not inserted into the atomizing chamber and other objects make the atomizing chamber move or change position, an atomizing heating function is started to cause a safety risk.

[0029] In the second way, a magnetic material is added inside the atomizing medium. When the atomizing medium is inserted into the atomizing chamber, the chamber defined in the atomizing chamber body is affected by the magnetic material inside the atomizing medium, the electromagnetic characteristic of the atomizing chamber body changes, and the detection of insertion of the atomizing medium is implemented by detecting the change of the electromagnetic characteristic. For example, the insertion of the atomizing medium is detected by measuring the magnetic flux in the atomizing chamber body or the inductance variation of a coil around the atomizing chamber body. However, to implement the detection of the atomizing medium being inserted into the atomizing chamber in this detection way, the magnetic material has to be added inside the atomizing medium, which is not conducive to cost control.

[0030] In view of the problems existing in the related art in detecting an insertion state of an atomizing medium, some embodiments of the present disclosure provide a method for detecting insertion of an atomizing medium and an electronic atomizing device.

[0031] FIG. 1 is a flowchart of a first embodiment of a method for detecting insertion of an atomizing medium according to the present disclosure.

[0032] The first embodiment of the method for detecting insertion of the atomizing medium according to the present disclosure includes following operations.

[0033] An operation S11 may include: inputting a microwave signal to an atomizing chamber, and acquiring a feedback signal of the atomizing chamber, the feedback signal being generated according to the microwave signal.

[0034] In some embodiments, a microwave source inputs the microwave signal to the atomizing chamber at a preset power, the preset power may be from 10dbm to 40dbm. When the preset power is less than 10dbm, the power is too small to be detected. When the preset power is more than 40dbm, the microwave signal is not suitable to be used as a detection signal.

[0035] In some embodiments, the microwave source inputs the microwave signal with a preset frequency to the atomizing chamber, or inputs the microwave signal with a preset frequency range to the atomizing chamber through a frequency sweep manner. When the microwave source inputs the microwave signal with the preset frequency to the atomizing chamber, the preset frequency may be from 433.05MHz to 5.857GHz. When the microwave source inputs the microwave signal with the preset frequency range to the atomizing chamber in the frequency sweeping manner, the preset frequency range is an industrial scientific medical (ISM) frequency band, such as 433.05MHz to 434.79MHz, 902MHz to 928MHz, 2.400GHz to 2.500GHz, 5.725GHz to 5.875GHz. In some embodiments, the preset frequency range may be 2.400GHz to 2.500GHz, 5.725GHz to 5.875GHz. In some embodiments, when the microwave source inputs the microwave signal with the preset frequency range to the atomizing chamber through the frequency sweep manner, the preset frequency range may be stepped at 0.01GHz.

[0036] It may be understood that, when the microwave signal with the preset frequency range is input to the atomization chamber through the frequency sweep manner, multiple frequency points may be detected, which may ensure the effectiveness and accuracy of the detection. When the microwave signal with the preset frequency is input to the atomizing chamber, the detection of insertion of the atomizing medium may be implemented fast and with a low energy consumption.

[0037] The microwave signal includes an amplitude of a microwave incident wave. After receiving the microwave signal, the atomizing chamber reflects the microwave signal to form a feedback signal, and the feedback signal includes an amplitude of the microwave reflected wave.

[0038] An operation S12 may include: determining a microwave characteristic value of the microwave signal based on the microwave signal and the feedback signal.

[0039] The microwave characteristic value of microwave signal may be represented by one or two of following microwave characteristics: a standing wave ratio, a reflection coefficient, a S11 parameter, an amplitude of a reflected wave, and an amplitude of an incident wave. There is a clear relationship between the standing wave ratio, the reflection coefficient, and the S11 parameter.

[0040] The formula for calculating the reflection coefficient is: $\Gamma=E^-/E^+$, where Γ represents the reflection coefficient, E^- represents the amplitude of the reflected wave in the feedback signal, and E^+ represents the amplitude of the incident wave in the microwave signal.

[0041] The formula for the standing wave ratio is: $VSWR=(1+\Gamma)/(1-\Gamma)$, where VSWR represents the standing wave ratio, and Γ represents the reflection coefficient.

[0042] The formula for calculating S11 parameter is: $S11=201g(\Gamma)$, where Γ represents the reflection coefficient.

[0043] In the detection operation, a signal detection circuit may be configured to process the microwave signal and the feedback signal, that is, the signal detection circuit may directly detect to acquire the reflection coefficient, the S11 parameter, or the standing wave ratio. When the signal detection circuit detects to acquire the reflection coefficient or the S11 parameter, the standing wave ratio may be calculated based on the relationship between the reflection coefficient and the standing wave ratio, or the standing wave ratio may be calculated based on the relationship between the S11 parameter and the standing wave ratio. When the signal detection circuit detects to acquire both the amplitude of the reflected wave and the amplitude of the incident wave, the standing wave ratio is calculated.

[0044] An operation S13 may include: determining whether the atomizing medium is inserted into the atomizing chamber based on the microwave characteristic value.

[0045] The inventors of the present application found that the standing wave ratio when the atomizing medium is inserted into the atomizing chamber is significantly different from a standing wave ratio when the atomizing medium is not inserted into the atomizing chamber. Therefore, the standing wave ratio may be configured to judge whether the atomizing medium is inserted into the atomizing chamber.

[0046] It may be understood that when the microwave characteristic value is the standing wave ratio, it may be directly judged whether there is the atomizing medium inserted in the atomizing chamber. When the microwave characteristic value is the reflection coefficient, the S11 parameter, the amplitude of the reflected wave, or the amplitude of the incident wave, the standing wave ratio may be calculated based on the reflection coefficient, the S11 parameter, or the amplitude of the reflected wave and the amplitude of the incident wave, and then whether the atomizing medium is inserted in atomizing chamber may be judged based on the calculated standing wave ratio.

