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

(11) EP 4 497 336 A1

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

(43) Date of publication:
29.01.2025 Bulletin 2025/05

(21) Application number: **22932632.7**

(22) Date of filing: **23.03.2022**

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

(52) Cooperative Patent Classification (CPC):
A24F 40/40

(86) International application number:
PCT/CN2022/082585

(87) International publication number:
WO 2023/178565 (28.09.2023 Gazette 2023/39)

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

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(54) AEROSOL GENERATION DEVICE AND MANUFACTURING METHOD THEREFOR

(57) An aerosol generation device (1) and a manufacturing method therefor. The aerosol generation device (1) comprises a microwave resonator (10) and an accommodating base (20). The microwave resonator (10) comprises an outer conductor unit (11) and an inner conductor unit (12) arranged in the outer conductor unit (11), the inner conductor unit (12) having one end connected to a closed end of the outer conductor unit and one end extending towards an open end of the outer conductor unit (11). The accommodating base (20) is connected to the open end, and comprises an accommodating portion (21) for accommodating an aerosol generation substrate, and the accommodating portion (21) is arranged in a resonant cavity (13). The inner conductor unit (12) comprises a conductor column (121) and a probe device (122), the conductor column (121) comprising a free end extending toward the accommodating portion (21), the probe device (22) comprising at least one probe (1222) extending to a side portion of the accommodating portion (21). The probe device (122) is arranged on the accommodating portion (21) and is in ohmic contact with the free end of the conductor column (121). The probe device (122) is arranged on the accommodating base (20), and is independent from the conductor column (121), thereby facilitating manufacturing. The probe (1222) extends to the side portion of the accommodating portion (21), so that the uniformity of a microwave field is significantly improved.

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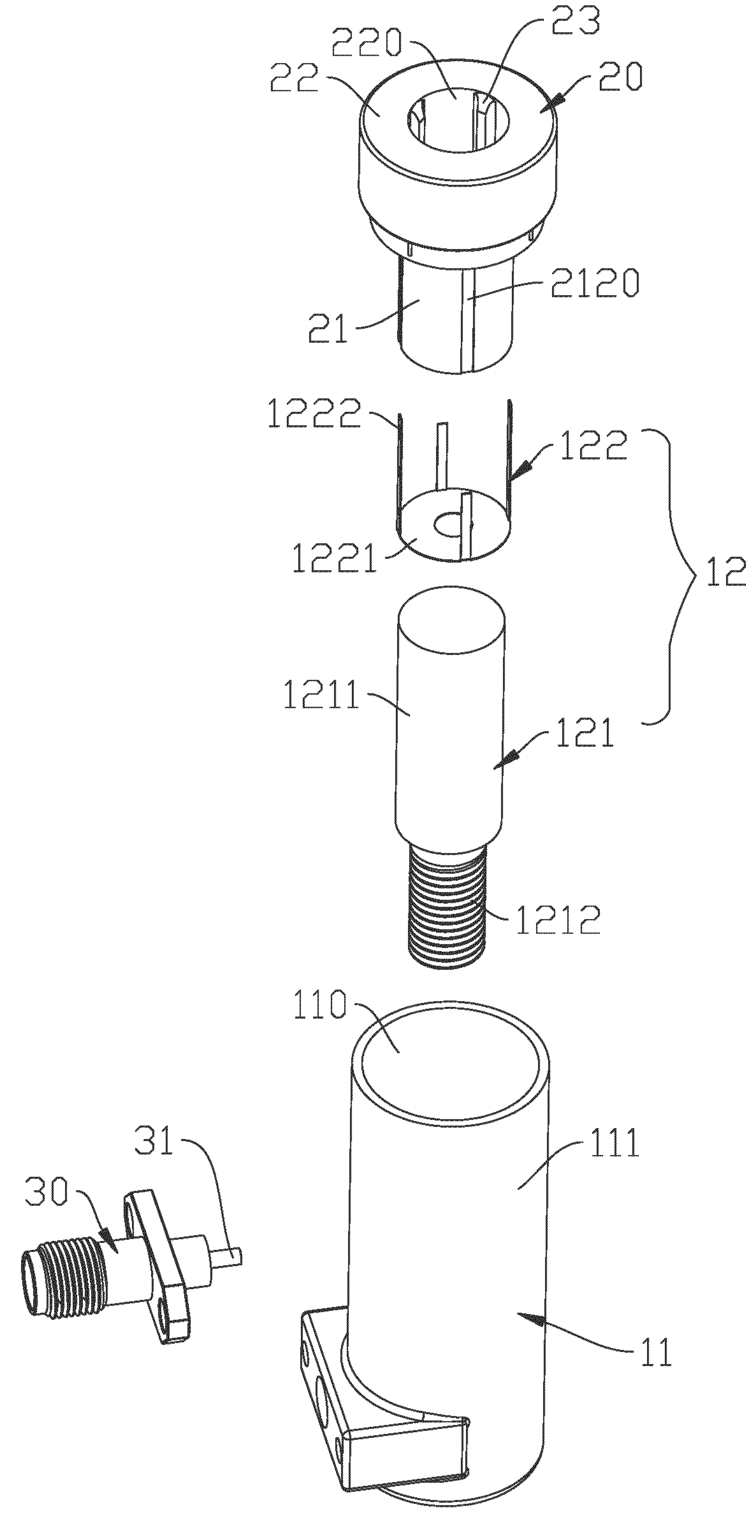
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Fig.3

Description

TECHNICAL FIELD

[0001] The present invention relates to the technical field of electronic atomization, and more particularly to an aerosol generation device and a manufacturing method therefor.

THE RELATED ART

[0002] A heat-not-burning (HNB) device is a kind of combination device including a heating device combined with an aerosol generation substrate (which is a product of processed plant leaves). An external heating device heats, at a high temperature, the aerosol generation substrate to a temperature that can generate an aerosol, but is not sufficient to cause burning, so that, without being caused to burn, the aerosol generation substrate generates an aerosol desired by a user. The heat-not-burning devices that are currently available in the market generally adopts resistor heating means, namely a centered heating plate or a heating pin penetrates, at a center location of the aerosol generation substrate, into the interior of the aerosol generation substrate to proceed with heating. Such a utensil takes a long time to wait for preheating before use, making it impossible to freely start or stop vaping, and the aerosol generation substrate cannot be uniformly carbonized, leading to insufficient baking of the aerosol generation substrate and low efficiency of utilization. Secondly, the heating plate of the HNB utensil may easily cause generation of contaminants, which are hard to cleanse, in an aerosol generation substrate extractor and a heating plate holder, and a portion of the aerosol generation substrate that is in contact with the heating body may get locally excessively high temperature, causing partial decomposition and releasing substances that are harmful to human bodies. Thus, the resistor heating means is gradually replaced by microwave heating technology, which becomes a new solution of heating. The microwave heating technology has advantages with respect to high efficiency, timeliness, optionality, and non-delay heating, and is only effective for heating specific substances having certain dielectric properties. Advantages of microwave heating based atomization include: (a) instantaneous vaping or stopping being achievable as the microwave heating is radiation based heating, rather than heat conduction; (b) there being no plate breaking or heating plate cleansing issues as no heating plate is involved; and (c) the utilization efficiency of the aerosol generation substrate being high and mouthfeel being consistent, and the mouthfeel being much closer to cigarettes.

[0003] In the prior art microwave heating devices for heating an aerosol generation substrate, microwave is often fed from one end and is subject to resonance in a resonant cavity. As the resonant cavity is relatively small, distribution of electromagnetic waves in the resonant cavity is relatively ununiform and uniformity of heating is poor.

