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(71) Applicant: **Shenzhen Smoore Technology Limited
Shenzhen, Guangdong 518102 (CN)**

(72) Inventors:
- **LI, Huanxi
Shenzhen, Guangdong 518102 (CN)**
- **DU, Hongfei
Shenzhen, Guangdong 518102 (CN)**
- **ZHOU, Hongming
Shenzhen, Guangdong 518102 (CN)**
- **CHEN, Hua
Shenzhen, Guangdong 518102 (CN)**
- **DU, Xianwu
Shenzhen, Guangdong 518102 (CN)**

(74) Representative: **Manitz Finsterwald
Patent- und Rechtsanwaltspartnerschaft mbB
Martin-Greif-Strasse 1
80336 München (DE)**

(54) ATOMIZER AND ELECTRONIC ATOMIZATION DEVICE

(57) An atomizer (100), comprising: a tube body (10) in which a heating cavity (11) is formed; and an electrode assembly (30) comprising a first electrode (32) and a second electrode (34), the first electrode (32) and the second electrode (34) both extending into the heating cavity (11). In the heating cavity (11), the axial end portions of the first electrode (32) and the second electrode (34) can be controlled to form an electric arc and generate plasma, and the length of the electric arc is greater than a radial spacing between the first electrode (32) and the second electrode (34). Further provided is an electronic atomization device.

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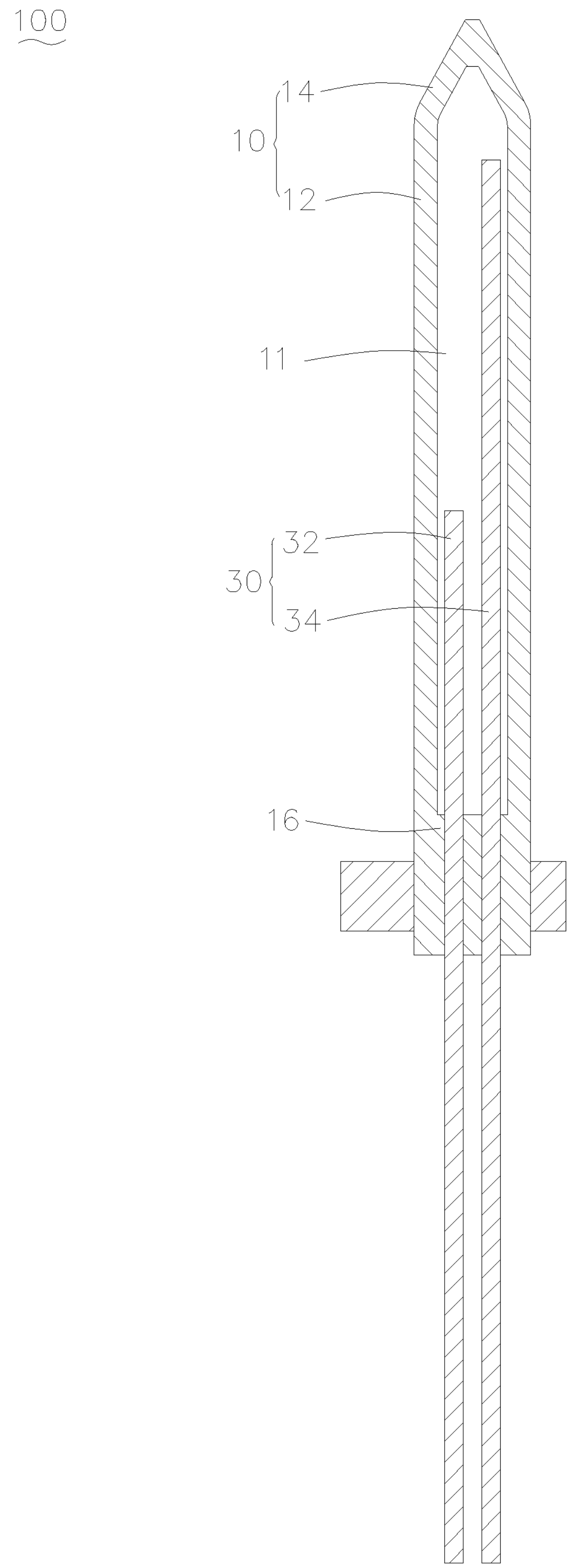

FIG. 1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims to priority of the Chinese patent application No. 2022200691654, entitled "ATOMIZER AND ELECTRONIC ATOMIZING DEVICE", filed with the China Patent Office on January 12, 2022, the contents of which are incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present application relates to the field of atomization technology, and in particular, to an atomizer and an electronic atomizing device.

BACKGROUND

[0003] Aerosol is a colloidal dispersion system formed by small solid or liquid particles dispersed and suspended in a gas medium. Since the aerosol can be absorbed by the human body through the respiratory system, it provides users with a new alternative absorption method. For example, electronic atomizing devices that can bake and heat the aerosol-generating substrate of herbal or ointment to generate aerosol are used in different fields to deliver aerosols to users for inhalation, replacing conventional product forms and absorption methods. The electronic atomizing devices usually utilize resistance or electromagnetic induction to heat the aerosol-generating substrate.

SUMMARY

[0004] In a conventional art, whether the aerosol-generating substrate is heated by means of resistance or electromagnetic induction, the required preheating waiting time is long, which is inconvenient for users. In addition, resistance heating is to energize a resistance element to generate heat through an external power supply, and the heated resistance element then transfers the heat to the aerosol-generating substrate through heat conduction. The heat conduction takes time and has hysteresis, so the aerosol-generating substrate near the resistance element is often overburned or even charred. High temperature overburning or charring leads to poor taste consistency. Moreover, when the resistance heating element contacts and heats the aerosol-generating substrate, the metal substance in the resistance heating element may enter the aerosol formed by the atomization of the aerosol-generating substrate, affecting the taste after atomization.

[0005] Therefore, the conventional method of heating the aerosol-generating substrate has a long preheating time and a poor taste after atomization.

[0006] Accordingly, it is necessary to provide an atomizer and an electronic atomizing device to address the problems of long preheating waiting time and poor taste after atomization of the conventional electronic atomizing devices.

[0007] A first aspect of the present application provides an atomizer. The atomizer includes: a tube body forming a heating cavity therein; and an electrode assembly including a first electrode and a second electrode. The first electrode and the second electrode extend into the heating cavity. In the heating cavity, an electric arc is controllably formed between an axial end of the first electrode and an axial end of the second electrode to generate plasma, and a length of the electric arc is greater than a radial spacing between the first electrode and the second electrode.

