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(71) Applicant: **Shenzhen First Union Technology Co., Ltd.**

Shenzhen, Guangdong 518000 (CN)

(72) Inventors:

- **WU, Jian**
Shenzhen, Guangdong 518000 (CN)
- **ZHANG, Shuyuan**
Shenzhen, Guangdong 518000 (CN)
- **XU, Zhongli**
Shenzhen, Guangdong 518000 (CN)
- **LI, Yonghai**
Shenzhen, Guangdong 518000 (CN)

(74) Representative: **Proi World Intellectual Property GmbH**

Obermattweg 12
6052 Hergiswil, Kanton Nidwalden (CH)

(54) **AEROSOL GENERATING APPARATUS**

(57) This application provides an aerosol generating apparatus. The aerosol generating apparatus includes: a chamber, configured to receive an aerosol generation product; a heater, configured to heat the aerosol generation product, where the heater includes a resistive heating element, the resistive heating element has at least

two resistive heating layers formed by a sheet including a resistive metal or alloy wound or folded up. In the foregoing aerosol generating apparatus, the resistive heating element of the heater is formed by the sheet wound or folded up. This is more convenient than production of a spiral heating wire by winding a wire.

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Chinese Patent Application No. 202210078133.5, filed with the China National Intellectual Property Administration on January 24, 2022 and entitled "AEROSOL GENERATING APPARATUS", which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] Embodiments of this application relate to the field of heat-not-burn cigarette device technologies, and in particular, to an aerosol generating apparatus.

BACKGROUND

[0003] Tobacco products (such as cigarettes, cigars) burn tobacco during use to produce tobacco smoke. Attempts are made by humans to replace these tobacco-burning products by manufacturing products that release compounds without burning tobacco.

[0004] An example of this type of products is a heating device that releases compounds by heating rather than burning materials. For example, the materials may be tobacco or other non-tobacco products. The non-tobacco products may or may not include nicotine. In the conventional technologies, the patent No. CN202010054217.6 proposes to heat tobacco products to generate aerosols with a heater in which a spiral heating wire is encapsulated in an outer sleeve.

SUMMARY

[0005] An embodiment of this application provides an aerosol generating apparatus, configured to heat an aerosol generation product to generate aerosols, and including:

- a chamber, configured to receive the aerosol generation product; and
- a heater, configured to heat the aerosol generation product, where the heater includes a resistive heating element having at least two resistive heating layers formed by a sheet including a resistive metal or alloy wound or folded up.

[0006] In a preferred embodiment, the sheet includes a foil layer made of the resistive metal or alloy.

[0007] In a preferred embodiment, the sheet includes: a stress compensation layer, combined with the foil layer made of the resistive metal or alloy, and configured to provide stress compensation during the winding or folding of the sheet to prevent cracking or breakage of the foil layer made of the resistive metal or alloy.

[0008] In a preferred embodiment, the foil layer made

of the resistive metal or alloy has a thickness of 0.5 μm to 200 μm .

[0009] In a preferred embodiment, the resistive heating layer is configured to generate heat due to Joule heat generated when a direct current flows through the resistive heating layer.

[0010] In a preferred embodiment, the heater further includes:

an insulating layer, formed between two adjacent resistive heating layers to provide insulation between the two adjacent resistive heating layers.

[0011] In a preferred embodiment, the sheet is continuous.

[0012] In a preferred embodiment, the at least two resistive heating layers are connected in series.

[0013] In a preferred embodiment, the resistive heating element is formed by the sheet wound or folded on a rigid base.

[0014] In a preferred embodiment, the rigid base includes ceramic or a surface-insulated metal.

[0015] In a preferred embodiment, the heater further includes:

a first wire and a second wire, configured to supply power to the resistive heating element.

[0016] In a preferred embodiment, the resistive heating element is formed by the sheet wound around the first wire, which serves as an axis.

[0017] In a preferred embodiment, the first wire has a larger diameter than the second wire.

[0018] In a preferred embodiment, the first wire has a diameter of 0.5 mm to 1.5 mm.

[0019] In a preferred embodiment, the resistive heating element is of a cylindrical shape formed by winding the sheet.

[0020] The first wire is at least partially inside the resistive heating element, and the second wire is located outside the resistive heating element.

[0021] In a preferred embodiment, the heater is constructed to be in a shape of a sheet extending at least partially in the chamber, and has a first side and a second side opposite to each other in a thickness direction. The first wire is located at the first side, and the second wire is located at the second side.

[0022] In a preferred embodiment, the first wire includes a first thermocouple wire, and the second wire includes a second thermocouple wire. The first thermocouple wire and the second thermocouple wire are made of different thermocouple materials to form a thermocouple, between the first wire and the second wire, for measuring a temperature of the resistive heating element.

[0023] In a preferred embodiment, the resistive heating element includes a plurality of resistive conductor paths formed on the at least two resistive heating layers.

[0024] In a preferred embodiment, the plurality of resistive conductor paths are defined by holes, or slits, or hollows formed in the at least two resistive heating layers.

[0025] In a preferred embodiment, the plurality of re-

sistive conductor paths are connected in series or in parallel.

[0026] In a preferred embodiment, the heater further includes:

a housing, extending at least partially in the chamber and configured to be inserted into the aerosol generation product. The resistive heating element is accommodated or held in the housing.

[0027] In a preferred embodiment, the heater includes: a first wire and a second wire, configured to supply power to the resistive heating element.

[0028] The housing has a slot extending in a length direction. The first wire is at least partially located in the housing, and the second wire is at least partially held in the slot.

[0029] In a preferred embodiment, the heater is constructed to be in a shape of a sheet extending at least partially in the chamber.

[0030] The at least two resistive heating layers are spaced apart from each other in a thickness direction of the heater.

[0031] In a preferred embodiment, the resistive heating element further includes:

a connecting part, extending between two adjacent resistive heating layers in the thickness direction of the heater to provide an electrical connection between the two adjacent resistive heating layers.

[0032] In a preferred embodiment, the connecting part is located on at least one side of the heater in a width direction.

[0033] In a preferred embodiment, the sheet is provided with a plurality of holes, hollows, or slits, to cause the sheet to form a grid pattern.

[0034] In a preferred embodiment, the heater further includes:

a temperature sensor, configured to sense a temperature of the resistive heating element.

[0035] In a preferred embodiment, the heater is constructed to be in a shape of a sheet extending at least partially in the chamber. The heater has a slit or a hollow extending through the heater in a thickness direction, and the temperature sensor is accommodated in the slit or the hollow.

[0036] In a preferred embodiment, the heater is constructed to be in a shape of a sheet extending at least partially in the chamber.

[0037] The resistive heating element is formed by the sheet folded in opposite directions alternately in a width direction of the heater.

[0038] In a preferred embodiment, resistance of the resistive heating element ranges from 0.1 S2 to 5.0 S2.

[0039] Another embodiment of this application further provides a heater for an aerosol generating apparatus. The heater includes a resistive heating element having at least two resistive heating layers capable of guiding a current on a power supply path of the resistive heating element during use. The resistive heating element is formed by a sheet including a resistive metal or alloy

wound or folded up.

[0040] In the foregoing aerosol generating apparatus, the resistive heating element of the heater is formed by the sheet wound or folded up. This is more convenient than production of a spiral heating wire by winding a wire.

[0041] Another embodiment of this application further provides an aerosol generating apparatus, configured to heat an aerosol generation product to generate aerosols, and including:

a chamber, configured to receive the aerosol generation product;

a magnetic field generator, configured to generate a changing magnetic field; and

a heater, configured to heat the aerosol generation product, where the heater includes an induction heating element that is penetrated by the changing magnetic field to generate heat, and the induction heating element has at least two induction heating layers formed by a sheet including an inductive metal or alloy wound or folded up.

[0042] In the foregoing aerosol generating apparatus, the heater penetrated by the magnetic field is formed by the sheet including the inductive metal or alloy wound or folded up. This is convenient in production.

BRIEF DESCRIPTION OF THE DRAWINGS

[0043] One or more embodiments are exemplarily described with reference to the corresponding figures in the accompanying drawings, and the descriptions are not to be construed as limiting the embodiments. Elements in the accompanying drawings that have same reference numerals are represented as similar elements, and unless otherwise particularly stated, the figures in the accompanying drawings are not drawn to scale.

FIG. 1 is a schematic diagram of an aerosol generating apparatus according to an embodiment.

FIG. 2 is a schematic diagram of a heater according to an embodiment.

FIG. 3 is a schematic diagram of a resistive heating element in FIG. 2 from another viewing angle.

FIG. 4 is a schematic diagram of a sheet of the resistive heating element in FIG. 3 before being wound.

FIG. 5 is a schematic diagram of a sheet according to another embodiment.

FIG. 6 is a schematic diagram of a sheet according to another embodiment.