SUMMARY OF THE INVENTION

Technical Problems

[0004] The technical issue that the present invention aims to resolve is to provide, with respect to the deficiency of the prior art, an improved aerosol generation device and a manufacturing method therefor.

Solution for Problems

Technical Solution

[0005] The technical solution that the present invention adopts to resolve the technical issues is as follows:

providing an aerosol generation device, which comprises a microwave resonator and an accommodating base;

the microwave resonator comprising an outer conductor unit that defines a resonant cavity and an inner conductor unit arranged in the outer conductor unit, the outer conductor unit having an open end and a closed end, the inner conductor unit having one end connected to the closed end of the outer conductor unit and an opposite end extending toward the open end of the outer conductor unit;

the accommodating base being connected to the open end and comprising an accommodating portion for receiving therein an aerosol generation substrate, the accommodating portion being arranged in the resonant cavity;

the inner conductor unit comprising a conductor column and a probe device, the conductor column comprising a fixed end connected to the closed end and a free end extending toward the accommodating portion, the probe device comprising at least one probe extending to a side portion of the accommodating portion;

the probe device being arranged on the accommodating portion and in ohmic contact with the free end of the conductor column.

[0006] In some embodiments, the probe device comprises a foundation portion connected to the at least one probe, and the foundation portion is arranged on an end surface of the accommodating portion facing the conductor column.

[0007] In some embodiments, the probe device comprises a foundation portion connected to the at least one probe, and the probe device is in ohmic contact with the free end of the conductor column by means of the foundation portion.

[0008] In some embodiments, the probe device comprises a foundation portion connected to the at least one probe, and the at least one probe is of an elongated configuration having one end connected to the foundation portion and an opposite end extending in a direction parallel to an axis of the inner conductor unit and away from the inner conductor unit.

[0009] In some embodiments, the at least one probe comprises at least two probes, and the at least two probes are distributed in a circumferential direction of the side wall of the accommodating portion in an equally spaced manner.

[0010] In some embodiments, the at least one probe comprises at least two probes, and lengths of the at least two probes are equal or unequal.

[0011] In some embodiments, the at least one probe comprises at least two probes, and the at least two probes comprise at least two pairs of probes, lengths being unequal among the pairs, the at least two pairs of probes being alternately and uniformly distributed in a circumferential direction of the side wall of the accommodating portion.

[0012] In some embodiments, the probe device is snap fit to, adhesively attached to, or integrally formed, as a one-piece structure, with the accommodating portion.

[0013] In some embodiments, the probe device is formed by processing an electrically conductive metal plate as a one-piece structure, or is formed by means of electroplating or printing.

[0014] In some embodiments, a range of thickness of the probe device is 1-2000 micrometers.

[0015] In some embodiments, the at least one probe is distributed on an inside wall surface or an outside wall surface of the accommodating portion, or is completely or partly embedded in the side wall of the accommodating portion.

[0016] In some embodiments, the accommodating base further comprises a fixing portion connected to the accommodating portion, the accommodating portion comprising an accommodating chamber extending axially to receive the aerosol generation substrate, the fixing portion comprising an axial through hole communicating the accommodating chamber with environment; and the fixing portion is connected to the open end.

[0017] In some embodiments, the accommodating base comprises a plurality of longitudinal positioning ribs and a plurality of elongated support ribs; the positioning ribs are arranged on a circumferential direction of a wall surface of the accommodating chamber and/or the through hole in a uniformly spaced manner; each of the positioning ribs extends longitudinally along the accommodating base; the support ribs are arranged, as being uniformly spaced, on a bottom surface of the accommodating chamber in a radiating manner; every two adjacent ones of the positioning ribs form a longitudinally extending first air ingress channel, and every two adjacent ones of the support ribs form a second air ingress channel in a radiating form, the second air ingress channels being respectively in communication with the first air ingress channels.

[0018] In some embodiments, a microwave feed-in device is further included to connect to the microwave resonator, the microwave feed-in device comprising an internal conductor, an external conductor, and a dielectric layer arranged between the internal conductor and the external conductor, the internal conductor being of a linear form and in ohmic contact with the conductor column in a manner of being perpendicular to an axis of the conductor column.

[0019] In some embodiments, a microwave feed-in device is further included to connect to the microwave resonator, the microwave feed-in device comprising an internal conductor, an external conductor, and a dielectric layer arranged between the internal conductor and the external conductor, the internal conductor comprising a first section perpendicular to an axis of the conductor column and a second section parallel to the axis of the conductor column, the second section being in ohmic contact with the end wall of the outer conductor unit.

[0020] In some embodiments, the microwave resonator is a quarter wavelength type coaxial resonator.

[0021] In some embodiments, the accommodating base is formed of one or a compound of multiple ones of plastics, microwave transparent ceramics, glass, aluminum oxide, zirconium oxide, and silicon oxide.

[0022] In some embodiments, an axis of the inner conductor unit is coincident with or parallel to an axis of the outer conductor unit.

[0023] In some embodiments, the probe device and the conductor column are detachable from each other or fixedly fastened together when bonding therebetween with an external force is removed.

[0024] In some embodiments, the at least one probe has a length range of 0-(L1+5)mm, wherein L1 is a length of the aerosol generation substrate.

[0025] An aerosol generation device is provided, comprising a quarter wavelength type coaxial resonator and an accommodating base arranged at an open-circuit terminal of the coaxial resonator, the accommodating base comprising an accommodating portion for receiving an aerosol generation substrate, the accommodating portion being located in a resonant cavity of the coaxial resonator;

the coaxial resonator comprising an inner conductor unit, the inner conductor unit comprising a conductor column adjacent to a short-circuit terminal of the coaxial resonator and a probe device adjacent to the open-circuit terminal, the probe device comprising at least one probe extending to a side portion of the accommodating portion;

the probe device being arranged on the accommodating portion and in ohmic contact with the conductor column.

[0026] In some embodiments, the probe device comprises a foundation portion connected to the at least one probe, the foundation portion being arranged on an end surface of the accommodating portion facing the conductor column; the probe device is set in ohmic contact with the conductor column by means of the foundation portion.

[0027] In some embodiments, the at least one probe comprises at least two pairs of probes having unequal lengths, and the at least two pairs of probes are alternately and uniformly distributed in a circumferential direction of the side wall of the accommodating portion.

[0028] In some embodiments, the conductor column comprises a free end facing the accommodating portion, the probe device being in ohmic contact with the free end.

[0029] An aerosol generation device manufacturing method is provided, characterized by comprising the following steps:

(1) providing an outer conductor unit and a conductor column, and mounting the conductor column in an axial direction into the outer conductor unit;

(2) providing an accommodating base and a probe device, and mounting the probe device to an accommodating portion of the accommodating base to form a combined structure;

(3) mounting the combined structure to the outer conductor unit, and setting the probe device in ohmic contact with the conductor column.

Advantageous Effect of the Invention

Advantageous Effect

[0030] Implementing the aerosol generation device and the manufacturing method therefor according to the present invention provides the following advantageous effects: The probe device is arranged on the accommodating base and is independent of the conductor column to thereby facilitate manufacturing. The probe of the probe device extends to an outer circumference of the accommodating chamber, so that the uniformity of a microwave field is significantly improved to enhance uniformity of heating to the aerosol generation substrate, and the uniformity of heating to the aerosol generation substrate is significantly enhanced to thereby enhance utilization of the aerosol generation substrate.