[0008] When the above atomizer works, the electric arc is formed between the axial end of the first electrode and the axial end of the second electrode in the heating cavity. The length of the electric arc is greater than the radial spacing between the first electrode and the second electrode, so that a longer electric arc is formed by the axial end of the first electrode and the axial end of the second electrode, thus increasing the heating region. As such, the atomizer can effectively heat and atomize the aerosol-generating substrate sleeved outside the tube body. In addition, the heat generated by the plasma is used to quickly heat the aerosol-generating substrate, and the high energy density characteristics of plasma heating is utilized to shorten the preheating waiting time, which is convenient for users to use, prevents the aerosol-generating substrate from being scorched due to the long preheating time, and improves the taste after atomization. In addition, during the heating process, metal parts such as electrodes do not need to directly contact the aerosol-generating substrate, which can prevent the atomized aerosol-generating substrate from being doped by metal substances, thereby further improving the taste after atomization.

[0009] In the first aspect of the present application, an outer periphery of the first electrode and an outer periphery of the second electrode are each coated with an insulating layer. The axial end of the first electrode and the axial end of the second electrode that are located in the heating cavity are exposed.

[0010] In the first aspect of the present application, an infrared radiation layer is coated on the insulating layer of each of the first electrode and the second electrode.

[0011] In the first aspect of the present application, the tube body includes a main body, a top cover, and a base. The main body is a hollow structure with an opening at each of both ends. The top cover is sleeved on the opening at one of the ends of the main body in an axial direction. The base is sleeved on the opening at another of the ends of the main body in the axial direction. The top cover, the main body, and the base enclose the heating cavity. The first electrode and the second electrode extend through the base and extend into the heating cavity.

[0012] In the first aspect of the present application, the main body and the top cover are integrally formed or separately formed.

[0013] In the first aspect of the present application, the main body is made of an infrared radiation material.

[0014] In the first aspect of the present application, the top cover is made of an infrared radiation material.

[0015] In the first aspect of the present application, the heating cavity includes a first heating sub-cavity defined in the main body. The first electrode and the second electrode extend into the first heating sub-cavity.

[0016] In the first aspect of the present application, the axial end of the first electrode and the axial end of the second electrode are staggered from each other in the axial direction.

[0017] In the first aspect of the present application, the heating cavity includes a second heating sub-cavity, a third heating sub-cavity, and a connecting space in communication with the second heating sub-cavity and the third heating sub-cavity. The first electrode and the second electrode extend into the second heating sub-cavity and the third heating sub-cavity, respectively. The electric arc passing through the connecting space is controllably formed between the axial end of the first electrode and the axial end of the second electrode to generate the plasma.

[0018] In the first aspect of the present application, the main body is provided with the second heating sub-cavity and the third heating sub-cavity extending therethrough in the axial direction. The connecting space is defined on an axial end of the main body. The top cover is provided at the end of the main body where the connecting space is defined.

[0019] In the first aspect of the present application, the axial end of the first electrode and the axial end of the second electrode are staggered from each other or coplanar with each other in the axial direction.

[0020] In the first aspect of the present application, the main body includes an inner tube body and an outer tube body. The outer tube body is sleeved outside the inner tube body and spaced apart from the inner tube body. The inner tube body has the second heating sub-cavity. The third heating sub-cavity is defined between the inner tube body and the outer tube body.

[0021] The top cover is sleeved on an axial end of the outer tube body. An axial end of the inner tube body is spaced apart from the top cover. The connecting space is defined between the axial end of the inner tube body and the top cover.

[0022] In the first aspect of the present application, the first electrode extends into the inner tube body. The second electrode extends between the inner tube body and the outer tube body. The axial end of the second electrode extends into the connecting space and faces the second heating sub-cavity in the inner tube body. The electric arc passing through the connecting space and the second heating sub-cavity is controllably formed between the axial end of the first electrode and the axial end of the second electrode.

[0023] In the first aspect of the present application, a portion of the first electrode and a portion of the second electrode that extend out of the heating cavity are relatively insulated from each other.

[0024] A second aspect of the present application provides an electronic atomizing device. The electronic atomizing device includes the atomizer of the above first aspect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a schematic view of an atomizer according to an embodiment of the present application.

FIG. 2 is a schematic view of an atomizer according to another embodiment of the present application.

FIG. 3 is a schematic view of an atomizer according to yet another embodiment of the present application.

FIG. 4 is a schematic view of a main body of the atomizer shown in FIG. 3.

FIG. 5 is a schematic cross-sectional view of an atomizer in one direction according to yet another embodiment of the present application.

FIG. 6 is a schematic cross-sectional view of the atomizer shown in FIG. 5 in another direction.

[0026] 100, atomizer; 10, tube body; 11, heating cavity; 112, first heating sub-cavity; 114, second heating sub-cavity; 116, third heating sub-cavity; 118, connecting space; 12, main body; 121, inner tube body; 123, outer tube body; 14, top cover; 16, base; 30, electrode assembly; 32, first electrode; 34, second electrode.

DETAILED DESCRIPTION

[0027] In order to make the above objects, features and advantages of the present application more obvious and understandable, specific implementations of the present application are described in detail below with reference to the accompanying drawings. In the following description, many specific details are set forth in order to fully understand the present application. However, the present application can be implemented in many other ways different from those described herein, and those skilled in the art can make similar improvements without departing from the connotation of the present application. Therefore, the present application is not limited by specific embodiments disclosed below.

[0028] In the description of the present application, it is to be understood that the orientation or position relationships indicated by the terms "central", "longitudinal", "transverse", "length", "width", "thickness", "upper", "lower", "front", "back", "left", "right", "vertical", "horizontal", "top", "bottom", "inner", "outer", "clockwise", "counterclockwise", "axial", "radial", "circumferential", and the like are based on the orientation or position relationships shown in the accompanying drawings, and are intended to facilitate the description of the present application and simplify the description only, rather than indicating or implying that the apparatus or element referred to must have a particular orientation or be constructed and operated in a particular orientation, and therefore are not to be interpreted as limiting the present application.

[0029] In addition, the terms "first" and "second" are used for descriptive purposes only, which cannot be construed as indicating or implying a relative importance, or implicitly specifying the quantity of the indicated technical features. Therefore, the features defined by "first" and "second" may explicitly or implicitly include at least one of the features. In the description of the present application, "a plurality of" means at least two, such as two or three, unless otherwise defined explicitly and specifically.

[0030] In the present application, unless otherwise specified and defined explicitly, the terms "mounting", "connection", "coupling", and "fixation" should be understood in a broad sense., which may be, for example, a fixed connection, a detachable connection, or an integral connection; or a mechanical connection or an electrical connection; or a direct connection, an indirect connection via an intermediate medium; or an internal connection between two elements, or interaction between two elements, unless otherwise specifically defined. Those of ordinary skill in the art can understand specific meanings of these terms in the present application according to specific situations.