FIG. 7 is a schematic diagram of a housing according to another embodiment.

FIG. 8 is a schematic diagram of a sheet wound on a sheet-shaped base according to another embodiment.

FIG. 9 is a schematic diagram of a heater according to another embodiment.

FIG. 10 is a schematic diagram of the sheet of the resistive heating element in FIG. 9 before being folded.

FIG. 11 is a schematic diagram of a sheet before being folded according to another embodiment.

FIG. 12 is a schematic diagram of a heater before being folded according to another embodiment.

FIG. 13 is a schematic diagram of a sheet before being folded according to another embodiment.

FIG. 14 is a schematic diagram of an aerosol generating apparatus according to another embodiment.

FIG. 15 is a cross sectional view of the heater in FIG. 14 from another viewing angle.

FIG. 16 is a schematic diagram of an aerosol generating apparatus according to another embodiment.

FIG. 17 is a schematic diagram of an aerosol generating apparatus according to another embodiment.

FIG. 18 is a schematic diagram of a sheet before being wound or folded according to an embodiment.

DETAILED DESCRIPTION

[0044] For ease of understanding of this application, this application is described below in more detail with reference to the accompanying drawings and specific embodiments. It should be noted that, when an element is expressed as "being fixed to" another element, the element may be directly on the another element, or one or more intermediate elements may exist between the element and the another element. When one element is expressed as "being connected to" another element, the element may be directly connected to the another element, or one or more intermediate elements may exist between the element and the another element. The terms "upper", "lower", "left", "right", "inner", "outer", and similar expressions used in this specification are merely used for an illustrative purpose.

[0045] Unless otherwise defined, meanings of all technical and scientific terms used in this specification are the same as that usually understood by a person skilled in the art to which this application relates. The terms used in this specification of this application are merely intended to describe objectives of the specific embodiments, and are not intended to limit this application. The term "and/or" used in this specification includes any or all combinations of one or more related listed items.

[0046] An embodiment of this application provides an aerosol generating apparatus. A structure of the aerosol generating apparatus may refer to FIG. 1. The aerosol generating apparatus includes:

a chamber, having an opening 40, where an aerosol generation product A can be removably received in the chamber through the opening 40 of the chamber during use;

a heater 30, at least partially extending in the chamber, where the heater is inserted into the aerosol generation product A for heating when the aerosol generation product A is received in the chamber, to cause the aerosol generation product A to release a plurality of volatile compounds, and the volatile compounds are formed only by heating;

a battery cell 10, configured to supply power; and

a circuit 20, configured to guide a current between the battery cell 10 and the heater 30.

[0047] In a preferred embodiment, the heater 30 is approximately in a shape of a pin or a needle or a bar or a rod or a column or a sheet or a plate, to facilitate insertion into the aerosol generation product A. In addition, the heater 30 may have a length of about 12 mm to 20 mm and an outer diameter of about 2 mm to 4 mm.

[0048] Further, in a preferred embodiment, the aerosol generation product A is preferably made of a tobacco-containing material that releases volatile compounds from a base material when being heated, or a non-tobacco material suitable for producing vapor during electric heating after being heated. The aerosol generation product A is preferably made of a solid base material. The solid base material may include one or more of powders, particles, fragmented strips, strips, or thin sheets of one or more of vanilla leaves, tobacco leaves, homogenized tobacco, or expanded tobacco. Alternatively, the solid base material may include additional tobacco or non-tobacco volatile aroma compounds to be released when the base material is heated.

[0049] In the embodiment, the heater 30 may generally include a resistive heating element and an auxiliary base material to facilitate fixation, production, and the like of the resistive heating element. For example, in some embodiments, the resistive heating element is in a shape or form of a spiral coil. Alternatively, in some other embodiments, the resistive heating element is in the form of conductive traces combined with a substrate. Alternatively, in some other embodiments, the resistive heating element is in a shape of a thin sheet.

[0050] Further, FIG. 2 is a schematic diagram of the heater 30 according to an embodiment. In the embodiment, the heater 30 includes:

a housing 32, extending between a free front end 310 and a rear end 320, where the housing 32 is in a shape of a pin or a needle, and is made of ceramic or stainless steel, or the like; the housing 32 is obtained by molding or machining; and the housing 32 has a hollow 321 extending in a length direction and terminating at the rear end 320;

a resistive heating element 31, accommodated and held in the hollow 321 of the housing 32; and

a first wire 341 and a second wire 342, connected to the resistive heating element 31 to supply power to the resistive heating element 31.

[0051] Further, refer to FIG. 2 to FIG. 4. The resistive heating element 31 is in a shape of a cylinder or a tube obtained by a sheet 3110 including a resistive metal or alloy wound up. The wound resistive heating element 31 has at least two wound resistive heating layers 30. The resistive metal or alloy includes at least one of nickel, cobalt, zirconium, titanium, nickel alloy, cobalt alloy, zirconium alloy, titanium alloy, nickel-chromium alloy, nickel-iron alloy, iron-chromium alloy, iron-chromium-aluminum alloy, titanium alloy, iron-manganese-aluminum based alloy, stainless steel, or the like.

[0052] In addition, in the embodiment, at least one side surface of the resistive heating element 31 formed by a sheet 3110 made of the resistive metal or alloy wound up has an insulating layer or an insulating material to provide insulation, so as to prevent contact short circuits between adjacent winding layers during winding. The insulating layer or the insulating material is, for example, a heat-resistant, inorganic adhesive/glaze.

[0053] In some embodiments, the sheet 3110 that is wound to form the resistive heating element 31 is a foil made of the resistive metal or alloy. The foil made of the resistive metal or alloy has a thickness of about 0.5 μm to 200 μm , more preferably, a thickness of about 10 μm to 30 μm .

[0054] In some more preferred embodiments, the sheet 3110 that is wound to form the resistive heating element 31 is a sheet having at least two composite layers. In a specific embodiment, the sheet 3110 that is wound to form the resistive heating element 31 includes:

a foil layer made of the resistive metal or alloy; and
a stress compensation layer, and combined with the foil layer made of the resistive metal or alloy. The stress compensation layer provides stress compensation for bending or twisting during the winding, to prevent cracking or breakage of the foil layer made of the metal or alloy with great brittleness during the winding.

[0055] In some optional embodiments, the stress compensation layer is hard, such as glaze, glass, or ceramic, to improve the strength or toughness of the sheet, so as to prevent cracking or breakage of the sheet during the winding.

[0056] In some preferred embodiments, the stress compensation layer is a flexible layer. A specific stress compensation layer is a flexible polymer material, such as polyimide, free polypropylene, or polyethylene.

[0057] The stress compensation layer has the same thickness as the metal or alloy layer. The stress compensation layer is formed on at least one side surface of the metal or alloy layer by coating, deposition, or the like.

[0058] The resistive heating element 31 is formed by the sheet 3110 wound at least twice, and therefore further includes at least two resistive heating layers 330. In a preferred embodiment, the resistive heating element 31 includes about 2 to 20 windings. For example, in FIG. 3,

the resistive heating element 31 is formed by the sheet 3110 spirally wound from the inside out. Starting from the innermost first wire 341, one winding is counted every 360 degrees around the first wire 341, and one resistive heating layer 330 is formed by each winding. For example, in the embodiment shown in FIG. 3, the resistive heating element 31 has five wound resistive heating layers 330.

[0059] The resistive heating layer 330 of the resistive heating element 31 is configured to generate heat due to Joule heat generated when a direct current flows through the resistive heating layer 31.

[0060] Further, refer to embodiments of FIG. 3 and FIG. 4. The sheet 3110 of the resistive heating element 31 before being wound is of a rectangular shape. The first wire 341 is fixedly connected to one side of the resistive heating element 31 in the length direction by welding, crimping, or the like, and the second wire 342 is fixedly connected to the other side of the resistive heating element 31 in the length direction by welding, crimping, or the like. In addition, the first wire 341 and the second wire 342 both extend in a width direction of the resistive heating element 31b, and the first wire 341 and the second wire 342 are at least partially located outside the resistive heating element 31 to facilitate connection with the circuit 20.

[0061] During production, the sheet 3110 is wound around one of the first wire 341 or the second wire 342 in FIG. 4, which serves as a central axis, and after the winding, the resistive heating element 31 of a rod shape or a cylindrical shape shown in FIG. 3 can be obtained.

[0062] To further improve the strength of the wound resistive heating element 31, in a more preferred embodiment, the first wire 341 and/or the second wire 342 serving as the central axis for the winding have/has a diameter and strength larger than that of an ordinary wire. For example, in the preferred embodiment shown in FIG. 4, the first wire 341 has a larger diameter than the second wire 342. In some specific embodiments, the second wire 342 may have a diameter of about 0.1 mm to 0.3 mm. The first wire 341 has a diameter of 0.5 mm to 1.5 mm, so that the first wire is stronger than an ordinary copper wire and silver-plated nickel wire. In this case, after the sheet 3110 is wound around the first wire 341, which serves as an axis, the resistive heating element 31 is supported by the thick first wire 341 and has higher strength.