[0047] In some embodiments, it is determined that the atomizing medium is inserted in the atomizing chamber, in response to the standing wave ratio being less than a preset standing wave ratio. In this embodiment, multiple experimental standing wave ratio s are acquired through multiple experiments when the atomizing medium is not inserted in the atomizing chamber, and the preset standing wave ratio is determined based on the multiple experimental standing wave ratio s. In some embodiments, the average value of the multiple experimental standing wave ratio s is taken as the preset standing wave ratio. Since the standing wave ratio when the atomizing medium is inserted into the atomizing chamber is significantly smaller than the standing wave ratio when the atomizing medium is not inserted into the atomizing chamber, when the standing wave ratio is determined to be less than the preset standing wave ratio, it may be determined that the atomizing medium is inserted into the atomizing chamber. It may be understood that a model of the electronic atomizing device used in the experiment for determining the preset standing wave ratio is the same as a model of the electronic atomizing device to be detected.

[0048] In other embodiments, it is determined that the atomizing medium is inserted into the atomizing chamber, in response to a difference between the standing wave ratio and a standing wave ratio when the atomizing chamber is in the first state being greater than a threshold. When the atomizing chamber is in the first state, the atomizing medium is not inserted the atomizing chamber. In this embodiment, a first experimental standing wave ratio is acquired experimentally when the atomizing medium is not inserted into the atomizing chamber. Since the atomizing chamber may adapt to various models of atomizing media, when different models of atomizing media are inserted into the atomizing chamber, standing wave ratio s are different. When different models of atomizing media are inserted into the atomizing chamber, multiple second experimental standing wave ratio s are acquired through experiments. A threshold is acquired based on multiple differences between the multiple second experimental standing wave ratio s and the first experimental standing wave ratio. In some embodiments, a minimum value in the multiple differences between the multiple second experimental standing wave ratio s and the first experimental standing wave ratio is taken as the threshold. When it is determined that the difference between the standing wave ratio and the standing wave ratio when the atomizing medium is not inserted into the atomizing chamber is greater than the threshold, it may be determined that the atomizing medium matching the atomizing chamber is inserted into the atomizing chamber. It may be understood that the model of the electronic atomizing device used in the experiments for determining the threshold is the same as the model of the electronic atomizing device to be detected.

[0049] In order to achieve good detection accuracy, the standing wave ratio is designed to be close to 1 when the atomizing medium is inserted into the atomizing chamber, and the standing wave ratio is designed to be significantly larger than 1 when the atomizing medium is not inserted into the atomizing chamber. In some embodiments, when the atomizing medium is inserted into the atomizing chamber, a standing wave ratio of at least one frequency point within the preset frequency range mentioned above is designed to be less than 3. When the atomizing medium is not inserted in the atomizing chamber, all standing wave ratio s within the preset frequency range mentioned above are at least greater than 3.

[0050] In some embodiments, the atomizing medium is heated, in response to the atomizing medium being inserted in the atomizing chamber.

[0051] In some embodiments, in response to the atomizing medium being inserted in the atomizing chamber, the microwave source is controlled to output the microwave signal to heat the atomizing medium at a preset heating mode, so that the atomizing medium is atomized to generate an aerosol.

[0052] In the method for detecting insertion of the atomizing medium provided in some embodiments of the present disclosure, the electronic atomizing device use its own microwave source to output the microwave signal, and whether the atomizing medium is inserted in the atomizing chamber is detected based on the difference between the standing wave ratio when the atomizing medium is inserted in the atomizing chamber and the standing wave ratio when the atomizing medium is not inserted in the atomizing chamber, so that the detection method is simple. Compared with the technical solution in the related art that the atomizing chamber is designed to be movable to implement detection, some embodiments of the present disclosure implement the detection by using the original microwave source arranged in the electronic atomizing device, thereby reducing the structural complexity of the electronic atomizing device. Moreover, compared with the technical solution in the related art that the detection is implemented by adding the magnetic material to the atomizing medium, some embodiments of the present disclosure may detect the atomizing medium without the magnetic material, thereby improving the applicability and reducing the cost.

[0053] FIG. 2 is a flowchart of a second embodiment of a method for detecting insertion of an atomizing medium according to the present disclosure.

[0054] A difference between the first and second embodiments of the method for detecting the insertion of the atomizing medium according to the present disclosure is that, in the second embodiment, an operation S10 is included in operation S11. The operation S10 is described in detail, and the same operations are not repeated.

[0055] The operation S10 may include: inputting a microwave signal to the atomizing chamber, in response to receiving a moving action signal.

[0056] In some embodiments, whether there is the moving action signal is first judged, that is, whether an action of the atomizing medium being inserted into the atomizing chamber is first judged, and then the microwave source is controlled to input the microwave signal to the atomizing chamber to complete the detection of whether the atomizing medium is inserted into the atomizing chamber, thereby saving energy consumption. after the moving action signal is received, the detection and identification operation of whether the atomizing medium is inserted into the atomizing chamber is quickly performed, thereby shortening the detection time and improving the detection efficiency.

[0057] In order to avoid unnecessary action triggering the moving action signal, and thereby triggering the operation of inputting the microwave signal into the atomizing chamber and detecting whether the atomizing medium is inserted into the atomizing chamber, the operation S10 may include following operations.

[0058] An operation S101 may include: determining a moving direction based on the moving action signal.

[0059] In some embodiments, the moving action signal is acquired by a moving sensor.

[0060] In some embodiments, the moving sensor is an acceleration sensor. When an action is preformed, an acceleration is generated in a moving direction of the action, and the acceleration sensor senses the acceleration and determines the moving direction of the action. For example, an insertion action causes an acceleration in the insertion direction, and the acceleration sensor senses the acceleration in the insertion direction and determines the moving direction of the insertion action.

[0061] An operation S 102 may include: inputting a microwave signal to the atomizing chamber, in response to the moving direction being the same as a direction of the atomizing medium being inserted into the atomizing chamber.

[0062] The moving direction of the moving action signal is the same as the direction of the atomizing medium being inserted into the atomizing chamber, which indicates that there is an action of the atomizing medium being inserted into the atomizing chamber. At this time, the operation of inputting the microwave signal into the atomizing chamber is triggered, and whether the atomizing medium is inserted into the atomizing chamber is detected, so as to avoid unnecessary actions triggering the detection operation, save energy consumption, improve detection accuracy and detection efficiency.