[0031] In the present application, unless otherwise explicitly specified and defined, a first feature being "on" or "below" a second feature may be the case that the first feature is in direct contact with the second feature, or the first feature is in indirect contact with the second feature via an intermediate medium. Furthermore, the first feature being "over", "above" and "on top of" the second feature may be the case that the first feature is directly above or obliquely above the second feature, or only means that the first feature is higher in level than the second feature. The first feature being "below", "underneath" or "under" the second feature may be the case that the first feature is directly underneath or obliquely underneath the second feature, or only means that the first feature is lower in level than the second feature.

[0032] It is to be noted that when one element is referred to as being "fixed to" or "arranged on" another element, it may be directly disposed on the other element or an intermediate element may exist. When one element is considered to be "connected to" another element, it may be directly connected to the other element or an intermediate element may exist at the same time. The terms "vertical", "horizontal", "up", "down", "left", "right" and similar expressions used herein are for illustrative purposes only and do not represent unique implementations.

[0033] Refer to FIG. 1, which shows an atomizer 100 according to an embodiment of the present application. The atomizer 100 heats an aerosol-generating substrate at least by plasma heating, and utilizes the high energy density of plasma heating to achieve instant rapid heating and atomization, effectively shortening the preheating time, preventing scorching caused by too long preheating time, and improving the taste after atomization.

[0034] As shown in FIG. 1, the atomizer 100 includes a tube body 10 and an electrode assembly 30. A heating cavity 11 is formed in the tube body 10. The electrode assembly 30 includes a first electrode 32 and a second electrode 34. The first electrode 32 and the second electrode 34 extend into the heating cavity 11. In the heating cavity 11, an electric arc may be controllably formed between an axial end of the first electrode 32 and an axial end of the second electrode 34 to generate plasma. During use, the aerosol-generating substrate can be inserted outside the tube body 10, and after the first electrode 32 and the second electrode 34 are powered, breakdown takes place between the axial end of the first electrode 32 and the axial end of the second electrode 34 to generate the electric arc, and then gas is ionized in the heating cavity 11 to form the plasma. The plasma heats the heating cavity 11 and the tube body 10. After the tube body 10 is heated, the aerosol-generating substrate sleeved outside the tube body 10 can be heated and atomized.

[0035] In addition, when the atomizer 100 works, the electric arc is formed between the axial end of the first electrode 32 and the axial end of the second electrode 34 in the heating cavity 11. The length of the electric arc is greater than the radial spacing between the first electrode 32 and the second electrode 34, so that a longer electric arc is formed by the axial end of the first electrode 32 and the axial end of the second electrode 34, thus increasing the heating region. As such, the atomizer 100 can effectively heat and atomize the aerosol-generating substrate sleeved outside the tube body 10. In addition, the heat generated by the plasma is used to quickly heat the aerosol-generating substrate, and the high energy density characteristics of plasma heating is utilized to shorten the preheating waiting time, which is convenient for users to use, prevents the aerosol-generating substrate from being scorched due to the long preheating time, and improves the taste after atomization. In addition, during the heating process, metal parts such as electrodes do not need to directly contact the aerosol-generating substrate, which can prevent atomized aerosol-generating substrate from being doped by metal substances, thereby further improving the taste after atomization.

[0036] In some embodiments, the heating cavity 11 is filled with inert gas. After the first electrode 32 and the second electrode 34 in the heating cavity 11 are broken down to generate the electric arc, the inert gas filled in the heating cavity 11 can be ionized to form plasma and generate heat. The generated heat can be efficiently transferred to the tube body 10 through the inert gas, thereby improving the heat transfer efficiency. For example, the heating cavity 11 is filled with helium, neon, argon and other gases. It can be understood that in some other embodiments, the heating cavity 11 can also be filled with air, which is not limited herein.

[0037] In some embodiments, the air pressure inside the heating cavity 11 is less than the standard atmospheric pressure, so that the pressure inside the heating cavity 11 is kept at a relatively low level, and no excessive pressure is exerted on a cavity wall (i.e., a heating element) of the heating cavity 11, thereby reducing the wall thickness and strength of the heating element, and further improving the heat transfer efficiency. For example, the air pressure inside the heating cavity 11 is between 1/5 of the atmospheric pressure and 1 atmospheric pressure.

[0038] Preferably, the air pressure in the heating cavity 11 is 1/5 to 1/3 of the atmosphere pressure. It is to be understood that in some other embodiments, the air pressure inside the heating cavity 11 can also be configured to be the standard atmospheric pressure, which is not limited herein.

[0039] In some embodiments, at least a portion of the tube body 10 is made of an infrared radiation material. When the tube body 10 is heated by the plasma inside, the tube body 10 itself can radiate infrared rays outward, so that the aerosol-generating substrate sleeved on the tube body 10 can be heated not only by plasma but also by infrared radiation, so as to provide high-temperature baking at the initial stage of inhalation, and the aerosol-generating substrate can be heated at high temperature in a short time, which can prevent the aerosol-generating substrate from being scorched and ensure the taste after atomization.

[0040] Optionally, at least a portion of the tube body 10 is made of any one selected from the group consisting of transparent quartz glass, opalescent quartz, black silica quartz, silicon nitride, zirconium oxide, and aluminum oxide. The tube body 10 is made of the above-mentioned material with high dielectric properties, so that the tube body 10 has good insulation, which can prevent leakage of electricity when the gas inside the tube body 10 is ionized. In addition, the tube body 10 made of the above-mentioned material can emit infrared rays after being heated, so that the atomizer 100 has both plasma heating and infrared radiation heating functions.

[0041] In some embodiments, an outer periphery of the first electrode 32 and an outer periphery of the second electrode 34 are each coated with an insulating layer, and the axial ends of the first electrode 32 and the second electrode 34 that are located in the heating cavity 11 are exposed. In this way, a relative insulation between the outer periphery of the first electrode 32 and the outer periphery of the second electrode 34 is achieved by the insulating layers, and the axial ends of the first electrode 32 and the second electrode 34 in the heating cavity 11 are exposed, so that the electric arc can be generated between the axial ends of the first electrode 32 and the second electrode 34. In other words, a direct breakdown between the outer peripheries of the first electrode 32 and the second electrode 34 is prevented by the insulating layers, which can prevent the electric arc generated between the first electrode 32 and the second electrode 34 from being too short to cause the heating region to be concentrated at one point, thereby ensuring that a long electric arc is generated between the axial ends of the first electrode 32 and the second electrode 34, so as to efficiently heat and atomize the aerosol-generating substrate.