[0063] Alternatively, in some other variable embodiments, for example, as shown in FIG. 5, a sheet 3110a that is wound to form the resistive heating element 31 is provide with a plurality of holes or hollows 311a, to increase resistance of the resistive heating element 31. In addition, the wound resistive heating element 31 is in a shape of a cylinder or a tube having at least two winding layers, so that the resistance is increased. In FIG. 5, the holes or hollows 311a are arranged in a regular matrix, and the holes or hollows 311a are formed by etching or the like, and are of a circular shape. Alternatively, in some other variable embodiments, the holes or

hollows 311a may be rectangular, polygonal, or in other shapes, to cause the sheet 3110a to form a grid pattern.

[0064] FIG. 6 is a schematic diagram of a sheet 3110b of the resistive heating element 31 before being wound according to another variable embodiment. A first wire 341b and a second wire 342b are disposed at two ends of the sheet 3110b in a length direction, and the sheet 3110b is sequentially provided with a first side part 311b, a center part 313b, and a second side part 312b in the length direction. In terms of shape and construction, the center part 313b has a greater extension length than the first side part 311b and the second side part 312b, and a width dimension d2 of the center part 313b is smaller than width dimensions d1 of the first side part 311b and the second side part 312b. Based on the construction of shapes, the resistance of the sheet 3110b is increased, and generation of heat is concentrated as much as possible at the center part 313b. The first side part 311b and the second side part 312b are used for winding and supplying power.

[0065] Further, FIG. 7 is a schematic diagram of a preferred embodiment of a housing 32a according to another preferred embodiment. The housing 32a is in a shape of a pin or a needle, and has a hollow 321a extending axially. An opening is formed at an end of the hollow 321a at a rear end 320a. A wall of the housing 32a is provided with a slot 322a extending in a length direction to the rear end 320a.

[0066] In an optional embodiment, to produce the heater 30, first wires 341/341a/341b at one end of the foregoing sheets 3110/3110a/3110b extend from the slot 322a into the hollow 321a of the housing 32a, and then the first wires 341/341a/341b are rotated to cause the sheets 3110/3110a/3110b lying flat to wind around the first wires 341/341a/341b, which serve as central axes, until the second wire 342a also extends into the hollow 321a and the winding is completed, so that the heater 30 of this embodiment is produced.

[0067] Alternatively, in a more preferred embodiment, the first wires 341/341a/341b first extend from the slot 322a into the hollow 321b of the housing 32b, and the sheets 3110/3110a/3110b are wound. The winding stops when the second wires 342/342a/342b extend into the slot 322a. In addition, the second wires 342/342a/342b are connected to the wall of the housing 32a in the slot 322a by solder welding, laser welding, or the like, and the second wires 342/342a/342b cover or block the slot 322a of the housing 32a. In this way, a surface of the heater 30 is sealed or closed to prevent entry of aerosols, aerosol condensate, organic residues from the aerosol generation product A, or the like into the housing 32a from the slot 322a.

[0068] In a more preferred embodiment, after winding is completed, a coating may be formed on the surface of the housing 32a by dip-coating or deposition to block or cover a gap between the second wires 342/342a/342b and the slot 322a, to prevent aerosol condensate or organic residues from entering the housing 32a.

[0069] Further, FIG. 8 is a schematic diagram of forming a sheet-shaped heater 30 by winding a sheet 3110e according to another variable embodiment. In this embodiment, the sheet 3110e is wound on a rigid base 35e, to form the sheet-shaped heater 30 after the winding. Similarly, a first wire 341e and a second wire 342e on two sides of the sheet 3110e supply power to the heater 30 after the winding. The base 35e may include ceramic, a surface-insulated metal, and the like.

[0070] Further, FIG. 9 is a schematic diagram of the heater 30 according to another embodiment. The heater 30 is constructed to be in a shape of a sheet, and has a length dimension L1 ranging from 12 mm to 20 mm, a width dimension L2 ranging from 3 mm to 6 mm, and a thickness dimension L3 ranging from 0.3 mm to 1 mm.

[0071] As shown in FIG. 9, the heater 30 has a free front end 310c and a rear end 320c opposite to each other in a length direction. In the embodiment, the free front end 310c is located in or exposed in the chamber so as to be inserted into the aerosol generation product A received in the chamber for heating. The rear end 320c is configured to be mounted and fixed in the aerosol generating apparatus. According to the preferred embodiment shown in FIG. 9, the free front end 310c of the heater 30 is a tapered tip, which facilitates insertion into the aerosol generation product A.

[0072] Further, as shown in FIG. 9, the heater 30 includes at least two or more resistive heating layers 31c, and heat is generated due to Joule heat generated when a direct current is supplied and flows through the resistive heating layers 31c.

[0073] In the preferred embodiment, the resistive heating layer 31c is a thin layer made of a suitable metal or alloy material. For example, the resistive heating layer 31c includes at least one of nickel, cobalt, zirconium, titanium, nickel alloy, cobalt alloy, zirconium alloy, titanium alloy, nickel-chromium alloy, nickel-iron alloy, iron-chromium alloy, iron-chromium-aluminum alloy, titanium alloy, iron-manganese-aluminum based alloy, stainless steel, or the like. In addition, the resistive heating layer 31c has a thickness of about 0.5 μm to 200 μm , more preferably, a thickness of about 10 μm to 30 μm .

[0074] In addition, the heater 30 further includes: a first wire 341c and a second wire 342c, configured to supply power to the heater 30. In the embodiment, the first wire 341c and the second wire 342c are both connected to the heater 30 at positions close to a rear end 320c.

[0075] The heater 30 further includes: layers 32c located between adjacent resistive heating layers 31c.

[0076] In some embodiments, the layer 32c is made of an insulating material such as glass glaze, ceramic, or polymer, and is configured to provide insulation and/or support between the adjacent resistive heating layers 31c. For example, the layer 32c is formed between corresponding adjacent resistive heating layers 31c by electroplating, deposition, coating, spraying, or the like. Specifically, any of the layers 32c can be applied between the corresponding adjacent resistive heating layers 31c

by spraying, dipping, rolling, electroplating, or coating.

[0077] The layer 32c may have a greater thickness or hardness than the resistive heating layer 31c, to provide the heater 30 with sufficient mechanical strength.

[0078] In some optional embodiments, the plurality of resistive heating layers 31c in the heater 30 are independently connected to the circuit 20 and independently operated by the circuit 20. Alternatively, in some other variable embodiments, the plurality of resistive heating layers 31c in the heater 30 are connected in parallel and are operated simultaneously or independently by the circuit 20.

[0079] Further, in the preferred embodiment shown in FIG. 9, the plurality of resistive heating layers 31c in the heater 30 are sequentially connected in series in a thickness direction.

[0080] Further, as shown in FIG. 9, the first wire 341c is connected to the outermost resistive heating layer 31c on one side in the thickness direction, and the second wire 342c is connected to the outermost resistive heating layer 31c on the other side in the thickness direction. The plurality of resistive heating layers 31c are arranged between the first wire 341c and the second wire 342c in the thickness direction of the heater 30. In addition, in some embodiments, the heater 30 includes two to seven resistive heating layers 31c.

[0081] Moreover, to facilitate the connection between the first wire 341c and the second wire 342c, the heater 30 further includes an electrode 33c, which is made of a metal or alloy with high conductivity and low resistivity, such as at least one of a patch electrode, a plate electrode, a track-type electrode, a printed or imprinted or sprayed or deposited electrode coating made of gold, silver, copper, or an alloy thereof. The electrode 33c is combined onto the resistive heating layer 31c and is electrically connected to each other. The first wire 341c and the second wire 342c are connected to the electrode 33c by, for example, welding to be electrically connected to the resistive heating layer 31c indirectly, so as to supply power to the resistive heating layer 31c.

[0082] In the embodiment shown in FIG. 9, the electrodes 33c are formed at least on the outermost resistive heating layers 31c on two sides in the thickness direction, and the electrodes 33c are each arranged close to the rear end 320c.

[0083] Further, in some other preferred embodiments, the plurality of resistive heating layers 31c of the heater 30 are formed by a continuous sheet folded up. For example, FIG. 10 is a schematic diagram of a sheet 3110c, having a plurality of resistive heating layers 31c, of the heater 30 before being folded according to an embodiment. The plurality of resistive heating layers 31c of the sheet 3110c before being folded in FIG. 10 are sequentially connected in the length direction. Specifically, the resistive heating layers 31c extend in a width direction of the sheet 3110c. The resistive heating layer 31c is provided with a slit or hollow 311c that extend in the length

direction of the resistive heating layer 31c. In an embodiment, the slit or hollow 311c has a width of about 0.2 mm to 1.0 mm and a length of about 8 mm to 12 mm. In addition, the slit or hollow 311c is terminated at an end of the resistive heating layer 31c close to the rear end 320c, and then the resistive heating layer 31c is divided into a first part 312c and a second part 313c on two sides of the slit or hollow 311c.