BRIEF DESCRIPTION OF THE ATTACHED DRAINGS

Description of the Drawings

[0031] Further explanation of the present invention will be provided below, with reference to the attached drawings and embodiments. In the drawings:

FIG. 1 is a schematic three-dimensional structure diagram of an aerosol generation device according to some embodiments of the present invention;

FIG. 2 is a schematic longitudinal sectional structure diagram of the aerosol generation device shown in FIG. 1;

FIG. 3 is a schematic three-dimensional exploded structure diagram of the aerosol generation device shown in FIG. 1;

FIG. 4 is a structure longitudinal sectional diagram of the aerosol generation device shown in FIG. 3 in an exploded form; and

FIG. 5 is a schematic longitudinal sectional structure diagram of the aerosol generation device according to some embodiments of the application.

BEST EMBODIMENTS FOR IMPLEMENTING THE INVENTION

Best Embodiments of the Invention

[0032] For better understanding of the technical features, objectives, and efficacy of the present invention, a detailed description will be given to specific embodiments of the present invention, with reference to the attached drawings.

[0033] FIGS. 1-4 show an aerosol generation device 1 according to some embodiments of the present invention. The aerosol generation device 1 may use microwave to heat an aerosol generation substrate for atomization to generate an aerosol to be vaped by a user. In some embodiments, the aerosol generation substrate can be a solid aerosol generation substrate, such as a product of processed plant leaves. Understandably, in some other embodiments, the aerosol generation substrate can also be a liquid aerosol generation substrate.

[0034] Further as shown in FIG. 2, the aerosol generation device 1 may comprise, in some embodiments, a microwave resonator 10, an accommodating base 20, and a microwave feed-in device 30. The microwave resonator 10 may be of a cylindrical form in some embodiments, comprising a resonant cavity 13 in which microwave continuously oscillates. The accommodating base 20 is configured to load therein an aerosol generation substrate, and is fixedly or detachably mounted on the microwave resonator 10 to allow the aerosol generation substrate contained therein to expose to a microwave field within the resonant cavity 13 to be heated and atomized by the microwave. The microwave feed-in device 30 is connected to the microwave resonator 10 to feed microwave generated by a microwave generation device (not shown in the drawings) into the resonant cavity 13. Understandably, the microwave resonator 10 is not limited to a cylindrical form and can be of other shapes, such as a square column and an elliptic column.

[0035] In some embodiments, the microwave resonator 10 may be a quarter wavelength type coaxial resonator, comprising a barrel-like outer conductor unit 11 for electromagnetic shielding, a longitudinal inner conductor unit 12 arranged in the outer conductor unit 11 for guiding waves, and a dielectric substance (such as air) located between an external wall surface of the inner conductor unit 12 and an inside wall surface of the outer conductor unit 11. The outer conductor unit 11 and the inner conductor unit 12 jointly define the resonant cavity 13. A first end of the inner conductor unit 12 is in ohmic contact with an end wall 111 of the outer conductor unit 11 to form a short-circuit terminal of the microwave resonator 10. A second end of the inner conductor unit 12 is extended toward an opening 110 of the outer conductor unit 11 and is not in direct ohmic contact with the outer conductor unit 11 to form an open-circuit terminal of the microwave resonator 10. The accommodating base 20 is mounted (such as being detachably or un-detachably inserted) in the open-circuit terminal B of the microwave resonator 10 and is connected to the second end of the inner conductor unit 12. In some embodiments, an axis of the inner conductor unit 12 and an axis of the outer conductor unit 11 are coincident with or parallel to each other, and preferably, the two are coincident with each other.

[0036] In some embodiments, the outer conductor unit 11 may comprise an electrically conductive side wall 111, an electrically conductive end wall 112, and the opening 110. The side wall 111 can be of a cylindrical form in some embodiments, comprises a first end and a second end opposite to the first end. The end wall 112 is formed to close the first end of the side wall 111 to form a closed end of the outer conductor unit 11. The opening 110 is formed in the second end of the side wall 111 to form an open end of the outer conductor unit 11 for receiving the accommodating base 20 to insert therein. The side wall 111 of the outer conductor unit 11 is formed, at a location adjacent to the end wall 112, with a feed-in aperture 1110 penetrating therethrough to receive the microwave feed-in device 30 mounted therein. The end wall 112 is formed, in a central portion thereof, with a mounting hole 1120 passing therethrough to receive a conductor column 121 of the inner conductor unit 12 inserted therein. The first end (which is a fixed end) of the inner conductor unit 12 is fixed to the end wall 112 of the outer conductor unit 11 and is in ohmic contact with the end wall 112; and the second end (which is a free end) of the inner conductor unit 12 is extended toward the opening 110 of the outer conductor unit 11 and is not in direct ohmic contact with the outer conductor unit 11 primarily for transmitting microwave. In some embodiments, a desired microwave field can be obtained by shape and arrangement of the second end of the inner conductor unit 12.

[0037] The outer conductor unit 11 can be formed, in some embodiments, as a one-piece structure made of an electrically conductive metallic material, of which the material can be an electrically conductive metal, such as aluminum, copper, gold, silver, and stainless steel. Understandably, the outer conductor unit 11 is not limited to a one-piece structure made of an electrically conductive metallic material, and can also be made by means of coating an electrically conductive layer on a surface of a nonconductive barrel. The electrically conductive layer can be, in some embodiments, a gold plating layer, a silver plating layer, a copper plating layer, and the likes. Further understandably, the outer conductor unit 11 is not limited to a cylindrical barrel form, and can also be other suitable shape, such as a square barrel and an elliptic barrel.

[0038] The inner conductor unit 12 may comprise, in some embodiments, the conductor column 121 located at a first end (first fixed end) and coaxial with the outer conductor unit 11 and a probe device 122 located at a second end (first free end) and independent (meaning the conductor column 121 and the probe device 122 being not integrally connected together) of the outer conductor unit 11. One end (second fixed end) of the conductor column 121 is connected to the end wall 112 of the outer conductor unit 11, and an opposite end (second free end) is in ohmic contact with the probe device 122. The ohmic contact between the probe device 122 and the conductor column 121 allows microwave to transmit from the conductor column 121 to the probe device 122. In some embodiments, the probe device 122 is specifically configured, with respect to shape and arrangement, to enhance more uniformly distribution of the microwave field around an outer circumference of the accommodating base 20 to thereby fulfill an effect of more uniformly microwave heating to the aerosol generation substrate contained in the accommodating base 20, to thereby increase the utilization of the aerosol generation substrate.

[0039] In some embodiments, as the probe device 122 and the conductor column 121 are of an arrangement of being mutually independent of each other, the probe device 122 and the conductor column 121 can be respectively mounted to the accommodating base 2 and the outer conductor unit 11 before assembling of the probe device 122 and the conductor column 121, which provides great easiness for designing and assembling of the probe device 122. In some embodiments, as the probe device 122 and the conductor column 121 are objects that are independent of each other, after being assembled together, under an action of an external force (a compressing force between the outer conductor unit 11 and the accommodating base 20), contact between the two is simple surface contact, and when the action of the external force is removed, the two can be easily separated from each other. This particularly suits for the accommodating base 20 being detachably mounted to the microwave resonator 10, for being easy to cleanse.

[0040] In some other embodiments, a fastening structure may be arranged between the probe device 122 and the conductor column 121, and after the probe device 122 and the conductor column 121 are assembled together, the two can be securely fastened together. This suits for the accommodating base 20 being mounted, in an undetachable manner, to the microwave resonator 10.