[0042] Optionally, the first electrode 32 and the second electrode 34 are both made of any one selected from the group consisting of tungsten alloy, carbon fiber and copper alloy. The diameter of the first electrode 32 and the diameter of the second electrode 34 ranges from 0.4 mm to 0.6 mm. Optionally, the first insulating layer and the second insulating layer are both formed by coating fused quartz.

[0043] Furthermore, an infrared radiation layer is coated on each of the insulating layers of the first electrode 32 and the second electrode 34, so that when plasma is generated in the heating cavity 11 through arc discharge, the interior of the heating cavity 11 is heated, and the first electrode 32 and the second electrode 34 located in the heating cavity 11 are also heated. In this case, the infrared radiation layers coated on the first electrode 32 and the second electrode 34 can emit infrared rays, so that not only the aerosol-generating substrate sleeved on the tube body 10 can be heated by plasma, but also the aerosol-generating substrate can be heated by infrared rays, which further increases the heating temperature, thereby improving the taste after atomization and improving the taste consistency. Optionally, the tube body 10 is at least partially constructed to be transparent, thus allowing the infrared rays generated at the first electrode 32 and the second electrode 34 to radiate outward into the aerosol-generating substrate.

[0044] Optionally, the first infrared radiation layer and the second infrared radiation layer both include one or more selected from the group consisting of iron manganese copper oxide, CrC, TiCN, diamond-like carbon film (DLC), HBQ black silicon, cordierite, transition-metal-oxide-based spinel, rare earth oxide, ion co-doped perovskite, silicon carbide, zircon, and boron nitride, which can achieve strong infrared radiation heating.

[0045] In some embodiments, the tube body 10 includes a main body 12, a top cover 14, and a base 16. The main body 12 is a hollow structure with an opening at each of both ends. The top cover 14 is sleeved on the opening at one end of the main body 12 in an axial direction. The base 16 is sleeved on the opening at the other end of the main body 12 in the axial direction. The top cover 14, the pump body and the base 16 enclose the heating cavity 11. The first electrode 32 and the second electrode 34 both extend through the base 16 and extend into the heating cavity 11. During the assembly process, the top cover 14 is assembled at the opening at one end of the main body 12, and then the first electrode 32 and the second electrode 34 are mounted into the heating cavity 11 via the opening at the other end of the main body 12. Finally, the opening of the main body 12 through which the first electrode 32 and the second electrode 34 extend is sealed by the base 16, so that the sealed heating cavity 11 is defined among the main body 12, the top cover 14, and the base 16 .

[0046] Optionally, the opening of the main body 12 through which the first electrode 32 and the second electrode 34 extend can be sealed by melting, and the corresponding base 16 is formed after the sealing by melting. Alternatively, the base 16 is made of a heat-resistant material such as ceramics and quartz, and the base 16 is sleeved on the opening of the main body 12 to perform a corresponding seal. Optionally, the top cover 14 is in a shape of a sharp cone, so as to facilitate the insertion of the aerosol-generating substrate into the outer periphery of the tube body 10.

[0047] Further, at least the main body 12 of the main body 12 and the top cover 14 is made of an infrared radiation material. In other words, the main body 12 is made of an infrared radiation material, or the main body 12 and the top cover 14 are both made of an infrared radiation material. In this case, the tube body 10 can radiate infrared rays outward by itself to perform infrared radiation heating on the aerosol-generating substrate sleeved on the tube body 10.

[0048] Referring to FIGS. 1 and 5, in some embodiments, the main body 12 and the top cover 14 are integrally formed and made of the same material, so that the subsequent assembling is relatively simple. Specifically, the main body 12 and the top cover 14 are made of any one selected from the group consisting of transparent quartz glass, milky quartz, black silica quartz, silicon nitride, zirconium oxide, and aluminum oxide, that is, the tube body 10 is made of the above-mentioned material with high dielectric properties, so that the tube body 10 has good insulation property, which can prevent leakage of electricity when the gas inside the tube body 10 is ionized. In addition, the tube body 10 made of the above-mentioned material itself can emit infrared rays after being heated, so that the atomizer 100 has both plasma heating and infrared radiation heating functions.

[0049] Referring to FIGS. 2 to 3, in other embodiments, the main body 12 and the top cover 14 are formed separately, which facilitates the manufacture of the tube body 10 and simplifies the manufacturing process. Specifically, the main body 12 is made of any one selected from the group consisting of transparent quartz glass, milky quartz, black silicon quartz, silicon nitride, zirconium oxide, and aluminum oxide, that is, the tube body 10 is made of the above-mentioned material with high dielectric properties, so that the tube body 10 has good insulation property, which can prevent leakage of electricity when the gas inside the tube body 10 is ionized. In addition, the tube body 10 made of the above-mentioned material itself can emit infrared rays after being heated, so that the atomizer 100 has both plasma heating and infrared radiation heating functions. In addition, the top cover 14 is made of any one selected from the group consisting of ceramic, glass or metal materials. Alternatively, the top cover 14 and the main body 12 can also be formed of the same material, and which is not limited hereto.

[0050] Referring to FIGS. 1 and 2, in some embodiments, the heating cavity 11 includes a first heating sub-cavity 112. The first heating sub-cavity 112 is defined in the main body 12. The first electrode 32 and the second electrode 34 both extend into the first heating sub-cavity 112. In the first heating sub-cavity 112, the axial ends of the first electrode 32 and the second electrode 34 are staggered from each other in the axial direction, that is, there is a height difference between the axial ends of the first electrode 32 and the second electrode 34, so that an oblique straight electric arc is formed between the axial ends of the first electrode 32 and the second electrode 34, and the length of the electric arc is longer, and a heating temperature field in a larger range can be formed. Optionally, the height difference between the axial ends of the first electrode 32 and the second electrode 34 is in the range of 5 mm to 10 mm. Also optionally, the main body 12 is a cylindrical tube. The outer diameter of the main body 12 is in the range of 2.0 mm to 2.5 mm, and the wall thickness of the main body 12 is in the range of 0.4 mm to 0.6 mm.