[0084] In the sheet 3110c, there is a connecting part 315c between two adjacent resistive heating layers 31c, to form a connection between the two adjacent resistive heating layers 31c. Specifically, in the two adjacent heat heating layers 31c of the sheet 3110c, the connecting part 315c is located between a second part 313c of a previous resistive heating layer 31c and a first part 312c of a next heat heating layer 31c, so that the plurality of heat heating layers 31c of the sheet 3110c are sequentially connected in series.

[0085] In addition, the connecting part 315c has an extension length of about 3 mm to 5 mm and a width of about 0.5 mm to 1.0 mm. The connecting part 315c is close to the rear end 320c. In this way, a slit or hollow 314c extending to the front end is defined and formed between the adjacent resistive heating layers 31c due to the presence of the connecting part 315c, so that the adjacent resistive heating layers 31c are connected to each other only at the connecting part 315c, and are not connected to each other at the slit or hollow 314c. In addition, in the heater 30 formed by folding, the connecting parts 315c are formed alternately on two sides of the heater 30 in the width direction.

[0086] A width of the slit or hollow 314c is greater than a width of the slit or the hollow 311c.

[0087] During supplying power, a U-shaped path of a current flowing through the resistive heating layer 31c is defined by the slit or the hollow 311c. In this way, among the plurality of resistive heating layer 31c connected in sequence, the first wire 341c is connected to a first part 312c of a resistive heating layer 31c at one side end, and the second wire 342c is connected to a second part 313c of a resistive heating layer 31c at the other side end, to form a current i that sequentially flows through the plurality of resistive heating layers 31c as shown in FIG. 10 during use. In addition, a plurality of resistive conductor paths connected in series are jointly defined by the first parts 312c and the second parts 313c that are sequentially connected end to end and that are of a plurality of resistive heating layers 31c connected in sequence.

[0088] Further, as shown in FIG. 9 and FIG. 10, space defined by the slits or hollows 311c of the heater 30 is used for installing a temperature sensor (not shown) to sense a temperature of the heater 30. The temperature sensor is, for example, PT1000, J-type thermocouple. In a preferred embodiment, the temperature sensor is located in the slit or hollow 311c of the resistive heating layer 31c close to an outer surface in the thickness direction. This is more convenient for installation.

[0089] Further, in a preferred embodiment of FIG. 10,

shapes of the plurality of resistive heating layers 31c in the sheet 3110c are substantially identical, and an end of the resistive heating layer 31c close to the free front end 310c is tapered.

[0090] In addition, in a preferred embodiment, the plurality of resistive heating layers 31c are folded in opposite directions alternately in the width direction to produce the heater 30.

[0091] Moreover, in a preferred embodiment, the plurality of sequentially connected resistive heating layers 31c are obtained by: etching positions on a rectangular foil or thin sheet made of a metal and an alloy where the slits or hollows 311c and the slits or hollows 314c need to be formed, to remove excess parts.

[0092] An electrode 33c in the form of coating is formed on the sheet 3110c at the end of the resistive heating layer 31c close to the rear end 320c by printing, spraying, deposition, or the like, to reduce contact resistance and heat accumulation caused by connection of the first wire 341c and/or the second wire 342c to the resistive heating layer 31c by, for example, welding. The electrode 33c is made of low-resistivity gold, silver, copper or an alloy thereof. Certainly, resistivity of the electrode 33c is lower than resistivity of the resistive heating layer 31c.

[0093] Alternatively, FIG. 11 is a schematic diagram of a sheet 3110d according to another variable embodiment. In this embodiment, the sheet 3110d also includes a plurality of sequentially connected resistive heating layers 31d, which are folded to form the heater 30, and in this embodiment, a first extension part 341d and a second extension part 342d extend from the resistive heating layer 31d and serve as electrical connecting parts for supplying power to the heater 30. During mounting, the first extension part 341d and the second extension part 342d can be directly connected to the circuit 20 as positive and negative electrodes respectively, and then the circuit 20 directly supplies power via the first extension part 341d and the second extension part 342d.

[0094] Alternatively, in some other variable embodiments, after the first wire is welded to the first extension part 341d and the second wire is welded to the second extension part 342d, power is supplied to the heater 30 by the first wire and the second wire.

[0095] In addition, as shown in the figure, the first extension part 341d is formed by extension of a first part 312d of the resistive heating layer 31d located at one side end of the sheet 3110d, and the second extension part 342d is formed by extension of a second part 313d of the resistive heating layer 31d located at the other side end of the sheet 3110d.

[0096] Alternatively, FIG. 12 is a schematic diagram of a heater 30 before folding according to another embodiment. The heater 30 in FIG. 12 includes:

a sheet-shaped or plate-shaped base 35f, where the base 35f may be made of a heat-shrinkable organic polymer, insulated ceramic, a surface-oxidized metal, or the like; and the end of the base 35f close to a

free front end is tapered;

first electrodes 36f, formed on two sides of the base 35f by coating, spraying, or the like, where FIG. 12 shows a part of the first electrode 36f located on the surface shown, and it may be understood that the first electrode 36f also has a part located on the back side of the shown surface;

a sheet 3110f, having at least two resistive heating layers 31f; and

a sheet 3120f, having at least two resistive heating layers 31f.

[0097] During production, the resistive heating layer 31f of the sheet 3110f is folded in opposite directions alternately in a width direction and combined to one side surface of the base 35f in a thickness direction, and the resistive heating layer 31f of the sheet 3120f is folded in opposite directions alternately in the width direction and combined to the other side surface of the base 35f in the thickness direction.

[0098] Similarly, connecting parts 315f are provided between adjacent resistive heating layers 31f of the sheet 3110f and/or the sheet 3120f, and the adjacent resistive heating layers 31f are electrically connected in sequence by the connecting parts 315f.

[0099] In addition, the foregoing layers 32c are formed between the resistive heating layers 31f of the folded sheet 3110f and/or sheet 3120f to provide support and/or insulation.

[0100] Moreover, a first wire 341f electrically connected indirectly by an electrode 331f is provided on a first part 312f of the outermost resistive heating layer 31f of the sheet 3110f, and a second wire 342f electrically connected indirectly by an electrode 333f is provided on a second part 313f of the outermost resistive heating layer 31f of the sheet 3120f.

[0101] When the sheet 3110f and the sheet 3120f are folded and combined to two sides of the base 35f, the electrode 332f on the second part 313f of the innermost resistive heating layer 31f of the sheet 3110f is connected to the first electrode 36f to form an electrical connection, and the electrode 334f on the innermost first part 312f of the sheet 3120f is connected to the first electrode 36f to form an electrical connection, so that the plurality of resistive heating layers 31f of the sheet 3110f and sheet 3120f are connected in series via the first wire 341f and the second wire 342f.

[0102] Further, in a more preferred embodiment, the heater 30 is produced by stacking or folding the resistive heating layers 31c/31d/31f, and a protective surface coating can further be formed by dipping, spraying, or the like, to prevent aerosol condensate or organic compounds from the aerosol generation product A from corroding or adhering to a surface of the heater 30. The protective surface coating is, for example, glass, or a metal oxide coating.

[0103] Further, in more variable embodiments, the heater 30 is produced by stacking a plurality of separated

resistive heating layers 31c/31d/31f. Correspondingly, the plurality of separated resistive heating layers 31c/31d/31f stacked are welded by, for example, carrying out solder welding alternately on adjacent resistive heating layers 31c/31d/31f on two sides of the heater 30 in the width direction, to cause the plurality of separated resistive heating layers 31c/31d/31f stacked together to be electrically connected in series.

[0104] Alternatively, further, in more variable embodiments, the layers 32 are provided between the plurality of separated resistive heating layers 31c/31d/31f that are stacked, to provide support. In addition, there are regions not occupied by the layers 32c between the plurality of separated resistive heating layers 31c/31d/31f, and the adjacent resistive heating layers 31c/31d/31f are electrically connected to each other via the unoccupied regions.

[0105] Alternatively, FIG. 13 is a schematic diagram of a sheet 3110g before being folded according to another variable embodiment. The sheet 3110g is basically rectangular, and a plurality of slits or hollows 311g as well as slits or hollows 312g are formed in the sheet 3110g by etching, cutting, or the like, to reduce an area of the sheet 3110g during supplying power, thereby increasing resistance of the heater 30. In FIG. 13, the slits or hollows 311g and/or the slits or hollows 312g are in a shape of elongated strips extending in a width direction of the sheet 3110g. In addition, the plurality of slits or hollows 311g as well as the slits or hollows 312g are alternately arranged/spaced apart from each other in a length direction of the sheet 3110g, and the slits or hollows 311g as well as the slits or hollows 312g are staggered in the length direction of the sheet 3110g. Specifically, in FIG. 13, the slits or hollows 311g are located at center positions of the sheet 3110g in the width direction, and the slits or hollows 312g are located at edge positions of the sheet 3110g of the sheet 3110g in the width direction.