[0063] As shown in FIG. 3, FIG. 3 is a flowchart of a third embodiment of a method for detecting insertion of an atomizing medium according to the present disclosure.

[0064] A difference between the first and third embodiments of the method for detecting the insertion of the atomizing medium according to the present disclosure is that, the third embodiment includes operation S14 and S15, and the same operations are not repeated.

[0065] An operation S14 may include: acquiring the feedback signal of the atomizing chamber at a preset time interval, determining the microwave characteristic value, and determining whether the atomizing medium is inserted into the atomizing chamber.

[0066] By acquiring the feedback signal of the atomizing chamber at the preset time interval, determining the microwave characteristic value, an operation of continuously detecting whether the atomizing medium is inserted into the atomizing chamber is achieved, so as to quickly respond to the atomizing medium being inserted into the atomizing chamber, thereby improving the user experience.

[0067] An operation S15 may include: stopping inputting the microwave signal to the atomizing chamber, in response to the atomizing medium being not inserted into the atomizing chamber within a preset duration.

[0068] When the atomizing medium is not inserted into the atomizing chamber within the preset duration, the microwave signal is stopped inputting to the atomizing chamber, that is, the detection operation is stopped to save energy consumption. The preset duration is may be designed as required. It is noted that, in response to receiving a start signal of the electronic atomizing device, the detection operation is started and the microwave signal is input to the atomization chamber again.

[0069] It may be understood that the operations S14 and S15 have no sequence relationship with the operations S13 and S14.

[0070] The operations S14 and S15 in the third embodiment of the method for detecting insertion of the atomizing medium provided in the present disclosure may be applied to the second embodiment of the method for detecting insertion of the atomizing medium provided in the present disclosure. When the atomizing medium is not inserted into the atomizing chamber within the preset duration, the microwave signal is stopped inputting to the atomizing chamber, and the moving sensor is stopped detecting, and the entire detection operation is in a standby state.

[0071] In the second embodiment of the method for detecting insertion of the atomizing medium, the detection operation of whether the atomizing medium is inserted into the atomizing chamber is triggered only when the action of the atomizing medium being inserted is occurred in the atomizing chamber, in this case, the preset duration may be set to a duration required for the atomizing medium to be inserted into the atomizing chamber. When continuous detection is performed at the preset time interval within the preset duration and the atomizing medium is not determined to be inserted into the atomizing chamber, the detection operation may be stopped, which saves energy consumption. In some embodiments, the preset duration is 2s.

[0072] As shown in FIG. 4, FIG. 4 is a structural schematic view of an electronic atomizing device according to some embodiments of the present disclosure.

[0073] The electronic atomizing device may include an atomizing chamber body 11, a microwave source 15, a detection mechanism 16, and a processor 17. The atomizing chamber body 11 defines an atomizing chamber 10 to accommodate an atomizing medium. The microwave source 15 is configured to input a microwave signal to the atomizing chamber 10 to heat the atomizing medium in the atomizing chamber 10. The detection mechanism 16 is connected to the microwave source 15, and is configured to acquire the microwave signal and a feedback signal of the atomizing chamber 10, and determine a microwave characteristic value of the microwave signal based on the microwave signal and the feedback signal. The processor 17 is connected to the microwave source 15 and the detection mechanism 16, respectively, and is configured to control the microwave source 15 to generate the microwave signal, and determine whether the atomizing medium is inserted into the atomizing chamber 10 based on the microwave characteristic value.

[0074] In some embodiments, the electronic atomizing device may include a circuit board 12, a battery 13, and a connector 14. The microwave source 15, the detection mechanism 16, and the processor 17 are arranged on the circuit board 12. The battery 13 is connected to the circuit board 12 to supply power to the microwave source 15. One end of the connector 14 is connected to the microwave source 15, and the other end of the connector 14 is connected to the atomizing chamber body 11.

[0075] The processor 17 is configured to control the microwave source 15 to input the microwave signal to the atomizing chamber 10 to heat the atomizing medium in the atomizing chamber 10. In some embodiments, the microwave source 15 is configured to input the microwave signal to the atomizing chamber 10 through the connector 14. The microwave signal inputted by the microwave source 15 to the atomizing chamber 10 may be configured to detect whether the atomizing medium is inserted into the atomizing chamber 10. It may be understood that the microwave signal configured to heat the atomizing medium in the atomizing chamber 10 and the microwave signal configured to detect whether the atomizing medium is inserted in the atomizing chamber 10 may be the same or different, which may be designed as required.

[0076] As shown in FIG. 5, FIG. 5 is a structural schematic diagram of an electronic atomizing device according to some embodiments of the present disclosure.

[0077] The detection mechanism 16 is connected to the microwave source 15, and is configured to acquire the microwave signal and the feedback signal of the atomizing chamber 10, and is configured to determine the microwave characteristic value of the microwave signal based on the microwave signal and the feedback signal. The feedback signal is generated according to the microwave signal.

[0078] The detection mechanism 16 may include a coupling module 161 and a signal detection circuit 162. The coupling module 161 is connected to the microwave source 15, and is configured to receive the feedback signal of the atomizing chamber 10. The signal detection circuit 162 is connected to the coupling module 161, is configured to acquire the microwave signal and the feedback signal of the atomizing chamber 10, and is configured to determine the microwave characteristic value of the microwave signal based on the microwave signal and the feedback signal.

[0079] The processor 17 is connected to the microwave source 15 and the detection mechanism 16, respectively, is configured to control the microwave source 15 to generate the microwave signal, and is configured to determine whether the atomizing medium is inserted into the atomizing chamber 10 based on the microwave characteristic value.