[0041] Further as shown in FIG. 3, the conductor column 121 may be made, in some embodiments, of an electrically conductive material, such as metals. In other embodiments, the conductor column 121 can be formed by coating a second electrically conductive layer on an external wall surface of a cylindrical body made of a nonconductive material. The second electrically conductive layer can be a metal plating film layer, such as a gold plating layer, a silver plating layer, and a copper plating layer. Understandably, in some embodiments, the conductor column 121 is not limited to a cylindrical column, and can be of other shapes, such as a square column, an elliptic column, a stepped column, and an irregular column.

[0042] The conductor column 121 may comprise, in some embodiments, a main body portion 1211 of a cylindrical form and a connecting portion 1212 axially connected to one end of the main body portion 1211. A diameter of the main body portion 1211 is smaller than an inside diameter of the side wall 111 of the outer conductor unit 11. The connecting portion 1212 has a diameter that is smaller than the diameter of the main body portion 1211 and is extended into the mounting hole 1120 to allow an end face of the main body portion 1211 that is adjacent to the connecting portion 1212 to abut an inside wall surface of the end wall 112. A side surface of the connecting portion 1212 is formed with an external thread in order to screw to a battery device (not shown in the drawings) of the aerosol generation device 1.

[0043] Further as shown in FIG. 4, the accommodating base 20 may comprise, in some embodiments, an accommodating portion 21 and a fixing portion 22 integrally connected with the accommodating portion 21. The accommodating portion 21 is configured to receive the aerosol generation substrate therein; and the fixing portion 22 is configured to block, in an axial direction, the opening 110 of the outer conductor unit 11 and allow the accommodating portion 21 to extend into the accommodating portion 21 to connect to the inner conductor unit 12. The accommodating base 20 may comprise, in some embodiments, a low dielectric loss material, such as one or a compound of multiple ones of plastics, microwave transparent ceramics, glass, aluminum oxide, zirconium oxide, and silicon oxide. Further, among the plastic materials, preferred ones are PEEK and PTFE). Loss tangent of the material of the accommodating base 20 is preferably less than 0.1.

[0044] The accommodating portion 21 may be, in some embodiments, of a cylindrical form having an outside diameter smaller than the inside diameter of the outer conductor unit 11. The accommodating portion 21 may comprises an axial accommodating chamber 210. The accommodating chamber 210 is configured to receive the aerosol generation substrate therein. The fixing portion 22 can be of an annular form coaxially connected with the accommodating portion 21. The fixing portion 22 can be coaxially received in and blocking the opening 110 of the outer conductor unit 11 to fix the accommodating portion 21 coaxially in the microwave resonator 10. The fixing portion 22 comprises an axial through hole 220 for communicating the accommodating chamber 210 with the environment so as to allow the aerosol generation substrate to be inserted into the accommodating chamber 210 after passing through the through hole 220.

[0045] The accommodating portion 21 may be, in some embodiments, of a cylindrical form, comprising a flat bottom wall 211 and a barrel-like side wall 212 arranged around a circumference of the bottom wall 211. An outside diameter of the side wall 212 is smaller than an inside diameter of the outer conductor unit. An external wall surface of the side wall 212 is formed with a plurality of longitudinally extending accommodating grooves 2120 for matching the probe device 122.

[0046] The accommodating base 20 may comprise, in some embodiments, a plurality of longitudinal positioning ribs 23 and a plurality of elongated support ribs 25. These positioning ribs 23 are arranged, in a manner of being uniformly spaced from each other, on a circumference of a wall surface of the accommodating chamber 210 and/or the through hole 220. Each of the positioning ribs 23 extends in a direction parallel to an axis of the accommodating base 20. The support ribs 25 are arranged, in a manner of being uniformly spaced from each other, on a bottom surface of the accommodating chamber 210. The positioning ribs 23 are used, on the one hand, to tightly hold the aerosol generation substrate inserted into the accommodating chamber 210 and/or the through hole 220, and, on the other hand, every two adjacent ones of the positioning ribs 23 form therebetween a first air ingress channel that extends longitudinally. The support ribs 25 are used, on the one hand, to support the aerosol generation substrate, and, on the other hand, to form a plurality of second air ingress channels that are arranged in a radiating form. These second air ingress channels are respectively in communication with the first air ingress channels to allow environment air to be easily sucked to the bottom of the aerosol generation substrate to then enter interior of the aerosol generation substrate to take away an aerosol generated through heating by microwave.

[0047] Further as shown in FIG. 3, the probe device 122 may comprise, in some embodiments, a foundation portion 1221 and a plurality of longitudinal probes 1222. The foundation portion 1221 is in contact engagement with an end surface of the accommodating base 20 facing the conductor column 121 (i.e., an outer surface of the bottom wall 211 of the accommodating portion 21), and is in ohmic contact with the conductor column 121. These probes 1222 are arranged, at intervals, in a circumferential direction of the foundation portion 1221 and abut the accommodating grooves 2120 in the side wall surface of the accommodating portion 21 of the accommodating base 20 to enhance more uniformly distribution of the microwave field around a circumference of the accommodating portion 21.

[0048] The probes 1222 of the probe device 122 extend upward to a side portion of the accommodating chamber 210 to significantly enhance uniformity of the microwave field to thereby enhance uniformity of heating to the aerosol generation substrate, and the uniformity of heating to the aerosol generation substrate is significantly enhanced to thereby increase utilization of the aerosol generation substrate. With the probes 1222 being arranged on the side wall of the accommodating portion 21 of the accommodating base 20, a field intensity range in the aerosol generation substrate can be: 894.3-8086.4, a field intensity ratio being maximally 9.04, so that uniformity is greatly improved, while the field intensity ratios of other forms of traditional ones that do not include this kind of probes 1222 is generally higher than 30, uniformity being relatively poor. Understandably, the probes 1222 are not limited to being fixed on the side wall 212 of the accommodating portion 21, and in some embodiments, a similar effect can be obtained even when they are spaced from the side wall 212.

[0049] In some embodiments, the probe device 122 has a relatively weak electrical field at a bottom thereof and a relatively strong electrical field at a top thereof, and as such, placing the probes 1222 of the probe device 122 close to a top of the aerosol generation substrate may fulfill quick heating of the top of the aerosol generation substrate to quickly release aerosol, i.e., facilitating to increase vapor discharging speed and reduce preheating time. An arrangement of different lengths of the probes allows for better uniformity of heating of the aerosol generation substrate.

[0050] In some embodiments, with the probe device 122 additionally including the probes 1222, during the entire atomization process and vaping process, fluctuation range of the optimum feed-in frequency of the microwave resonator 10 is significantly narrowed, reducing from ~150MHz to less than 20MHz, so as to reduce requirements for the microwave source, and also to better meet the stipulated government regulations, the government regulations requiring the frequency range for microwave heating being 2400-2500MHz. In some embodiments, during the entire atomization process, the microwave feed-in efficiency is significantly improved, and the overall feed-in efficiency can be kept higher than 80%.

[0051] In some embodiments, the probe device 122 is formed by shaping an electrically conductive material, such as shaping through stamping and bending an electrically conductive material, and the operation is easy and the efficiency is high. Further, the probe device 122 can be formed on the accommodating base 20 through techniques of electroplating or printing. In some embodiments, the probe device 122 has a thickness of 1-2000 micrometers, and the probe device 122 is made of a material that is at least one of copper, copper alloy, stainless steel, aluminum, and aluminum alloy.