[0106] In addition, the sheet 3110g is provided with a first wire 341g and a second wire 342g for supplying power, and the slits or hollows 311g as well as slits or hollows 312g are staggered, to form a bypass current *i* flowing through the heater 30 in FIG. 13.

[0107] In this case, during production, the heater 30 can be obtained by folding the sheet 3110g successively based on folding lines m1 defined by the slits or hollows 311g or based on folding lines m2 defined by the slits or hollows 312g.

[0108] Certainly, in some embodiments, an insulating and supporting material such as glaze and ceramics is sprayed on a surface of at least one side of the sheet 3110g, to provide insulation or support between the folded resistive heating layers.

[0109] The wound or folded resistive heating elements 31a/31c/31d/31f/31g define a plurality of resistive conductor paths connected in series or in parallel with each other, to form a circuitous current path that extends forward and backward alternately, such as the current *i* shown, thereby increasing a path length of the current

flowing through the heater 30 and increasing resistance of the resistive heating elements 31a/31c/31d/31f/31g. In addition, the resistance of the resistive heating elements 31a/31c/31d/31f/31g satisfies a predetermined range, specifically, the resistance of the resistive heating elements 31a/31c/31d/31f/31g is controlled to be 0.1 S2 to 5.0 Ω .

[0110] In addition, the plurality of resistive conductor paths connected in series or in parallel with each other are defined by holes, slits, or hollows formed in the sheets 31a/3110c/3110d/3110f/3110g.

[0111] Moreover, according to FIG. 10 and FIG. 11, the plurality of resistive conductor paths that is connected in series and defined by the first part 312c and the second part 313c sequentially connected end to end are sequentially connected end to end.

[0112] Further, according to FIG. 9 to FIG. 13, the heater 30 formed by folding the sheets 3110c/3110d/3110g extends in the length direction of the slits or hollows 311c/311d/311g and is only partially interrupted by the slits or hollows 311c/311d/311g.

[0113] In addition, in the embodiment in FIG. 9, the slit or hollow 311c runs through the heater 30 in the thickness direction. Space formed by the slit or hollow 311c is used for accommodating and installing a temperature sensor for sensing a temperature of the heater 30.

[0114] Alternatively, in another variable embodiment, the first wire configured to supply power to the heater 30 is made of a first thermocouple material, the second wire is made of a second thermocouple material, and the first thermocouple material is different from the second thermocouple material. Therefore, a thermocouple for obtaining the temperature of the heater 30 by measuring thermoelectric potential can be formed between the first wire and the second wire. In some embodiments, the first wire is made of one of thermocouple materials such as nickel, nickel-chromium alloy, nickel-silicon alloy, nickel-chromium-copper, constantan, and iron-chromium alloy, and the second wire is made of another of the thermocouple materials such as nickel, nickel-chromium alloy, nickel-silicon alloy, nickel-chromium-copper, constantan, and iron-chromium alloy.

[0115] In some other embodiments, the heater 30 is independently formed by a resistive heating element formed by a sheet wound or folded up. For example, in some embodiments, after a resistive sheet or thin sheet is wound or folded to form a precursor in a cylindrical shape, a bar shape, or a sheet shape, and one end of the precursor is pressed, ground, and cut to form a tip for insertion into the aerosol generation product A, so that the heater 30 is obtained. In addition, in a more preferred embodiment, the obtained heater 30 can also form a protective surface coating by spraying, dipping, or the like, so that a surface of the wound or folded heater 30 is sealed, to prevent corrosion of the resistive heating element and prevent entry of aerosols, organic compounds, or the like into the resistive heating element from the surface of the heater 30.

[0116] Alternatively, FIG. 14 is a schematic diagram of an aerosol generating apparatus according to another variable embodiment. In FIG. 14, the aerosol generating apparatus includes:

- a chamber, having an opening 40, where an aerosol generation product A can be removably received in the chamber through the opening 40 of the chamber during use;
- a heater 30h, constructed to be in a shape of a tube surrounding and defining the chamber, and configured to heat the aerosol generation product A when the aerosol generation product A is received in the chamber, so that the aerosol generation product A releases a plurality of volatile compounds, and the volatile compounds are formed only by heating;
- a direct current battery cell 10, configured to supply power; and
- a circuit 20, configured to guide a current between the battery cell 10 and the heater 30h.

[0117] Further, as shown in FIG. 15, the heater 30h is formed by the sheet including the foil or thin sheet of the resistive metal or alloy wound at least twice, so that the heater 30h has at least two resistive heating layers 311h after the winding. Similarly, before being wound, a foil or a thin sheet made of the metal or alloy may also have the foregoing structures such as holes or slits, to increase resistance of the heater 30h.

[0118] In addition, the sheet that is wound to form the heater 30h may be a single-layered foil or thin sheet made of the resistive metal or alloy. In some more preferred embodiments, the sheet may be a sheet of at least two composite layers. For example, the sheet includes: a metal or alloy layer; and a stress compensation layer, and combined to the metal or alloy layer. The stress compensation layer provides stress compensation for bending or twisting during the winding, to prevent cracking or breakage of the metal or alloy layer with great brittleness during the winding.

[0119] Further, FIG. 16 is a schematic diagram of an aerosol generating apparatus according to another embodiment. In the embodiment, the aerosol generating apparatus includes:

- a chamber, configured to receive an aerosol generation product A;
- a heater 30j, constructed to be in a shape of a pin or a needle or a rod or a bar, or the like extending at least partially in the chamber in this embodiment;
- a magnetic field generator, such as an induction coil 50j, configured to generate a changing magnetic field to induce the heater 30j to generate heat; and
- a support 40j, defining the chamber and at least partially configured to provide support for the induction coil 50j and/or the heater 30j.

[0120] In the embodiment, the heater 30j includes an

induction heating element, which is also formed by a sheet including a metal or alloy wound or folded up. Certainly, the heater 30j may also have a housing, a flange, and the like, to facilitate the mounting and fixation of the induction heating element. Specifically, in some embodiments, the induction heating element is obtained by winding a foil or thin sheet made of an inductive metal or alloy. The foil or thin sheet made of the inductive metal or alloy is, for example, nickel foil, nickel-iron alloy foil, iron foil.

[0121] In some production processes, the induction heating element of the heater 30j is first formed into a cylindrical shape, a bar shape, or a sheet shape by winding or folding the foil or thin sheet made of the inductive metal or alloy. The induction heating element is then accommodated and mounted in a housing or casing having a tip end to obtain the heater 30j, and the induction heating element formed by winding or folding the foil or thin sheet made of the inductive metal or alloy has at least two induction heating layers.

[0122] In addition, in the embodiment of heating by induction, the at least two induction heating layers of the heater 30j are in contact with or abut against with each other.

[0123] Alternatively, in some other production processes, the heater 30j is independently produced by the induction heating element. For example, an induction heating element of a tubular shape or a bar shape or a sheet shape is first formed by winding or folding the foil or thin sheet made of the inductive metal or alloy, and then one end of the induction heating element is pressed, ground, and cut to form a tip for insertion into the aerosol generation product A, so that the heater 30j is obtained.

[0124] Alternatively, in some other variable embodiments, the heater 30j may be further constructed to be formed by winding the foil or thin sheet made of the inductive metal or alloy.

[0125] In more variable embodiments, the heater 30j is constructed to be in a tubular or cylindrical shape formed by winding the foil or thin sheet made of the inductive metal or alloy. In this case, a hollow in a tubular or cylindrical shape of the heater 30j formed by winding is at least partially used as a chamber for receiving or accommodating the aerosol generation product A.

[0126] Alternatively, FIG. 17 is a schematic diagram of an aerosol generating apparatus according to another embodiment. In the embodiment, the aerosol generating apparatus includes:

- a near end 110k and a far end 120k opposite to each other in a length direction;
- a heater 30k, constructed to extend in the length direction of the aerosol generating apparatus and located at or close to the near end 110k, and the heater 30k is constructed to be in a shape of a longitudinally extending rod, or bar, or pin, or sheet, or tube, or the like, and the aerosol generation product A can be inserted into the heater 30k at the near

end 110k or accommodated in the heater 30k so as to be heated to generate aerosols;
a battery cell 10k, close to the far end 120k; and
a circuit board 20k, configured to control the battery cell 10k to provide power to the heater 30.