[0080] In some embodiments, the microwave characteristic value includes one or two of following microwave characteristics: an amplitude of a reflected wave, an amplitude of an incident wave, a reflection coefficient, a S11 parameter, and a standing wave ratio. There is a clear relationship between the standing wave ratio, the reflection coefficient, and the S11 parameter, as described above. The microwave characteristic value is the standing wave ratio or the standing wave ratio is calculated, and the processor 17 is configured to determine that the atomizing medium is inserted in the atomizing chamber 10, in response to the standing wave ratio being less than a preset standing wave ratio. In some embodiments, the processor 17 is configured to determine that the atomizing medium is inserted into the atomizing chamber 10, in response to a difference between the standing wave ratio and the standing wave ratio when the atomizing chamber 10 is in the first state being greater than a threshold. When the atomizing chamber 10 is in the first state, the atomizing medium is not inserted into the atomizing chamber 10. In the detection principle diagram shown in FIG. 5, the implementation of the detection operation may be referred to the first embodiment of the method for detecting insertion of the atomizing medium described above, which is not repeated.

[0081] It should be noted that the processor 17, the detection mechanism 16, and the microwave source 15 are configured to cooperate to acquire the feedback signal of the atomizing chamber 10 at the preset time interval, determine the microwave characteristic value, and continuously perform the detection operation of whether the atomizing medium is inserted into the atomizing chamber. When the atomizing medium is not inserted into the atomizing chamber 10 within the preset duration, the microwave signal is stopped inputting to the atomizing chamber 10, that is, the detection operation is stopped, which saves energy consumption. The process of the continuous detection operation may be referred to in the third embodiment of the method for detecting insertion of the atomizing medium, and is not repeated.

[0082] As shown in FIG. 6, FIG. 6 is a structural schematic diagram of an electronic atomizing device according to some embodiments of the present disclosure.

[0083] In some embodiments, as shown in FIG. 4, the electronic atomizing device includes a moving sensor 18 arranged on the circuit board 12. As shown in FIG. 6, the moving sensor 18 is connected to the processor 17, and the processor 17 is configured to control the microwave source 15 to generate the microwave signal, in response to the moving sensor 18 sensing the moving action signal. When the electronic atomizing device is not used, the electronic atomizing device is in the standby state, and the processor 17 sets the moving sensor 18 to be an energy consumption saving mode. When an action of the atomizing medium being inserted into the atomizing chamber 10 occurs and the action is sensed by the moving sensor 18, the moving sensor 18 wakes up the processor 17 through interrupting a pin, the processor 17 controls the microwave source 15 to input the microwave signal to the atomizing chamber 10, and then the processor 17 acquires the standing wave ratio of the atomizing chamber 10 through the detection mechanism 16. According to the difference between the standing wave ratio when the atomizing medium is inserted into the atomizing chamber 10 and the standing wave ratio when the atomizing medium is not inserted into the atomizing chamber 10, the detection operation of whether the atomizing medium is inserted into the atomizing chamber 10 is completed. In the detection principle diagram shown in FIG. 6, the implementation of the detection operation may be referred to the second embodiment of the method for detecting insertion of the atomizing medium described above and is not repeated.

[0084] It should be noted that the processor 17, the detection mechanism 16, and the microwave source 15 are configured to cooperate to acquire the feedback signal of the atomizing chamber 10 at the preset time interval, determine the microwave characteristic value, and continuously perform the detection operation of whether the atomizing medium is inserted into the atomizing chamber. When the atomizing medium is not inserted into the atomizing chamber 10 within the preset duration, the microwave signal is stopped inputting to the atomizing chamber 10, that is, the detection operation is stopped, which saves energy consumption. The process of the continuous detection operation may be referred to in the third embodiment of the method for detecting insertion of the atomizing medium, and is not repeated.

[0085] It may be understood that, after the processor 17 determines that the atomizing medium is inserted into the atomizing chamber 10, the processor 17 controls the microwave source 15 to output the microwave signal to the atomizing chamber 10 to heat the atomizing medium based on the preset heating mode, so as to atomize the atomizing medium to generate an aerosol. In addition, the processor 17 is configured to control an indication light (not shown) of the electronic atomizing device to perform corresponding light indication.

[0086] As shown in FIGS. 7 and 8, FIG. 7 is a structural schematic view of an embodiment of an atomizing chamber body of the electronic atomizing device shown in FIG. 4 according to the present disclosure, and FIG. 8 is a structural schematic view of an assembly structure of the atomizing chamber body and a connector shown in FIG. 7.

[0087] The atomizing chamber body 11 is a hollowly cylindrical structure, and an inner space of the atomizing chamber body 11 defines the atomizing chamber 10. The shape of the atomizing chamber 10 is designed based on the shape of the atomizing medium. Since the atomizing medium is cylindrical, a cross-sectional shape of the atomizing chamber 10 is designed to be circular to ensure the convenience of assembling the atomizing medium with the atomizing chamber 10. The material of the atomizing chamber body 11 is metal or the surface of the atomizing chamber body 11 is coated with a metal coating for the need of radio frequency shielding and radio frequency feeding.

[0088] In this embodiment, the atomization chamber 10 is fed by being connected to the microwave source 15 through the connector 14 (as shown in FIG. 8), which ensures the convenience of connection and facilitates the miniaturization of the electronic atomizing device. In other embodiments, the atomization chamber 10 may be fed by being connected to the microwave source 15 through a radio frequency ejector pin, so as to achieve convenience of connection and miniaturization of the electronic atomizing device.

[0089] In some embodiments, as shown in FIGS. 7 and 8, a through hole 111 is defined on the side wall of the atomizing chamber body 11, and a connector 14 is arranged corresponding to the through hole 111, so as to connect the connector 14 to the atomizing chamber body 11. An inner conductor 112 is arranged in the bottom of the atomizing chamber 10, and the inner conductor 112 is spaced from the inner side surface of the atomizing chamber body 11. The connector 14 includes a signal input terminal 141 abutting against the inner conductor 112 to input the microwave signal to the atomizing chamber 10.

[0090] In some embodiments, the inner conductor 112 is integrally formed with the atomizing chamber body 11.

[0091] In some embodiments, an antenna 113 is arranged on the end of the inner conductor 112 away from the bottom of the atomizing chamber 10, and the axis of the antenna 113 coincides with the axis of the inner conductor 112 (as shown in FIG. 7). The end of the antenna 113 away from the bottom of the atomizing chamber 10 does not extend out of the atomizing chamber 10. When the atomizing medium is inserted into the atomizing chamber 10, the antenna 113 is inserted into the atomizing medium.