[0052] In the instant embodiment, the foundation portion 1221 is of an annular form, and a center hole of the foundation portion 1221 aligns with the through hole defined in the bottom of the accommodating base 20. Understandably, the foundation portion 1221 can also be of other shapes, such as a circular plate form, a square plate form, and a polygonal plate form, which is covered on a lower end surface of the accommodating base 20.

[0053] In some embodiments, the probes 1222 are arranged to extend upward from a bottom of the accommodating portion 21 of the accommodating base 20 along the side wall. The probes 1222 are located on an outer side of the side wall 212 of the accommodating portion 21 to abut the external wall surface of the accommodating portion 21. The accommodating grooves 2120 arranged in the external wall surface of the accommodating portion 21 receive the probes 1222 to fit and position therein.

[0054] In some embodiments, the probes 1222 can be alternatively arranged on an inner side of the side wall 212 of the accommodating portion 21, inserting from a bottom of the accommodating portion 21 to the inside wall surface of the accommodating chamber 210 of the accommodating portion 21. In some embodiments, it is also feasible to form accommodating grooves 2120 in the inside wall surface of the accommodating chamber 210 to receive the probes 1222 to fit and position therein. In some embodiments, the probe 1222 is entirely or partly embedded in the side wall 212 of the accommodating portion 21, and the side wall of the accommodating portion 21 is formed with insertion holes extending upward from the bottom to allow the probes 1222 to insert therein. Or alternatively, the accommodating base 20 may be molded to directly encloses the probes 1222.

[0055] A range of length of the probes 1222 is 0-Lmm, and H is smaller than or equal to a length L1 of the aerosol generation substrate in the accommodating base 20 plus around 5mm. In other words, the length range of the probes 1222 is 0~(L1+5)mm. Taking the HEETS aerosol generation substrate available from IQOS company as an example for the aerosol generation substrate, the length L1 of the aerosol generation substrate is 12mm, and the range of the length L of the probes 1222 is 0~17mm.

[0056] Preferably, the position of the free end portion of the probes 1222 corresponds to the lengthwise position of the aerosol generation substrate in the accommodating portion 21. Preferably, the length L of the probes is 0-(12mm+ thickness of the bottom of the accommodating portion 21), meaning after insertion of cigarette, the highest point of the probes 1222 is generally flush with a position of a tobacco section.

[0057] In some embodiments, to more uniformly atomize the aerosol generation substrate in the accommodating portion 21, the number of the probes 1222 is at least two, and in the embodiment illustrated in the drawings, the number of the probes 1222 is four, and the probes 1222 are distributed in a circumferential direction of the accommodating portion 21 to carry out atomization in the circumference. In some embodiments, the probes 1222 are distributed, in a manner of being equally spaced from each other, in the circumferential direction of the accommodating base 20 to help improve uniformity.

[0058] In some embodiments, the lengths of the probes 1222 arranged in the circumference can be the same, or they can be different. Preferably, the number of the probes 1222 is an even number, and the lengths of each pair of the probes 1222 include two or more than two types. Taking two types of lengths as an example for illustration, the long ones and the short ones are alternately distributed in the circumferential direction, meaning one long and one short are arranged in an alternate manner. In the embodiment illustrated in the drawings, four probes 1222 being taken as an example, including two long ones and two short ones, the length of the two long probes 1222 is 11mm, and the length of the two short probes 1222 is 6mm. In some embodiments, arranging more pairs of probes 1222 having different lengths makes uniformity of heating of the aerosol generation substrate better. Similarly, the number of the probes 1222 can also be an odd number, such as nine, divided into three groups, each group including three probes. Lengths of the probes 1222 of the same group are identical, and lengths of the probes 1222 of different groups are different. The three groups of probes 1222 can be alternately and uniformly distributed in the circumferential direction of the side wall of the accommodating portion 21.

[0059] The accommodating base 20 is made of a material that is a low dielectric loss material having a loss tangent less than 0.1, being transmittable for microwave. Further, the accommodating base 20 comprises a material that is one or a compound of multiple ones of plastics, microwave transparent ceramics, glass, aluminum oxide, zirconium oxide, and silicon oxide, and further, the plastic materials are PEEK or PTFE.

[0060] Further as shown in FIG. 2, the microwave feed-in device 30 can be, in some embodiments, a coaxial connector, which comprises an internal conductor 31, an external conductor 33, and a dielectric layer 32 arranged between the internal conductor 31 and the external conductor 33. The microwave feed-in device 30 is mounted to the microwave resonator 10 such that the internal conductor 31 is in ohmic contact with an internal wall surface of the outer conductor unit 11 and/or a surface of the conductor column 121 of the inner conductor unit 12, and the external conductor 33 is in ohmic contact with a surface of the outer conductor unit 11, in order to feed microwave into the microwave resonator 10.

[0061] In some embodiments, the internal conductor 31 of the microwave feed-in device 30 is of a linear form, and the microwave feed-in device 30 is mounted to the microwave resonator 10 such that the internal conductor 31 is in ohmic contact with the surface of the conductor column 121 and is perpendicular to an axis of the conductor column 121.

[0062] To manufacture the aerosol generation device 1, the following steps are adopted:

(1) providing an outer conductor unit 11 and a conductor column 121, and inserting a lower end of the conductor column 121 in an axial direction into the end wall 1 1 1 of the outer conductor unit 11;

(2) providing an accommodating base 20 and a probe device 122, and mounting the probe device 122 to an accommodating portion 21 of the accommodating base 20 to form a combined structure;

(3) inserting the combined structure into an opening 110 of the outer conductor unit 11 to make a foundation portion 1221 of the probe device 122 in ohmic contact with a free end of the conductor column 121; and

(4) providing a microwave feed-in device 30, and mounting the microwave feed-in device 30 in a feed-in aperture 1110 of the outer conductor unit 11 to make an internal conductor 31 of the microwave feed-in device 30 in ohmic contact with the conductor column 121, and an external conductor 33 in ohmic contact with the outer conductor unit 11.

[0063] The above sequence of the steps is not provided to limit the sequence of operation, and during an actual manufacturing process, steps that can be carried out in parallel with each other can completely be adjusted for sequence thereof. For example, step (1) and step (2) of the above can be switched with respect to the sequence thereof.

[0064] FIG. 5 illustrates an aerosol generation device 1a according to some other embodiments of the present invention, which is generally similar, with respect to structure, to the above-described aerosol generation device 1, and a difference between the two is that a microwave feed-in device 30a is used to replace the microwave feed-in device 30 of the above-described aerosol generation device 1.

[0065] As shown in the drawing, the microwave feed-in device 30a can be, in some embodiments, a coaxial connector, which comprises an internal conductor 31a, an external conductor 33a, and a dielectric layer 32a arranged between the internal conductor 31a and the external conductor 33a. The microwave feed-in device 30a is mounted to the microwave resonator 10 such that the internal conductor 31a is in ohmic contact with an internal wall surface of the outer conductor unit 11, and the external conductor 33a is in ohmic contact with a surface of the outer conductor unit 11, in order to feed microwave into the microwave resonator 10.

[0066] The internal conductor 31a of the microwave feed-in device 30a can be, in some embodiments, of an L-shape, which comprises a first section 311a perpendicular to an axis of the microwave resonator 10 and a second section 312a parallel to the axis of the microwave resonator 10, and the second section 312a is in ohmic contact with the end wall 112 of the outer conductor unit 11.

[0067] Understandably, each of the technical features described above can be arbitrability combined without being constrained in any way.