[0127] In the embodiment, for example, in the aerosol generating apparatus shown in FIG. 17, the heater 30k is substantially exposed, to facilitate combination of the aerosol generation product A with the heater 30k in the embodiment.

[0128] Alternatively, in some other embodiments, the aerosol generating apparatus further includes a blocking member or a blocking wall for blocking the heater 30k, to prevent a user from contacting or touching the heater 30k.

[0129] In addition, in some embodiments, the blocking member or blocking wall is removably or movably combined to the aerosol generating apparatus. The heater 30k can be selectively blocked or exposed by removal or movement of the blocking member or blocking wall.

[0130] Further, in some specific embodiments, the heater 30k may be a resistive heating element 31k formed by a flexible sheet including metal wound or folded up. For example, FIG. 18 is a schematic diagram of a sheet before being wound or folded according to an embodiment. The sheet includes:

a substrate 311k, which is a foil or thin sheet made of a metal or alloy; and
a plurality of heating coatings or traces 312k spaced apart from each other, formed on the substrate 311k in a shape of a foil or a thin sheet by printing, imprinting, deposition, or the like.

[0131] In a preferred embodiment, the heating coating or trace 312k is formed by a slurry of a metal or an alloy. In addition, as shown in FIG. 9, the heating coating or trace 312k is in a shape of an elongated band or strip or trace, or the like, extending in a width direction of the substrate 311k, and the plurality of heating coatings or traces 312k are spaced apart from each other in a length direction of the substrate 311k.

[0132] Further, according to the preferred embodiment shown in FIG. 18, a common electrode 3411k is provided on an electrical connection of the heating coating or trace 312k, and is in a shape of an elongated strip extending in the length direction of the substrate 311k. All left ends of the heating coatings or traces 312k close to the substrate 311k in the width direction are partially overlapped or connected to the common electrode 3411k to form an electrical connection. The common electrode 3411k is welded to a first wire 341k so as to be connected to the circuit board 20k via the first wire 341k. Right ends of the heating coatings or traces 312k close to the substrate 311k in the width direction are welded to second wires 342k so as to be connected to the circuit board 20l via the second wires 342k.

[0133] In some preferred embodiments, the common electrode 3411k is, for example, a coating electrode or a patch electrode. The common electrode 3411k is made of low-resistivity gold, silver, copper, an alloy thereof, or the like. In a preferred embodiment, the common electrode 3411k includes silver, and the heating coating or trace 312k includes silver. In addition, a mass percentage of silver in the common electrode 3411k is higher than a mass percentage of silver in the heating coating or trace 312k.

[0134] Alternatively, in some other variable embodiments, the heating coatings or traces 312k are each independently connected to the circuit board 20k via wires, so that heat generation can be independently controlled by the circuit board 20k to heat different parts of the aerosol product respectively.

[0135] Further, in a preferred embodiment, a coefficient of thermal conductivity of the heating coating or trace 312k is higher than a coefficient of thermal conductivity of the substrate 311k. During the heating, the coefficient of thermal conductivity of the substrate 31k decreases gradually facilitates the balance between heat storage and heat dissipation.

[0136] Further, the coefficient of thermal conductivity of the heating coating or trace 312k is three times higher than that of the substrate 311k. In addition, the coefficient of thermal conductivity of the heating coating or trace 312k is 10 times lower than that of the substrate 311k. More preferably, the coefficient of thermal conductivity of the heating coating or trace 312k is eight times lower than that of the substrate 311k. It is advantageous for the substrate 311k to effectively dissipate the heat of the heating coating or trace 312k and then cool the heating coating or trace 312k. In some preferred embodiments, the heating coating or trace 312k has a coefficient of thermal conductivity of higher than 350 W/mK, for example, a silver alloy with a coefficient of thermal conductivity higher than 350 W/mK. The coefficient of thermal conductivity of the substrate 311k ranges from 40 W/mK to 110 W/mK.

[0137] In addition, in some specific embodiments, a material of the heating coating or trace 312k has a mass percentage of silver of higher than 60%, and has a thickness of less than 0.05 mm, preferably 0.005 mm to 0.02 mm, so that the heating coating or trace 312k has proper resistance. More preferably, the mass percentage of silver in the material of the heating coating or trace 312k is higher than 80%.

[0138] Moreover, in some specific embodiments, the substrate 311k includes a metal or an alloy, such as iron-chromium-aluminum alloy, and nickel-chromium-aluminum alloy. In the embodiment, the substrate 311k has a thickness of less than 0.15 mm, for example, a thickness of 0.05 mm to 0.15 mm. Correspondingly, a surface of the substrate 311k is provided with an insulating layer to provide insulation between the heating coatings or traces 312k. In a specific embodiment, an insulating layer on a surface of the substrate 311k made of the metal or alloy is

formed by thermal oxidation. For example, the iron-chromium-aluminum alloy is heated to 500 degrees or more in the air, to cause the surface to be oxidized to form a film of metal oxides. In addition, in a preferred embodiment, the formed film of metal oxide has a thickness of 10 nm or less, to provide insulation without affecting thermal conductivity.

[0139] Further, as shown in FIG. 17, when formed by winding a sheet into a pin or needle shape, the heater 30k may further include a housing 32k and the like to encapsulate and accommodate the resistive heating element 31k.

[0140] Alternatively, when the resistive heating element 31k is formed by a sheet wound or folded into a sheet shape, surface spraying or treatment can be directly performed.

[0141] Alternatively, when the resistive heating element 31k is formed by a sheet wound into a tubular shape, the aerosol generation product A is directly accommodated in an inner hollow of the resistive heating element 31k in the tubular shape to be heated.

[0142] It should be noted that, the specification of this application and the accompanying drawings thereof illustrate preferred embodiments of this application. However, this application may be implemented in various forms, and is not limited to the embodiments described in this specification. These embodiments are not intended to be an additional limitation on the content of this application, and are described for the purpose of providing a more thorough and comprehensive understanding of the content disclosed in this application. Moreover, the foregoing technical features are further combined to form various embodiments not listed above, and all such embodiments shall be construed as falling within the scope of the specification of this application. Further, a person of ordinary skill in the art may make improvements or modifications according to the foregoing descriptions, and all the improvements and modifications shall fall within the protection scope of the appended claims of this application.

Claims

1. An aerosol generating apparatus, configured to heat an aerosol generation product to generate aerosols, and comprising:

a chamber, configured to receive the aerosol generation product; and
a heater, configured to heat the aerosol generation product, wherein the heater comprises a resistive heating element, the resistive heating element has at least two resistive heating layers formed by a sheet comprising a resistive metal or alloy wound or folded up.

2. The aerosol generating apparatus according to

claim 1, wherein the sheet comprises a foil layer made of the resistive metal or alloy.

3. The aerosol generating apparatus according to claim 2, wherein the sheet further comprises:
a stress compensation layer, configured to provide stress compensation during the winding or folding of the sheet, to prevent cracking or breakage of the foil layer made of the resistive metal or alloy.
4. The aerosol generating apparatus according to claim 2, wherein the foil layer made of the resistive metal or alloy has a thickness of 0.5 μm to 200 μm .
5. The aerosol generating apparatus according to any one of claims 1 to 4, wherein the resistive heating layer is configured to generate heat due to Joule heat generated when a direct current flows through the resistive heating layer.
6. The aerosol generating apparatus according to any one of claims 1 to 4, wherein the heater further comprises:
an insulating layer, formed between two adjacent resistive heating layers to provide insulation between the two adjacent resistive heating layers.
7. The aerosol generating apparatus according to any one of claims 1 to 4, wherein the sheet is continuous.
8. The aerosol generating apparatus according to any one of claims 1 to 4, wherein the at least two resistive heating layers are connected in series.
9. The aerosol generating apparatus according to any one of claims 1 to 4, wherein the resistive heating element is formed by the sheet wound or folded on a rigid base.
10. The aerosol generating apparatus according to claim 9, wherein the rigid base comprises ceramic or a surface-insulated metal.
11. The aerosol generating apparatus according to any one of claims 1 to 4, wherein the heater further comprises:
a first wire and a second wire, configured to supply power to the resistive heating element.
12. The aerosol generating apparatus according to claim 11, wherein the resistive heating element is formed by the sheet wound around the first wire, which serves as an axis; and the first wire has a larger diameter than the second wire.
13. The aerosol generating apparatus according to claim 11, wherein the resistive heating element is formed by the sheet wound around the first wire,

which serves as an axis; and the first wire has a diameter of 0.5 mm to 1.5 mm.