[0051] Referring to FIGS. 2 to 6, in other embodiments, the heating cavity 11 includes a second heating sub-cavity 114, a third heating sub-cavity 116, and a connecting space 118 in communication with the second heating sub-cavity 114 and the third heating sub-cavity 116. The first electrode 32 and the second electrode 34 extend into the second heating sub-cavity 114 and the third heating sub-cavity 116, respectively. The electric arc passing through the connecting space 118 can be controllably formed between the axial ends of the first electrode 32 and the second electrode 34e to generate the plasma. In other words, the first electrode 32 is received in the second heating sub-cavity 114, the second electrode 34 is received in the third heating sub-cavity 116, and the electric arc passing through the connecting space 118 can be formed between the axial ends of the first electrode 32 and the second electrode 34, so that the electric arc can pass through the second heating sub-cavity 114, the connecting space 118, and the third heating sub-cavity 116, thereby increasing the length of the electric arc and ensuring the discharge heating area.

[0052] Referring to FIGS. 2 to 4, further, the main body 12 is provided with the second heating sub-cavity 114 and the third heating sub-cavity 116 extend through the main body 12 in the axial direction, and the connecting space 118 is defined on the axial end of the main body 12, so that the connecting space 118 is in communication with the second heating sub-cavity 114 and the third heating sub-cavity 116. The top cover 14 is provided at the end of the main body 12 where the connecting space 118 is defined, so as to seal the axial end of the main body 12. During the manufacturing process, the second heating sub-cavity 114, the third heating sub-cavity, and the connecting space 118 are firstly defined in the main body 12, and then the top cover 14 is provided on the main body 12, which is convenient for manufacturing and processing. That is, the main body 12 and the top cover 14 are formed separately. Optionally, the depth of the connecting space 118 defined by sinking the axial end of the main body 12 is in the range of 1 mm to 3 mm.

[0053] Furthermore, the axial ends of the first electrode 32 and the second electrode 34 are staggered from each other or coplanar with each other in the axial direction. That is, the axial end of the first electrode 32 can be arranged at different positions of the second heating sub-cavity 114 in the axial direction, and the axial end of the second electrode 34 can be arranged at different positions of the third heating sub-cavity 116 in the axial direction, so that the axial ends of the first electrode 32 and the second electrode 34 can be aligned with each other or axially staggered from each other. As such, the arrangements can be determined as required, to form the electric arcs of different lengths and different positions between the axial ends of the first electrode 32 and the second electrode 34, and thus different temperature fields can be formed.

[0054] Specifically, different temperature fields can be formed by arranging the axial ends of the first electrode 32 and the second electrode 34 at different positions. For example, the greater the height difference between the axial ends of the first electrode 32 and the second electrode 34, the longer the formed electric arc, the longer the top high temperature region of the tube body 10 adjacent to the top cover 14, and vice versa. For another example, the farther the axial ends of the first electrode 32 and the second electrode 34 as a whole away from the top cover 14, the longer the formed electric arc, the longer the top high temperature region of the tube body 10 adjacent to the top cover 14, and vice versa. Optionally, the electric arc in this embodiment is in a shape of an inverted U- shape.

[0055] Referring to FIGS. 5 and 6, in some other embodiments, the main body 12 includes an inner tube body 121 and an outer tube body 123. The outer tube body 123 is sleeved outside the inner tube body 121 and spaced apart from the inner tube body 121. The inner tube body 121 itself has the second heating sub-cavity 114. The third heating sub-cavity 116 is defined between the inner tube body 121 and the outer tube body 123. The top cover 14 is arranged at the axial end of the outer tube body 123. The axial end of the inner tube body 121 is spaced apart from the top cover 14. The connecting space 118 is defined between the axial end of the inner tube body 121 and the top cover 14. In this way, the second heating sub-cavity 114, the third heating sub-cavity 116 and the connecting space 118 are formed by the inner tube body 121 and the outer tube body 123 that are sleeved together and spaced apart from each other.

[0056] Further, the first electrode 32 extends into the inner tube body 121, the second electrode 34 extends between the inner tube body 121 and the outer tube body 123. The axial end of the second electrode 34 extends into the connecting space 118 and faces the second heating sub-cavity 114 in the inner tube body 121. In other words, a portion of the second electrode 34 is sleeved in the third heating sub-cavity 116 between the inner tube body 121 and the outer tube body 123, and the other end of the second electrode 34 is bent into the connecting space 118 and faces the second heating sub-cavity 114. In this way, the electric arc passing through the connecting space 118 and the second heating sub-cavity 114 can be controllably formed between the axial ends of the first electrode 32 and the second electrode 34. That is, the electric arc is formed in the second heating sub-cavity 114 and the connecting space 118 to generate the plasma. Specifically, the axial ends of the first electrode 32 and the second electrode 34 are located on an axis of the second heating sub-cavity 114. As such, the axial ends of the first electrode 32 and the second electrode 34 are arranged in a colinear manner. The generated electric arc is linear, and the plasma is generated along the axial direction of the tube body 10 to heat and the atomize the aerosol-generating substrate.

[0057] Optionally, the discharge distance between the axial ends of the first electrode 32 and the second electrode 34 is in the range of 4 mm to 10 mm. Optionally, the outer tube body 123 and the inner tube body 121 are both cylindrical tubes, and the outer diameter of the outer tube body 123 is in the range of 2.5 mm to 3.5 mm. The hole diameter of the second heating sub-cavity 114 in the inner tube body 121 is in the range of 0.3 mm to 0.6 mm. The wall thickness of the inner tube body 121 is in the range of 0.6 mm to 0.8 mm. The diameters of the first electrode 32 and the second electrode 34 are both in the range of 0.3 mm to 0.5 mm.

[0058] Furthermore, a portion of the inner tube body 121 is sleeved in the outer tube body 123, and the other portion of the inner tube body 121 extends out of the outer tube body 123 to be sleeved on the first electrode 32 outside the heating cavity 11, thereby insulating and protecting the first electrode 32, and preventing the first electrode 32 outside the heating cavity 11 and the second electrode 34 from being broken down to generate the electric arc.

[0059] In any of the above embodiments, the portion of the first electrode 32 and the portion of the second electrode 34 that extend out of the heating cavity 11 are relatively insulated from each other, thus preventing the generation of the electric arc between the first electrode 32 outside the heating cavity 11 and the second electrode 34, and ensuring that the discharge breakdown is formed inside the heating cavity 11.

[0060] In another embodiment of the present application, an electronic atomizing device is further provided. The electronic atomizing device includes the above-mentioned atomizer 100. When the atomizer 100 works, the electric arc is formed between the axial ends of the first electrode 32 and the second electrode 34 in the heating cavity 11. The length of the electric arc is greater than the radial spacing between the first electrode 32 and the second electrode 34, so that a longer electric arc is generated between the axial ends of the first electrode 32 and the second electrode 34, thus increasing the heating region. As such, the atomizer 100 can effectively heat and atomize the aerosol-generating substrate sleeved outside tube body 10. In addition, the heat generated by the plasma is used to quickly heat the aerosol-generating substrate, and the high energy density characteristics of plasma heating is utilized to shorten the preheating waiting time, which is convenient for users to use, prevents the aerosol-generating substrate from being scorched due to the long preheating time, and improves the taste after atomization. In addition, during the heating process, metal parts such as electrodes do not need to directly contact the aerosol-generating substrate, which can prevent atomized aerosol-generating substrate from being doped by metal substances, thereby further improving the taste after atomization.