[0068] The above description provides only examples of implementation of the present invention and is not intended to limit the scope of patent of the present invention. All equivalent structures or equivalent flow variations made according to the contents of the specification and the drawings of the present invention, or direct or indirect applications thereof to other related technical fields, are similarly included in the scope of patent protection of the present invention.

Claims

1. An aerosol generation device, comprising a microwave resonator (10) and an accommodating base (20);

    the microwave resonator (10) comprising an outer conductor unit (11) that defines a resonant cavity (13) and an inner conductor unit (12) arranged in the outer conductor unit (12), the outer conductor unit (11) having an open end and a closed end, the inner conductor unit (12) having one end connected to the closed end of the outer conductor unit (11) and another end extending toward the open end of the outer conductor unit (11);
    the accommodating base (20) being connected to the open end and comprising an accommodating portion (21) for receiving therein an aerosol generation substrate, the accommodating portion (21) being arranged in the resonant cavity (13);
    the inner conductor unit (12) comprising a conductor column (121) and a probe device (122), the conductor column (121) comprising a fixed end connected to the closed end and a free end extending toward the accommodating portion (21), the probe device (122) comprising at least one probe (1222) extending to a side portion of the accommodating portion (21);
    characterized in that the probe device (122) is arranged on the accommodating portion (21) and is in ohmic contact with the free end of the conductor column (121).

2. The aerosol generation device according to claim 1, **characterized in that** the probe device (122) comprises a foundation portion (1221) connected to the at least one probe (1222), and the foundation portion (1221) is arranged on an end surface of the accommodating portion (21) facing the conductor column (121).

3. The aerosol generation device according to claim 1, **characterized in that** the probe device (122) comprises a foundation portion (1221) connected to the at least one probe (1222), and the probe device (122) is in ohmic contact with the free end of the conductor column (121) by means of the foundation portion (1221).

4. The aerosol generation device according to claim 1, **characterized in that** the probe device (122) comprises a foundation portion (1221) connected to the at least one probe (1222), and the at least one probe (1222) is of an elongated configuration having one end connected to the foundation portion (1221) and an opposite end extending in a direction parallel to the axis of the inner conductor unit (12) and away from the inner conductor unit (12).

5. The aerosol generation device according to claim 1, **characterized in that** the at least one probe (1222) comprises at least two probes (1222)which are distributed in a circumferential direction of the side wall (212) of the accommodating portion (21) in an equally spaced manner.

6. The aerosol generation device according to claim 1, **characterized in that** the at least one probe (1222) comprises at least two probes (1222), and lengths of the at least two probes (1222) are equal or unequal.

7. The aerosol generation device according to claim 1, **characterized in that** the at least one probe (1222) comprises at least two probes (1222), and the at least two probes (1222) comprise at least two pairs of probes (1222), lengths being unequal among the pairs, the at least two pairs of probes (1222) being alternately and uniformly distributed in a circumferential direction of the side wall (212) of the accommodating portion (21).

8. The aerosol generation device according to claim 1, **characterized in that** the probe device (122) is snap fit to, adhesively attached to, or integrally formed, as a one-piece structure, with the accommodating portion (21)

9. The aerosol generation device according to claim 1, **characterized in that** the probe device (122) is formed by processing an electrically conductive metal plate as a one-piece structure, or is formed by means of electroplating or printing.

10. The aerosol generation device according to claim 1, **characterized in that** a range of thickness of the

probe device (122) is 1-2000 micrometers.

11. The aerosol generation device according to claim 1, **characterized in that** the at least one probe (1222) is distributed on an inside wall surface or an outside wall surface of the accommodating portion (21), or is completely or partly embedded in the side wall (212) of the accommodating portion (21).

12. The aerosol generation device according to claim 1, **characterized in that** the accommodating base (20) further comprises a fixing portion (22) connected to the accommodating portion (21), the accommodating portion (21) comprising an accommodating chamber (210) extending axially to receive the aerosol generation substrate, the fixing portion (22) comprising an axial through hole (220) communicating the accommodating chamber (210) with environment; and the fixing portion (22) is connected to the open end.

13. The aerosol generation device according to claim 12, **characterized in that** the accommodating base (20) comprises a plurality of longitudinal positioning ribs (23) and a plurality of elongated support ribs (25); the positioning ribs (23) are arranged on a circumferential direction of a wall surface of the accommodating chamber (210) and/or the through hole (220) in a uniformly spaced manner; the support ribs (25) are arranged on a bottom surface of the accommodating chamber (210) in a radiating manner; longitudinally extending first air ingress channels being formed between at least some adjacent ones of the positioning ribs (23), radially extending second air ingress channels being formed between at least some adjacent ones of the support ribs (25), the second air ingress channels being respectively in communication with the first air ingress channels.

14. The aerosol generation device according to claim 1, **characterized by** further comprising a microwave feed-in device (30, 30a) connected to the microwave resonator, the microwave feed-in device (30, 30a) comprising an internal conductor (31, 31a), an external conductor (33, 33a), and a dielectric layer (32, 32a) arranged between the internal conductor (31, 31a) and the external conductor (33, 33a), the internal conductor (31, 31a) being of a linear form and in ohmic contact with the conductor column (121) in a manner of being perpendicular to an axis of the conductor column (121).

15. The aerosol generation device according to claim 1, **characterized by** further comprising a microwave feed-in device (30, 30a) connected to the microwave resonator, the microwave feed-in device (30, 30a) comprising an internal conductor (31, 31a), an external conductor (33, 33a), and a dielectric layer (32, 32a) arranged between the internal conductor (31, 31a) and the external conductor (33, 33a), the internal conductor (31, 31a) comprising a first section (311a) perpendicular to an axis of the conductor column (121) and a second section (312a) parallel to the axis of the conductor column (121), the second section (312a) being in ohmic contact with the end wall (112) of the outer conductor unit (11).

16. The aerosol generation device according to claim 1, **characterized in that** the microwave resonator (10) is a quarter wavelength type coaxial resonator

17. The aerosol generation device according to claim 1, **characterized in that** the accommodating base (20) is formed of one or a compound of multiple ones of plastics, microwave transparent ceramics, glass, aluminum oxide, zirconium oxide, and silicon oxide.

18. The aerosol generation device according to claim 1, **characterized in that** an axis of the inner conductor unit (12) is coincident with or parallel to an axis of the outer conductor unit (11).

19. The aerosol generation device according to claim 1, **characterized in that** the probe device (122) and the conductor column (121) are detachable from each other or fixedly fastened together when constraint of an external force exerted therebetween is removed.

20. The aerosol generation device according to claim 1, **characterized in that** the at least one probe (1222) has a length range of 0-(L1+5) mm, wherein L1 is a length of the aerosol generation substrate.

21. An aerosol generation device, comprising a quarter wavelength type coaxial resonator (10) and an accommodating base (20) arranged at an open-circuit terminal (B) of the coaxial resonator (10), the accommodating base (20) comprising an accommodating portion (21) for receiving an aerosol generation substrate, the accommodating portion (21) being located in a resonant cavity (13) of the coaxial resonator (10);

the coaxial resonator (10) comprising an inner conductor unit (12) which comprises a conductor column (121) adjacent to a short-circuit terminal (A) of the coaxial resonator (10) and a probe device (122) adjacent to the open-circuit terminal (B), the probe device (122) comprising at least one probe (1222) extending to a side portion of the accommodating portion (21);
characterized in that the probe device (122) is arranged on the accommodating portion (21) and is in ohmic contact with the conductor column (121).