[0092] In other embodiments, as shown in FIG. 9, FIG. 9 is a structural schematic view of another embodiment of an atomizing chamber body of the electronic atomizing device shown in FIG. 4 according to the present disclosure. Multiple antennas 113 are arranged on the end of the inner conductor 112 away from the bottom of the atomizing chamber 10, the multiple antennas 113 are arranged spaced at equal interval along the circumference of the inner conductor 112 (as shown in FIG. 9). The ends of the antennas 113 away from the bottom of the atomizing chamber 10 do not extend out of the atomizing chamber 10. When the atomizing medium is inserted into the atomizing chamber 10, the multiple antennas 113 are clamped and fixed to the surface of the atomizing medium. The antennas 113 includes a first portion 1131 and a second portion 1132, the first portion 1131 and the second portion 1132 extend vertically, the first portion 1131 extends from a side surface of the inner conductor 112 toward the inner side surface of the atomizing chamber body 11, and the second portion 1132 extends along the axis of the atomizing chamber body 11.

[0093] Some embodiments of the present disclosure implement the detection operation of whether the atomizing medium is inserted in the atomizing chamber 10 by using the original microwave source arranged in the electronic atomizing device, thereby reducing the structural complexity of the electronic atomizing device. Moreover, some embodiments of the present disclosure may detect the atomizing medium without the magnetic material, thereby improving the applicability and reducing the cost.

[0094] The above is only some embodiments of the present disclosure, and does not intend to limit the scope of the present disclosure. Any equivalent structure or equivalent process transformation made by using the description of the present disclosure and the drawings, or directly or indirectly applying the description of the present disclosure and the drawings to other relevant technical fields, are included in the scope of the present disclosure.

Claims

1. A method for detecting insertion of an atomizing medium, comprising:

   inputting a microwave signal to an atomizing chamber, and acquiring a feedback signal of the atomizing chamber; wherein the feedback signal is generated according to the microwave signal;
   determining a microwave characteristic value of the microwave signal based on the microwave signal and the feedback signal; and
   determining whether the atomizing medium is inserted into the atomizing chamber based on the microwave characteristic value.

2. The method according to claim 1, wherein the microwave characteristic value comprises one or two of following microwave characteristics: an amplitude of a reflected wave, an amplitude of an incident wave, a reflection coefficient, a S11 parameter, and a standing wave ratio.

3. The method according to claim 2, wherein the microwave characteristic value is the standing wave ratio; the determining whether the atomizing medium is inserted into the atomizing chamber based on the microwave characteristic value, comprises:
   determining that the atomizing medium is inserted into the atomizing chamber, in response to the standing wave ratio being less than a preset standing wave ratio.

4. The method according to claim 2, wherein the microwave characteristic value is the standing wave ratio; the determining whether the atomizing medium is inserted into the atomizing chamber based on the microwave characteristic value, comprises:

   determining that the atomizing medium is inserted into the atomizing chamber, in response to a difference between the standing wave ratio and a standing wave ratio when the atomizing chamber is in a first state being greater than a threshold;
   wherein when the atomizing chamber is in the first state, the atomizing medium is not inserted into the atomizing chamber.

5. The method according to claim 1, wherein the inputting a microwave signal to an atomizing chamber, comprises:
   inputting the microwave signal to the atomizing chamber, in response to receiving a moving action signal.

6. The method according to claim 5, wherein the inputting the microwave signal to the atomizing chamber, in response to receiving a moving action signal, comprises:

   determining a moving direction based on the moving action signal; and
   inputting the microwave signal to the atomizing chamber, in response to the moving direction being the same as a direction of the atomizing medium being inserted into the atomizing chamber.

7. The method according to claim 1, wherein the inputting a microwave signal to an atomizing chamber, comprises:

   inputting the microwave signal with a preset frequency to the atomizing chamber; or
   inputting the microwave signal with a preset frequency range to the atomizing chamber through a frequency sweeping manner.

8. The method according to claim 3 or 4, comprising:

   acquiring the feedback signal of the atomizing chamber at a preset time interval, determining the microwave characteristic value, and determining whether the atomizing medium is inserted into the atomizing chamber; and
   stopping inputting the microwave signal to the atomizing chamber, in response to the atomizing medium being not inserted into the atomizing chamber within a preset duration.

9. An electronic atomizing device, comprising:

   an atomizing chamber body, defining an atomizing chamber configured to accommodate an atomizing medium;
   a microwave source, configured to input a microwave signal to the atomizing chamber to heat the atomizing medium in the atomizing chamber;
   a detection mechanism, connected to the microwave source, configured to acquire the microwave signal and a feedback signal of the atomizing chamber, and configured to determine a microwave characteristic value of the microwave signal based on the microwave signal and the feedback signal; wherein the feedback signal is generated according to the microwave signal; and
   a processor, connected to the microwave source and the detection mechanism, respectively, configured to control the microwave source to generate the microwave signal, and configured to determine whether the atomizing medium is inserted in the atomizing chamber

based on the microwave characteristic value.

10. The electronic atomizing device according to claim 9, wherein the detection mechanism comprises:

a coupling module, connected to the microwave source, and configured to receive the feedback signal of the atomizing chamber; and
a signal detection circuit, connected to the coupling module, configured to acquire the microwave signal and the feedback signal of the atomizing chamber, and configured to determine the microwave characteristic value of the microwave signal based on the microwave signal and the feedback signal.

11. The electronic atomizing device according to claim 9, wherein the microwave characteristic value comprises one or two of following microwave characteristics: an amplitude of a reflected wave, an amplitude of an incident wave, a reflection coefficient, a S11 parameter, and a standing wave ratio.

12. The electronic atomizing device according to claim 11, wherein the microwave characteristic value is the standing wave ratio; and the processor is configured to:

determine that the atomizing medium is inserted into the atomizing chamber, in response to the standing wave ratio being less than a preset standing wave ratio; or
determine that the atomizing medium is inserted into the atomizing chamber, in response to a difference between the standing wave ratio and a standing wave ratio when the atomizing chamber is in a first state being greater than a threshold; wherein when the atomizing chamber is in the first state, the atomizing medium is not inserted into the atomizing chamber.