[0061] The technical features of the above-mentioned embodiments can be combined arbitrarily. In order to make the description concise, not all possible combinations of the technical features are described in the embodiments. However, as long as there is no contradiction in the combination of these technical features, the combinations should be considered as falling in the scope of the specification.

[0062] The above-described embodiments only illustrate several implementations of the present application, and the descriptions are relatively specific and detailed, but they should not be construed as limiting the scope of the present application. It should be understood by those of ordinary skill in the art that various modifications and improvements can be made without departing from the concept of the present application, and all fall within the protection scope of the present application. Therefore, the patent protection of the present application shall be subjected to the appended claims.

Claims

1. An atomizer, comprising:

   a tube body forming a heating cavity therein; and
   an electrode assembly comprising a first electrode and a second electrode, the first electrode and the second electrode extending into the heating cavity,
   wherein in the heating cavity, an electric arc is controllably formed between an axial end of the first electrode and an axial end of the second electrode to generate plasma, and a length of the electric arc is greater than a radial spacing between the first electrode and the second electrode.

2. The atomizer according to claim 1, wherein an outer periphery of the first electrode and an outer periphery of the second electrode are each coated with an insulating layer, and the axial end of the first electrode and the axial end of the second electrode that are located in the heating cavity are exposed.

3. The atomizer according to claim 2, wherein an infrared radiation layer is coated on the insulating layer of each of the first electrode and the second electrode.

4. The atomizer according to claim 1, wherein the tube body comprises a main body, a top cover, and a base;

   wherein the main body is a hollow structure with an opening at each of both ends;
   the top cover is sleeved on the opening at one of the ends of the main body in an axial direction;
   the base is sleeved on the opening at another of the ends of the main body in the axial direction;
   the top cover, the main body, and the base enclose the heating cavity; and
   the first electrode and the second electrode extend through the base and extend into the heating cavity.

5. The atomizer according to claim 4, wherein the main body and the top cover are integrally formed or separately formed.

6. The atomizer according to claim 4, wherein the main body is made of an infrared radiation material.

7. The atomizer according to claim 4, wherein the top cover is made of an infrared radiation material.

8. The atomizer according to any one of claims 4 to 7, wherein the heating cavity comprises a first heating sub-cavity defined in the main body, and the first electrode and the second electrode extend into the first heating sub-cavity; and
   wherein in the first heating sub-cavity, the axial end of the first electrode and the axial end of the second electrode are staggered from each other in the axial direction.

9. The atomizer according to any one of claims 4 to 7, wherein the heating cavity comprises a second heating sub-cavity, a third heating sub-cavity, and a connecting space in communication with the second heating sub-cavity and the third heating sub-cavity;

   the first electrode and the second electrode extend into the second heating sub-cavity and the third heating sub-cavity, respectively; and
   the electric arc passing through the connecting space is controllably formed between the axial

end of the first electrode and the axial end of the second electrode to generate the plasma.

10. The atomizer according to claim 9, wherein the main body is provided with the second heating sub-cavity and the third heating sub-cavity extending therethrough in the axial direction, the connecting space is defined on an axial end of the main body, and the top cover is provided at the end of the main body where the connecting space is defined.

11. The atomizer according to claim 9, wherein the axial end of the first electrode and the axial end of the second electrode are staggered from each other or coplanar with each other in the axial direction.

12. The atomizer according to claim 9, wherein the main body comprises an inner tube body and an outer tube body sleeved outside the inner tube body and spaced apart from the inner tube body,

wherein the inner tube body has the second heating sub-cavity, and the third heating sub-cavity is defined between the inner tube body and the outer tube body; and
wherein the top cover is sleeved on an axial end of the outer tube body, an axial end of the inner tube body is spaced apart from the top cover, and the connecting space is defined between the axial end of the inner tube body and the top cover.

13. The atomizer according to claim 12, wherein the first electrode extends into the inner tube body, the second electrode extends between the inner tube body and the outer tube body, the axial end of the second electrode extends into the connecting space and faces the second heating sub-cavity in the inner tube body,
wherein the electric arc passing through the connecting space and the second heating sub-cavity is controllably formed between the axial end of the first electrode and the axial end of the second electrode.

14. The atomizer according to any one of claims 1 to 7, wherein a portion of the first electrode and a portion of the second electrode that extend out of the heating cavity are relatively insulated from each other.