22. The aerosol generation device according to claim 18, **characterized in that** the probe device (122) comprises a foundation portion (1221) connected to the at least one probe (1222), the foundation portion (1221) being arranged on an end surface of the accommodating portion (21) facing the conductor column (121); the probe device (122) is in ohmic contact with the conductor column (121) by means of the foundation portion (1221).

23. The aerosol generation device according to claim 18, **characterized in that** the at least one probe (1222) comprises at least two pairs of probes (1222) having unequal lengths, and the at least two pairs of probes (1222) are alternately and uniformly distributed in a circumferential direction of the side wall of the accommodating portion (21).

24. The aerosol generation device according to claim 18, **characterized in that** the conductor column (121) comprises a free end facing the accommodating portion (21), the probe device (122) being in ohmic contact with the free end.

25. An aerosol generation device manufacturing method, **characterized by** comprising the following steps:

(1) providing an outer conductor unit (11) and a conductor column (121), and mounting the conductor column (121) in an axial direction into the outer conductor unit (11);
(2) providing an accommodating base (20) and a probe device (122), and mounting the probe device (122) to an accommodating portion (21) of the accommodating base (20) to form a combined structure;
(3) mounting the combined structure to the outer conductor unit (11), and setting the probe device (122) in ohmic contact with the conductor column (121).

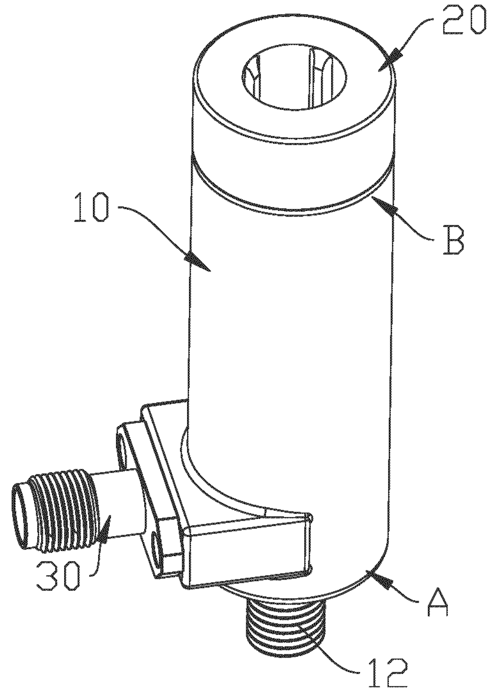


Fig.1

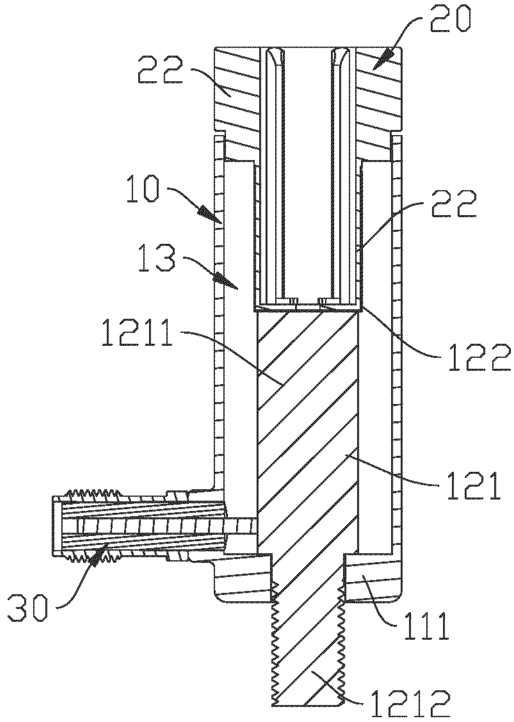
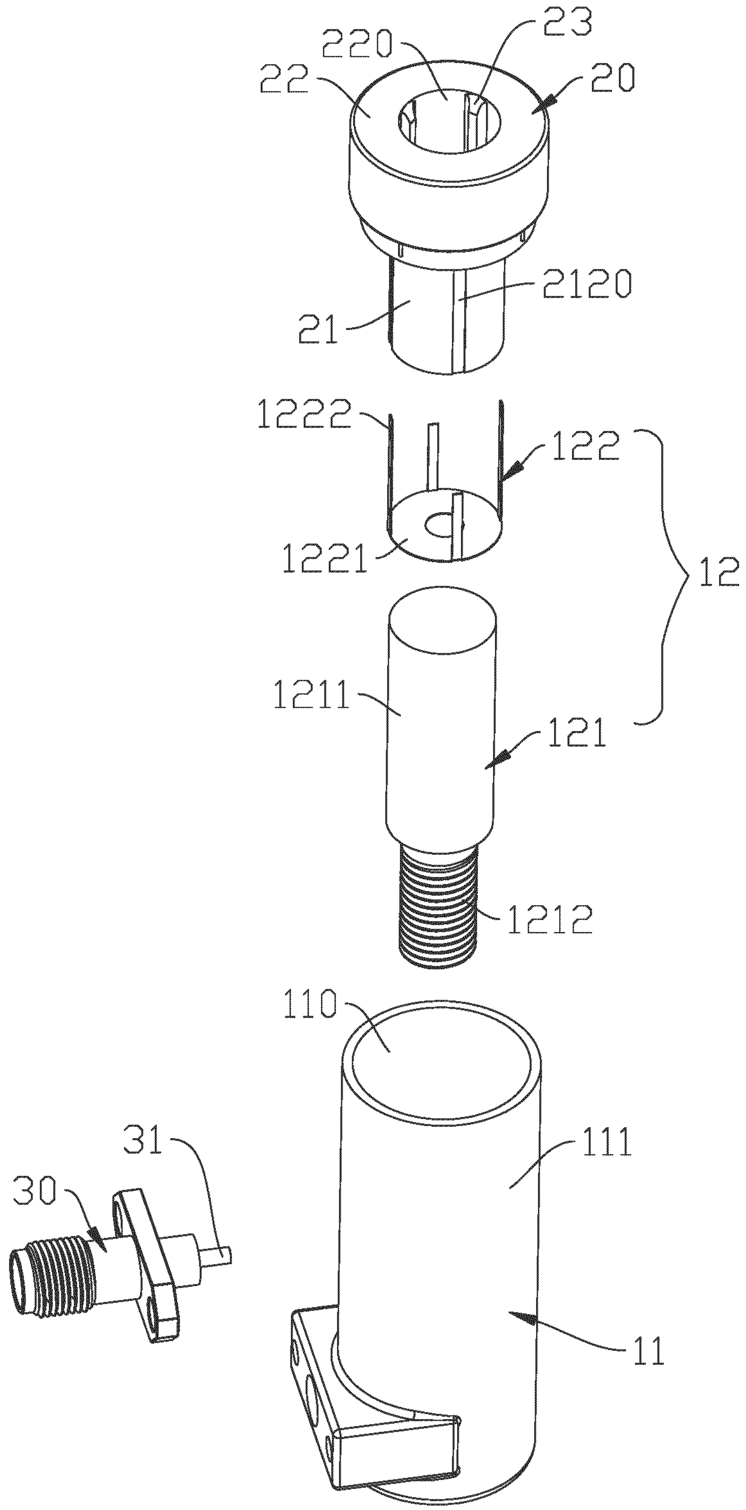