13. The electronic atomizing device according to claim 9, comprising a moving sensor connected to the processor, wherein the processor is configured to:
control the microwave source to generate the microwave signal, in response to the moving sensor sensing a moving action signal.

14. The electronic atomizing device according to claim 9, comprising a circuit board and a connector, wherein the microwave source, the detection mechanism, and the processor are arranged on the circuit board, one end of the connector is connected to the microwave source, and the other end of the connector is connected to the atomizing chamber body.

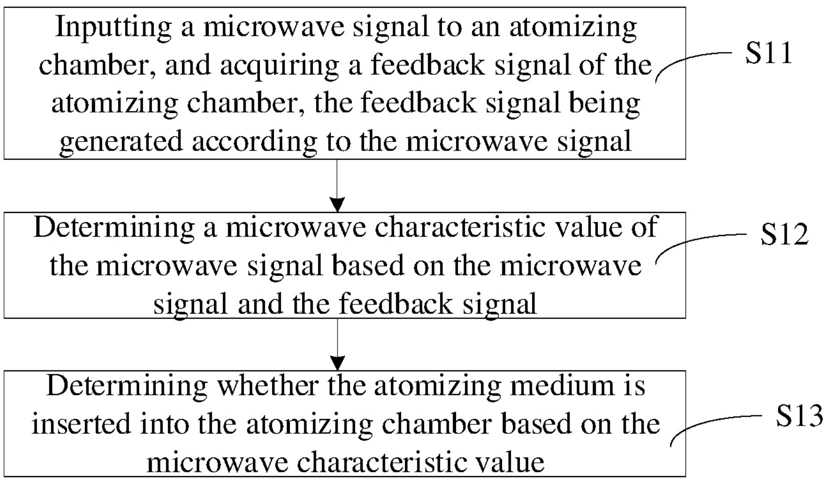

FIG. 1

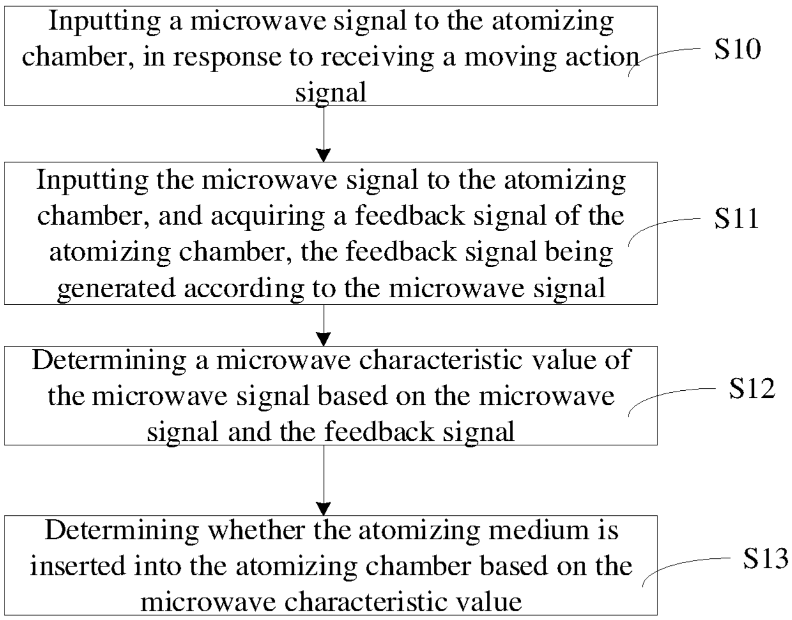

FIG. 2

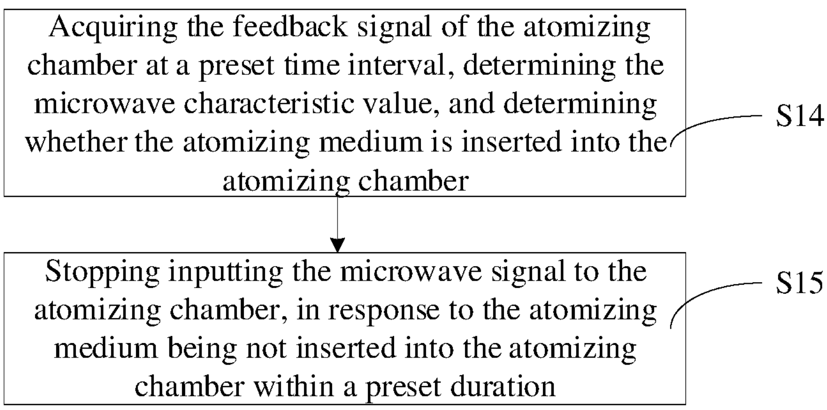

FIG. 3

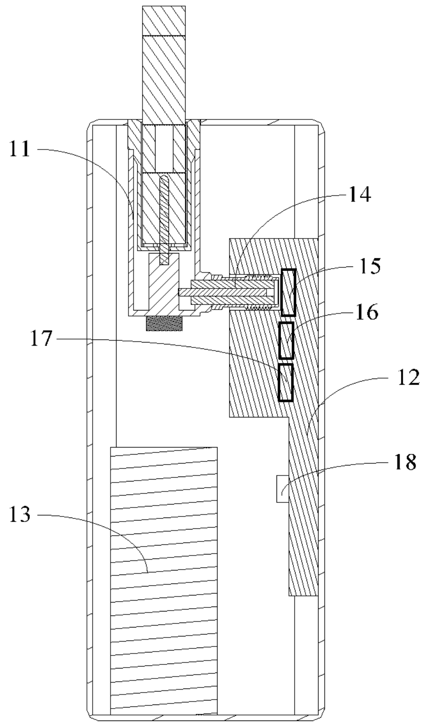
11
14
15
16
17
12
18
13

FIG. 4

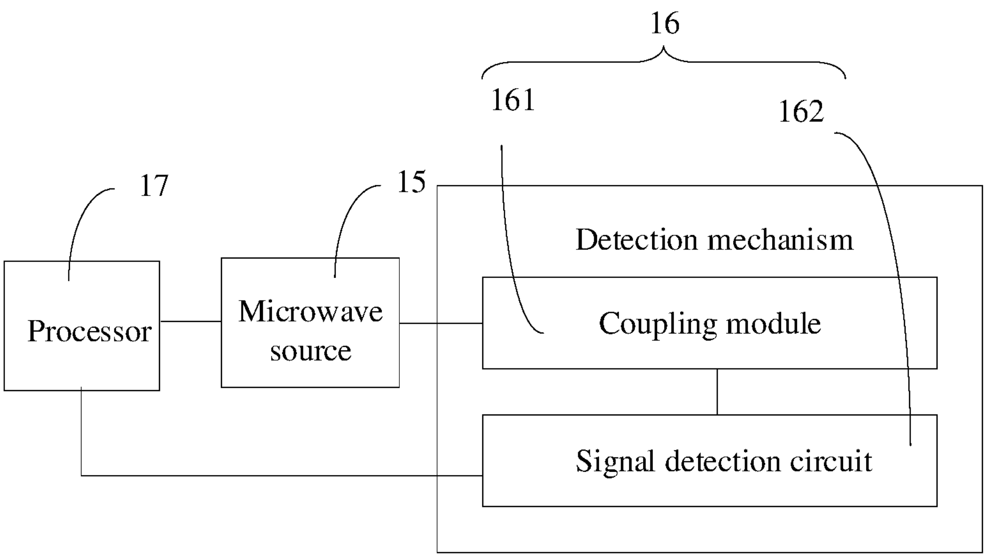
16
161
162
17
15
Detection mechanism
Processor
Microwave source
Coupling module
Signal detection circuit

FIG. 5

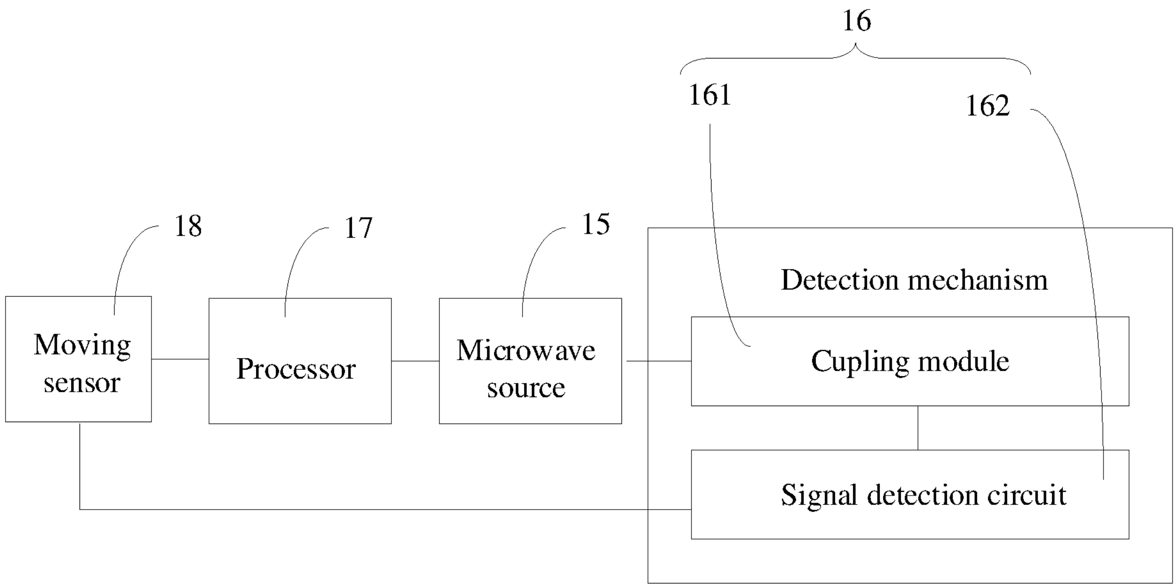
16
161
162
18
17
15
Detection mechanism
Moving sensor
Processor
Microwave source
Cupling module
Signal detection circuit