15. An electronic atomizing device, comprising the atomizer according to any one of claims 1 to 14.

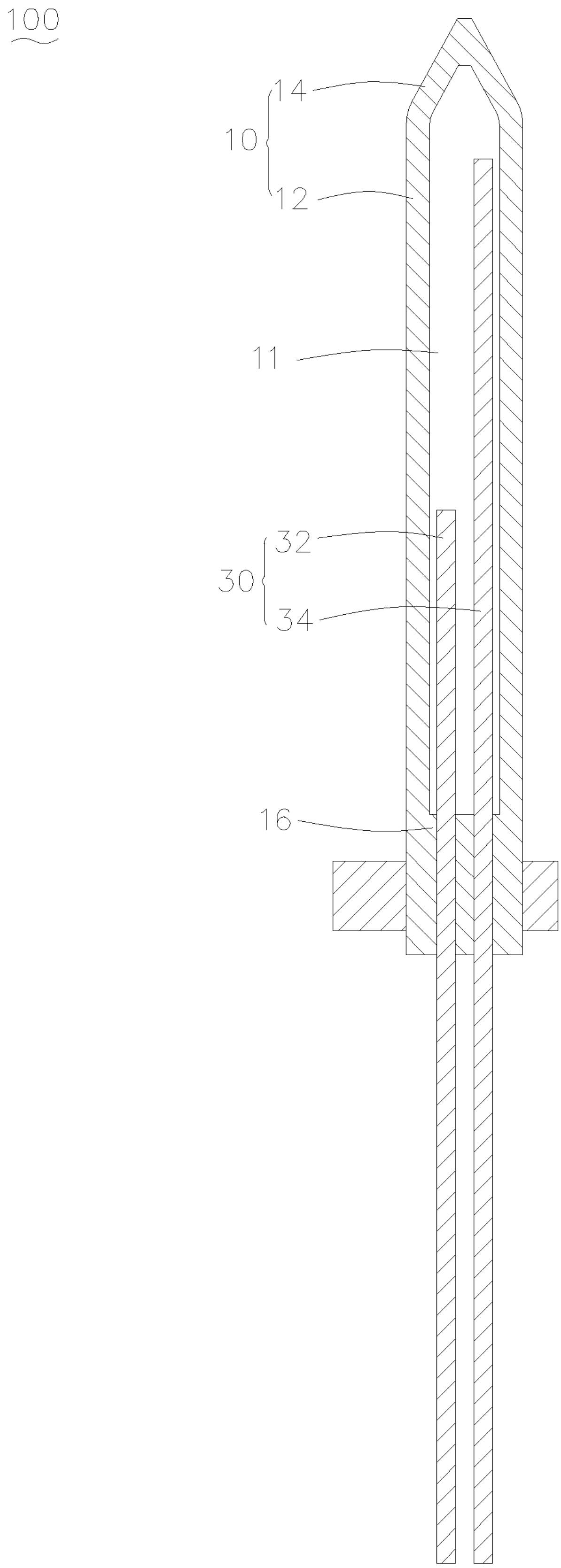

FIG. 1

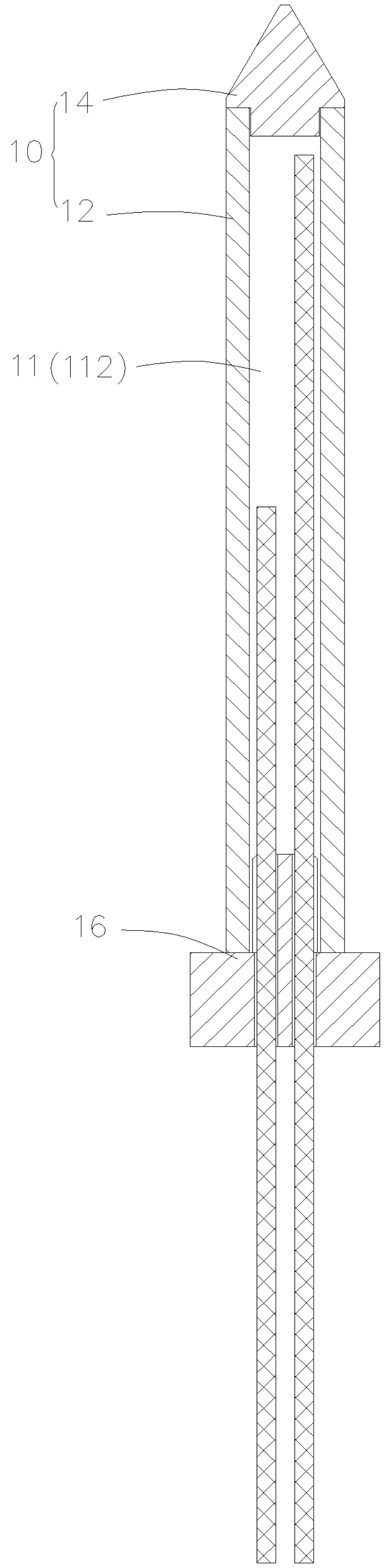

FIG. 2

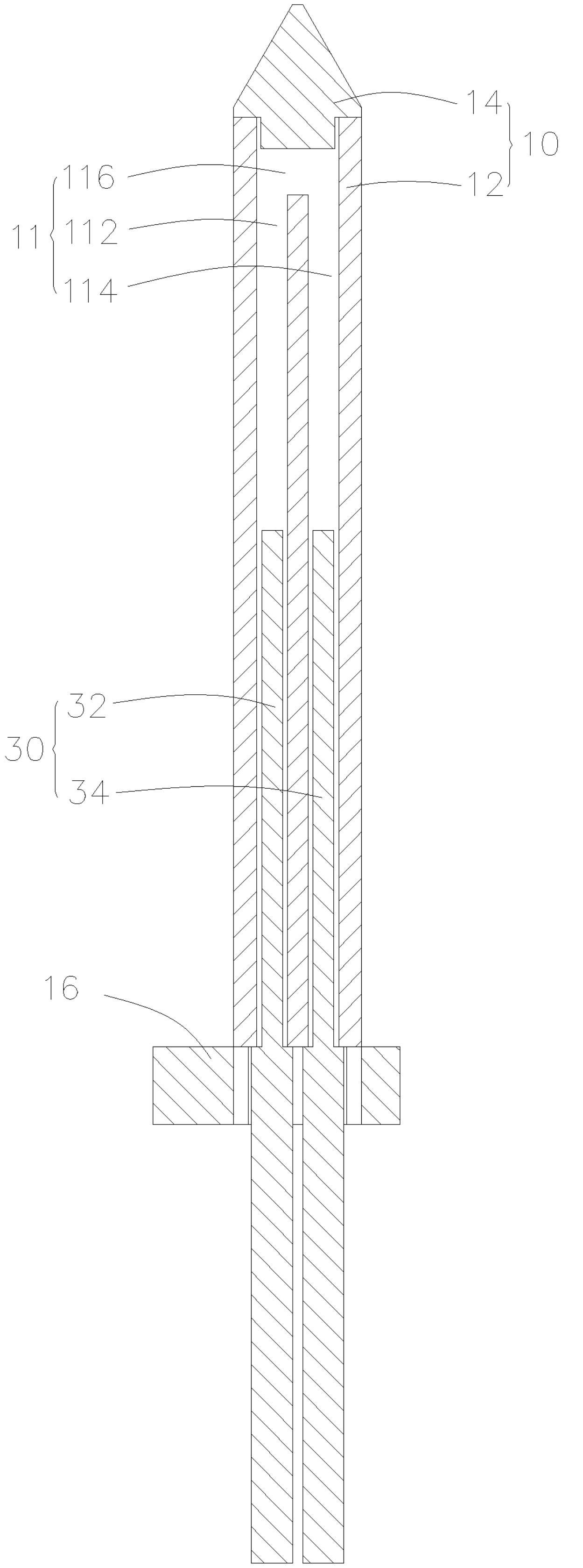

FIG. 3

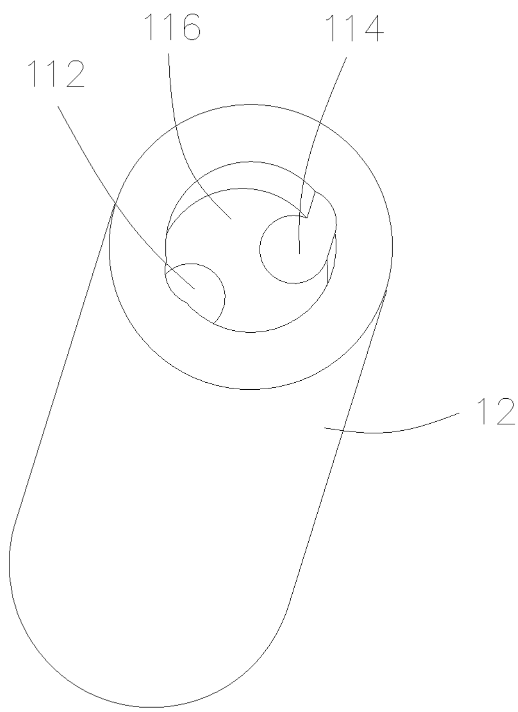

FIG. 4

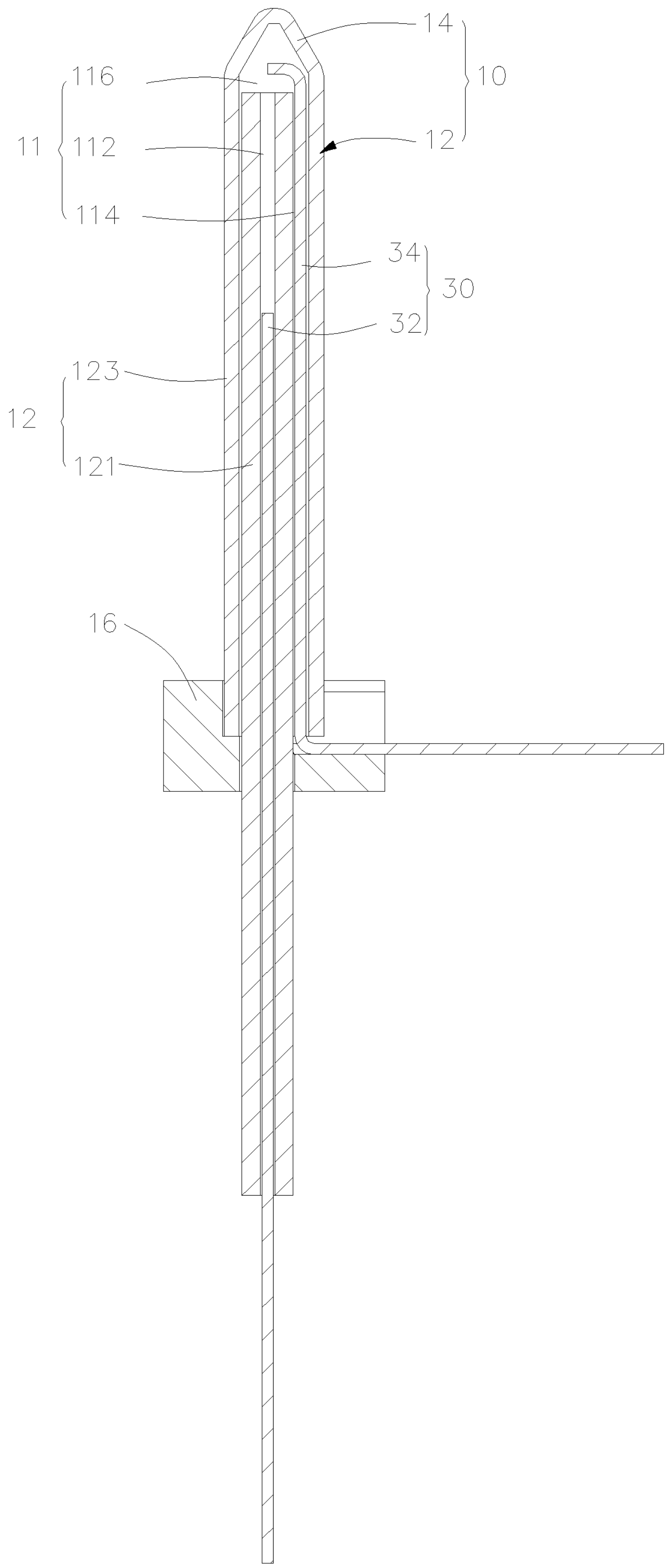

FIG. 5

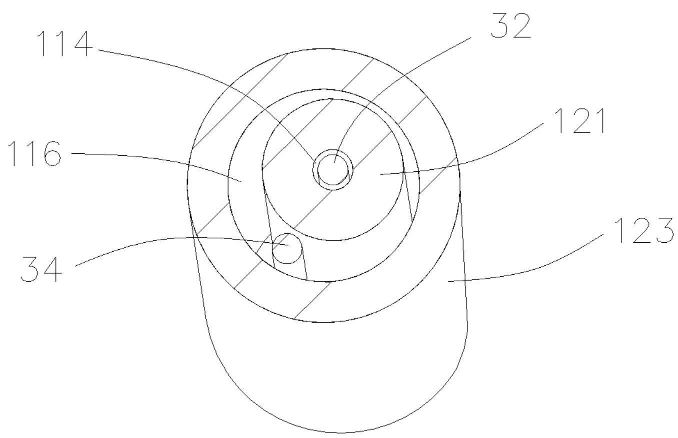

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/130002

A. CLASSIFICATION OF SUBJECT MATTER

A24F40/46(2020.01)i;A24F47/00(2020.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: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)

CNTXT, ENTXTC, ENTXT, VEN, JPTXT, CJFD: 雾化, 不等长, 长电极, 长度, 加长, 增长, 等离子, 电弧, 电极, 端部, 末端, 短电极, 放电, atomiz+, electronic, length, plasma, heat+, electrode?, electric arc, discharge

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 204579893 U (ZHAO HUIPING) 26 August 2015 (2015-08-26) description, paragraphs 51-61, and figures 1-5	1-15
A	CN 203367231 U (BEIJING ZHONGHAI HONGWEI INTELLIGENT TECHNOLOGY CO., LTD. et al.) 25 December 2013 (2013-12-25) entire document	1-15
A	US 2018332890 A1 (TWEEDIE, X. V.) 22 November 2018 (2018-11-22) entire document	1-15
A	US 2019357593 A1 (ACOUSTIC ARC INTERNATIONAL LTD.) 28 November 2019 (2019-11-28) entire document	1-15

☐ 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
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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
01 February 2023	**06 February 2023**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/130002

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 204579893 U	26 August 2015	None	
CN 203367231 U	25 December 2013	None	
US 2018332890 A1	22 November 2018	US 11470875 B2	18 October 2022
		WO 2018213509 A1	22 November 2018
US 2019357593 A1	28 November 2019	None	

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 2022200691654 **[0001]**