14. The aerosol generating apparatus according to claim 11, wherein the resistive heating element is of a cylindrical shape formed by winding the sheet; and the first wire is at least partially inside the resistive heating element, and the second wire is located outside the resistive heating element.
15. The aerosol generating apparatus according to claim 11, wherein the heater is constructed to be in a shape of a sheet extending at least partially in the chamber, and has a first side and a second side opposite to each other in a thickness direction; and the first wire is located at the first side, and the second wire is located at the second side.
16. The aerosol generating apparatus according to claim 11, wherein the first wire comprises a first thermocouple wire, and the second wire comprises a second thermocouple wire; and the first thermocouple wire and the second thermocouple wire are made of different thermocouple materials to form a thermocouple, between the first wire and the second wire, for measuring a temperature of the resistive heating element.
17. The aerosol generating apparatus according to any one of claims 1 to 4, wherein the resistive heating element comprises a plurality of resistive conductor paths formed on the at least two resistive heating layers.
18. The aerosol generating apparatus according to claim 17, wherein the plurality of resistive conductor paths are defined by at least one of holes, slits, or hollows formed in the at least two resistive heating layers.
19. The aerosol generating apparatus according to claim 17, wherein the plurality of resistive conductor paths are connected in series or in parallel.
20. The aerosol generating apparatus according to any one of claims 1 to 4, wherein the heater further comprises:
a housing, extending at least partially in the chamber and configured to be inserted into the aerosol generation product; and the resistive heating element is accommodated or held in the housing.
21. The aerosol generating apparatus according to claim 20, wherein the heater comprises: a first wire and a second wire, configured to supply power to the resistive heating element; and the housing has a slot extending in a length direction,

the first wire is at least partially located in the housing, and the second wire is at least partially held in the slot.

22. The aerosol generating apparatus according to any one of claims 1 to 4, wherein the heater is constructed to be in a shape of a sheet extending at least partially in the chamber; and the at least two resistive heating layers are spaced apart from each other in a thickness direction of the heater.
23. The aerosol generating apparatus according to claim 22, wherein the resistive heating element further comprises:
a connecting part, extending between two adjacent resistive heating layers in the thickness direction of the heater to provide an electrical connection between the two adjacent resistive heating layers.
24. The aerosol generating apparatus according to claim 22, wherein the connecting part is located on at least one side of the heater in a width direction.
25. The aerosol generating apparatus according to any one of claims 1 to 4, wherein the sheet is provided with a plurality of holes, hollows, or slits, to cause the sheet to form a grid pattern.
26. The aerosol generating apparatus according to any one of claims 1 to 4, wherein the heater further comprises:
a temperature sensor, configured to sense a temperature of the resistive heating element.
27. The aerosol generating apparatus according to claim 26, wherein the heater is constructed to be in a shape of a sheet extending at least partially in the chamber; and the heater has a slit or a hollow extending through the heater in a thickness direction, and the temperature sensor is accommodated in the slit or the hollow.
28. The aerosol generating apparatus according to any one of claims 1 to 4, wherein the heater is constructed to be in a shape of a sheet extending at least partially in the chamber; and
The resistive heating element is formed by the sheet folded in opposite directions alternately in a width direction of the heater.
29. The aerosol generating apparatus according to any one of claims 1 to 4, wherein resistance of the resistive heating element ranges from 0.1 Ω to 5.0 Ω .
30. An aerosol generating apparatus, configured to heat an aerosol generation product to generate aerosols,

and comprising: a heater, configured to heat the aerosol generation product, wherein the heater comprises a resistive heating element, the resistive heating element has at least two resistive heating layers formed by a sheet comprising a resistive metal or alloy wound or folded up, and the at least two resistive heating layers define a plurality of resistive conductor paths that extend forward and backward alternately in a length direction or a width direction of the resistive heating element.

- 31.** An aerosol generating apparatus, configured to heat an aerosol generation product to generate aerosols, and comprising:

a chamber, configured to receive the aerosol generation product;
a magnetic field generator, configured to generate a changing magnetic field; and
a heater, configured to heat the aerosol generation product, wherein the heater comprises an induction heating element that is penetrated by the changing magnetic field to generate heat, and the induction heating element has at least two induction heating layers formed by a sheet comprising an inductive metal or alloy wound or folded up.

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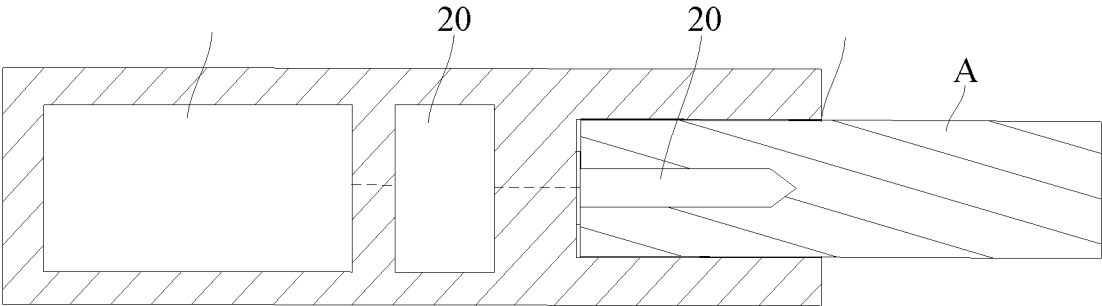