Fig.2


23
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1222
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1221
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121
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110
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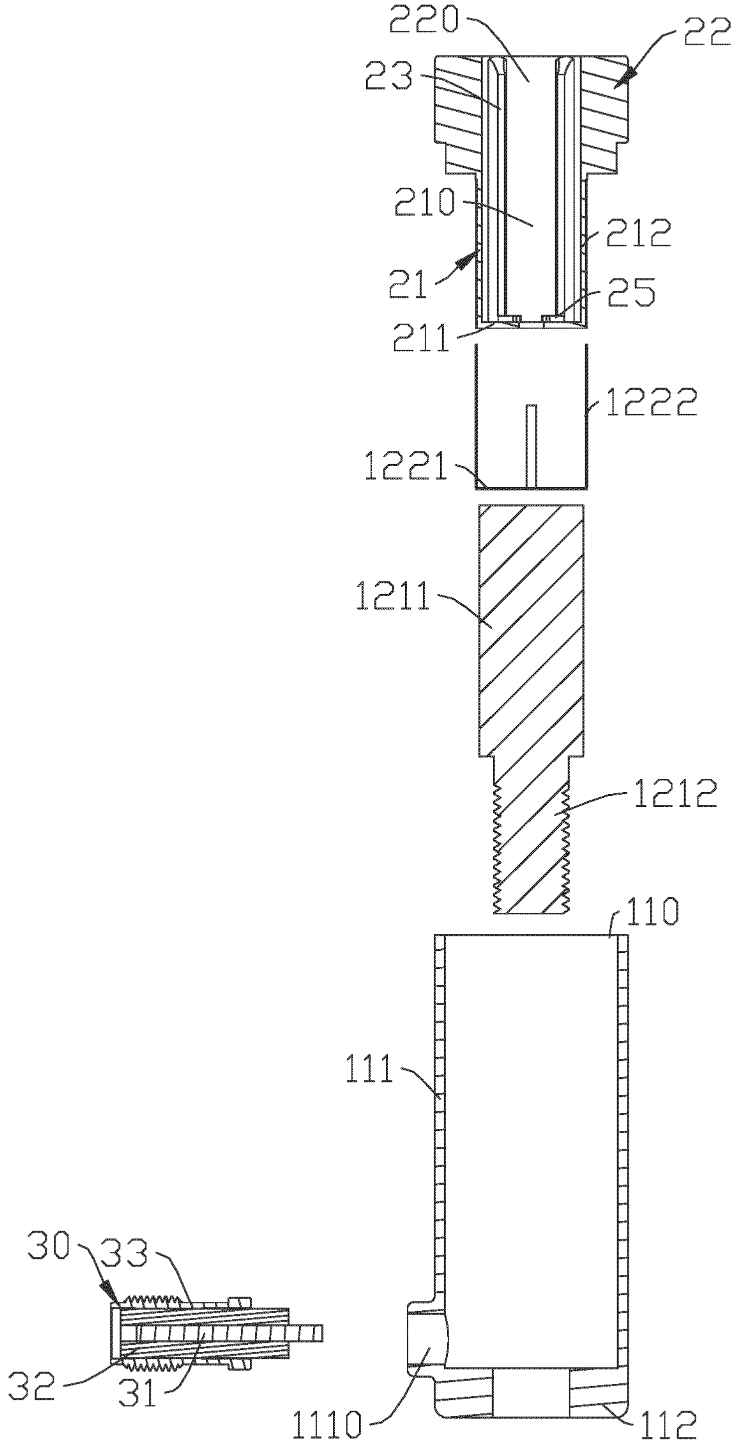
31
30
11

Fig.3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212
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1222
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1211
1212
110
111
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33
32
31
1110
112

Fig.4

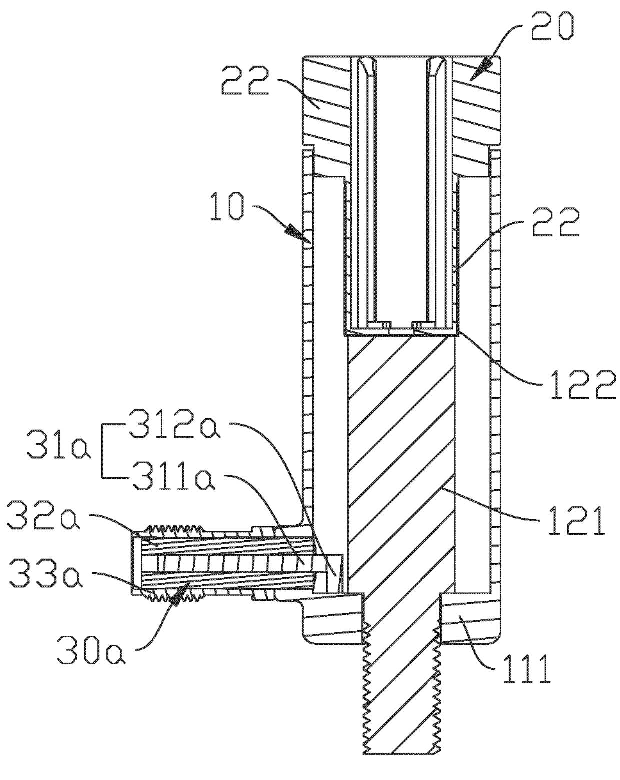

Fig.5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/082585

A. CLASSIFICATION OF SUBJECT MATTER

A24F 40/40(2020.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A24F

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: 气溶胶, 微波谐振, 微波加热, 外导体, 内导体, 收容, 探针, 欧姆接触, 四分之一波长, aerosol, microwave resonance, microwave heating, outer conductor, inner conductor, housing, probe, ohmic contact

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 114209096 A (SHENZHEN MAISHI TECHNOLOGY CO., LTD.) 22 March 2022 (2022-03-22) description, paragraphs [0040]-[0075], and figures 1-7	1-25
A	CN 110279152 A (YUNNAN BAGU BIOTECHNOLOGY CO., LTD.) 27 September 2019 (2019-09-27) entire document	1-25
A	CN 215913314 U (SHENZHEN MAXWELL SCIENCE AND TECHNOLOGY CO., LTD. et al.) 01 March 2022 (2022-03-01) entire document	1-25
A	CN 113729304 A (SHENZHEN MAXWELL SCIENCE AND TECHNOLOGY CO., LTD. et al.) 03 December 2021 (2021-12-03) entire document	1-25
A	CN 114025630 A (NVX LABS GMBH) 08 February 2022 (2022-02-08) entire document	1-25
A	US 2021112882 A1 (RAI STRATEGIC HOLDINGS, INC.) 22 April 2021 (2021-04-22) entire document	1-25

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

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

Date of the actual completion of the international search	Date of mailing of the international search report
28 November 2022	**16 December 2022**

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

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/082585

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	114209096	A	22 March 2022	None			
CN	110279152	A	27 September 2019	None			
CN	215913314	U	01 March 2022	None			
CN	113729304	A	03 December 2021	None			
CN	114025630	A	08 February 2022	EP	3979865	A1	13 April 2022
				PT	3747289	T	21 April 2022
				KR	20220018489	A	15 February 2022
				US	2022330396	A1	13 October 2022
				JP	2022535369	A	08 August 2022
				PL	3747289	T3	20 June 2022
				EP	3747289	A1	09 December 2020
				ES	2911635	T3	20 May 2022
				CA	3142259	A1	10 December 2020
				WO	2020244996	A1	10 December 2020
US	2021112882	A1	22 April 2021	WO	2021074864	A1	22 April 2021
				EP	4044841	A1	24 August 2022
				CA	3154748	A1	22 April 2021

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