FIG. 6

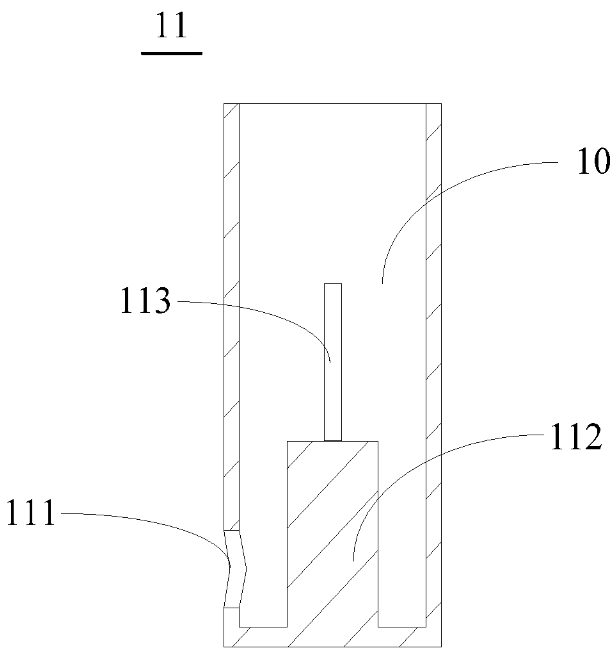
11
10
113
112
111

FIG. 7

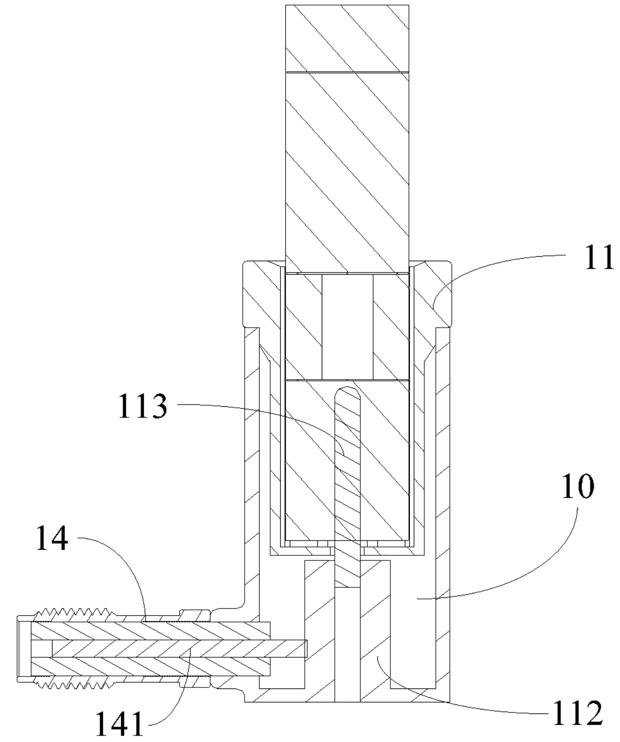

FIG. 8

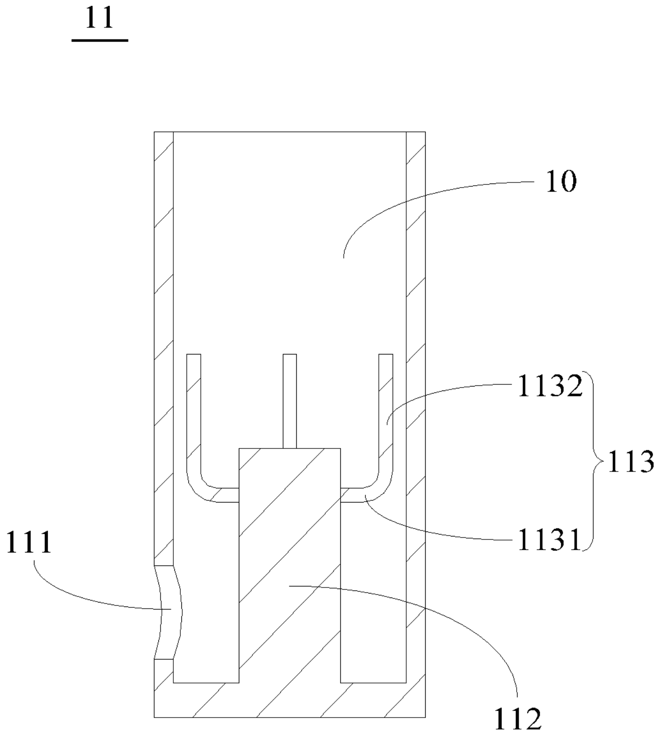

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No. **PCT/CN2023/073850**

A. CLASSIFICATION OF SUBJECT MATTER

A24F40/50(2020.01)i;A24F40/53(2020.01)i;A24F40/46(2020.01)i;A24F40/40(2020.01)i;A24F40/42(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)

A24F40/-,A24F47/- (IPC)

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

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

CNTXT, VEN, ENTXTC: 电子烟, 雾化, 介质, 微波, 插入, 在位, 到位, 驻波比, electronic cigarette, e-cigarette, atomiz+, substrate, microwave, insert+, in place, standing wave ratio, SWR

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	CN 115670030 A (SHENZHEN SMOORE TECHNOLOGY LIMITED) 2023-02-03 (2023-02-03) description, paragraphs 0006-0302, and figures 1-13	1, 7, 9, 10
Y	CN 114009840 A (SHENZHEN SMOORE TECHNOLOGY LIMITED) 2022-02-08 (2022-02-08) description, paragraphs 0030-0045, and figures 1-5	1-14
Y	CN 109068432 A (SHENZHEN ANXIN IOT TECHNOLOGY CO., LTD.) 2018-12-21 (2018-12-21) description, paragraphs 0035-0114, and figures 1-6	1-14
Y	CN 113925220 A (SHENZHEN MAISHI TECHNOLOGY CO., LTD. et al.) 2022-01-14 (2022-01-14) description, paragraphs 0059-0103, and figures 1-3	1-14
Y	CN 110662322 A (CHENGDU YAYAN TECHNOLOGY CO., LTD.) 2020-01-07 (2020-01-07) description, paragraphs 0024-0125, and figures 1-14	1-14

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

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

Date of the actual completion of the international search	Date of mailing of the international search report
27 March 2023	**06 April 2023**

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

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2023/073850

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 111165916 A (SHENZHEN SMOORE TECHNOLOGY LIMITED) 2020-05-19 (2020-05-19) entire document	1-14
A	CN 111567899 A (SHENZHEN MAISHI TECHNOLOGY CO., LTD.) 2020-08-25 (2020-08-25) entire document	1-14
A	CN 111557481 A (O-NET AUTOMATION TECHNOLOGY (SHENZHEN) LTD.) 2020-08-21 (2020-08-21) entire document	1-14
A	US 2015181945 A1 (TREMBLAY, M.) 2015-07-02 (2015-07-02) entire document	1-14

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2023/073850

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	115670030	A	03 February 2023	None			
CN	114009840	A	08 February 2022	None			
CN	109068432	A	21 December 2018	None			
CN	113925220	A	14 January 2022	None			
CN	110662322	A	07 January 2020	None			
CN	111165916	A	19 May 2020	EP	3838027	A1	23 June 2021
				US	2021186115	A1	24 June 2021
CN	111567899	A	25 August 2020	None			
CN	111557481	A	21 August 2020	None			
US	2015181945	A1	02 July 2015	US	2023045092	A1	09 February 2023
				CA	2876267	A1	30 June 2015
				US	2018289074	A1	11 October 2018
				US	10440999	B2	15 October 2019
				US	2021112877	A1	22 April 2021
				US	2020008481	A1	09 January 2020
				US	11000076	B2	11 May 2021
				US	2023045092	A1	09 February 2023
				CA	2876267	A1	30 June 2015
				US	2018289074	A1	11 October 2018
				US	10440999	B2	15 October 2019
				US	2021112877	A1	22 April 2021
				US	2020008481	A1	09 January 2020
				US	11000076	B2	11 May 2021

Form PCT/ISA/210 (patent family annex) (July 2022)

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- CN 202210377157 **[0001]**