FIG. 1

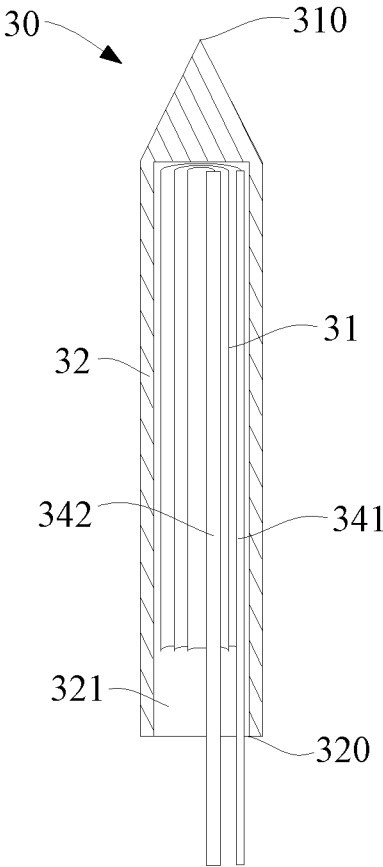


FIG. 2

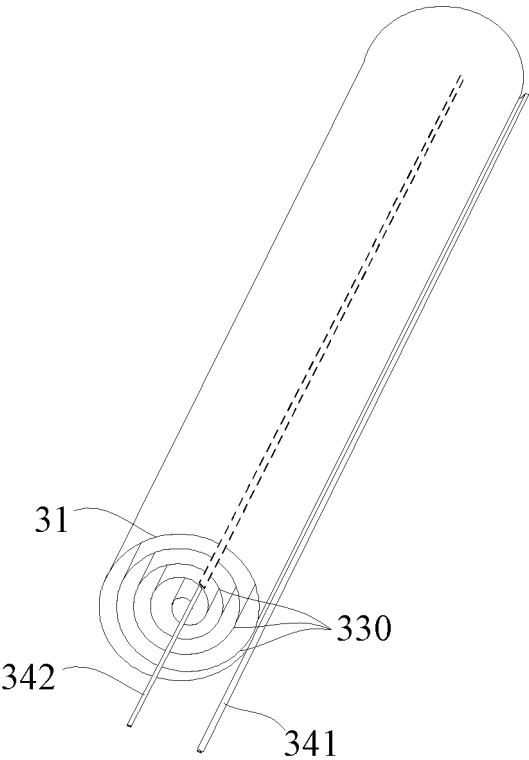


FIG. 3

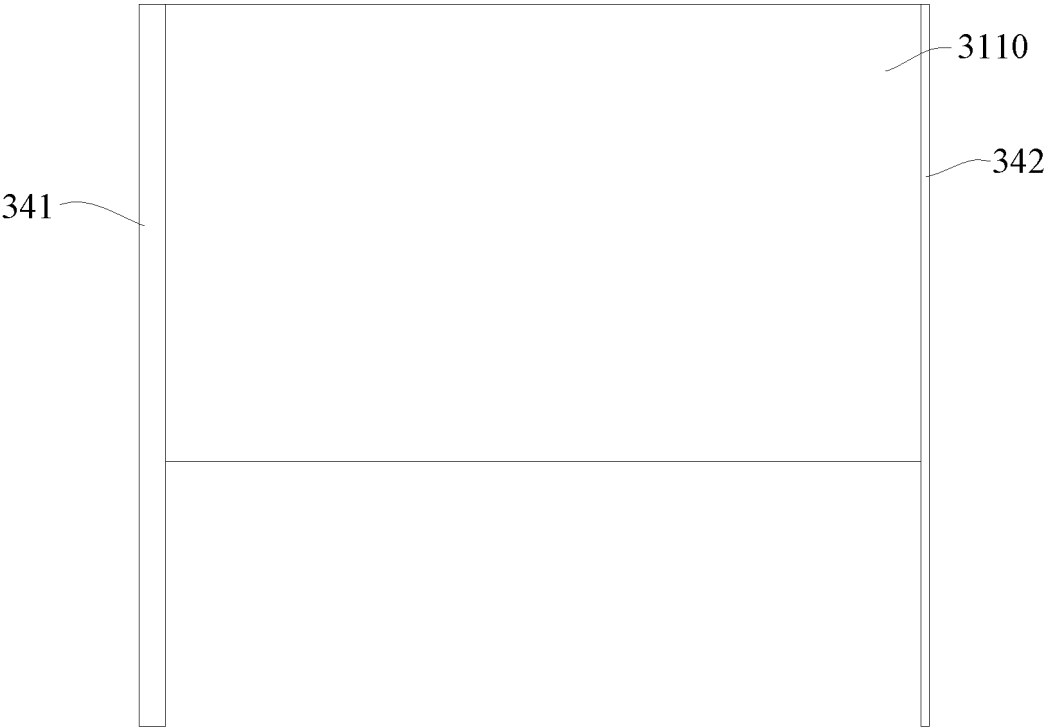


FIG. 4

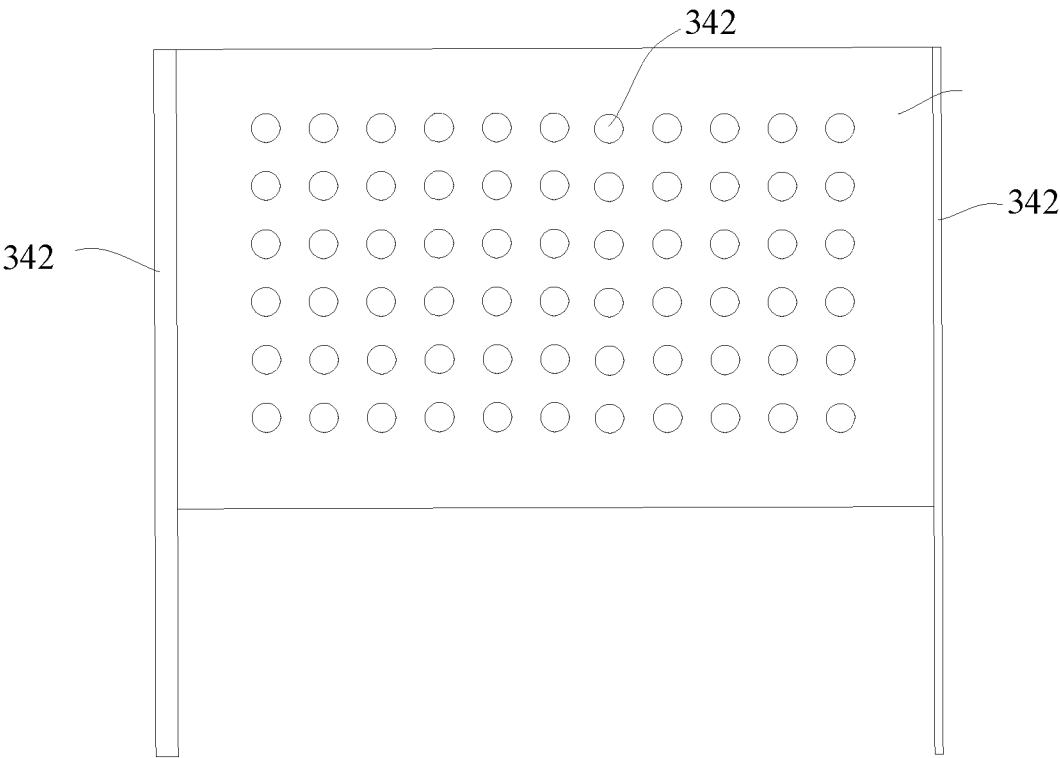


FIG. 5

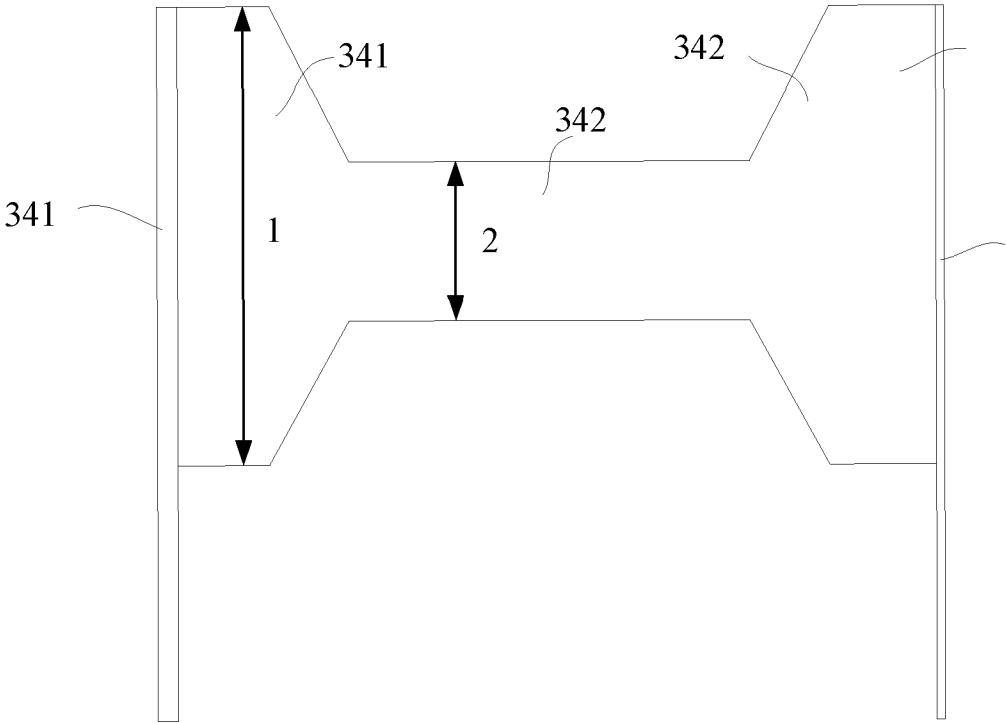


FIG. 6

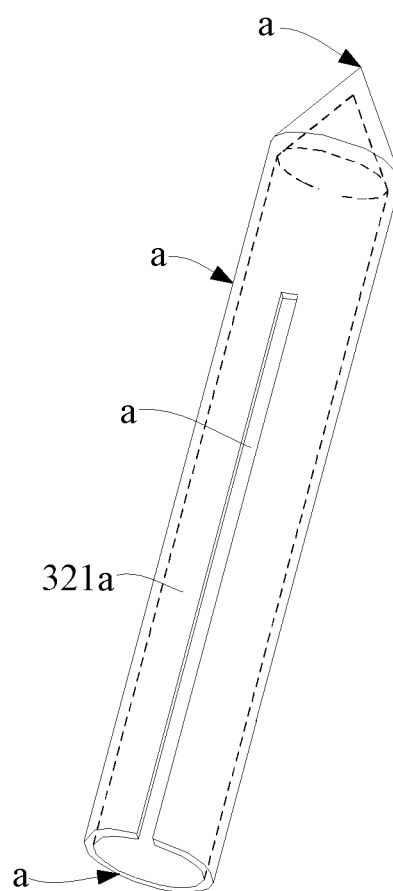


FIG. 7

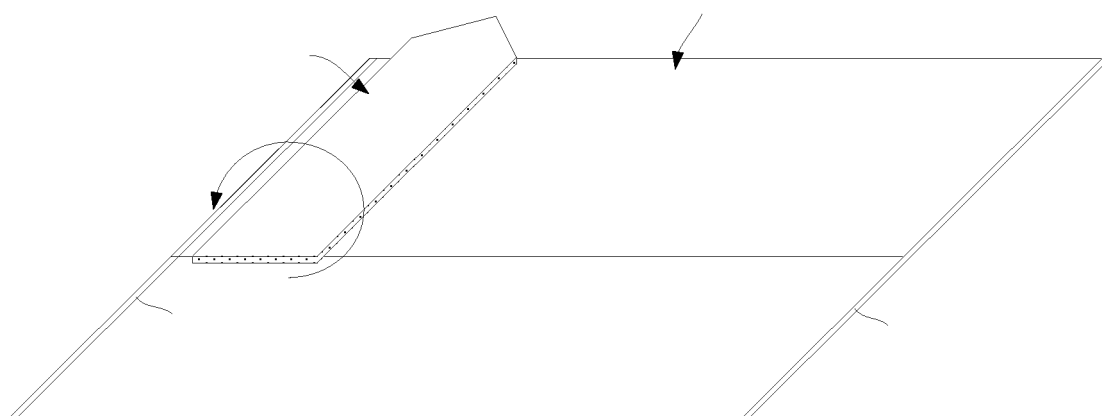


FIG. 8

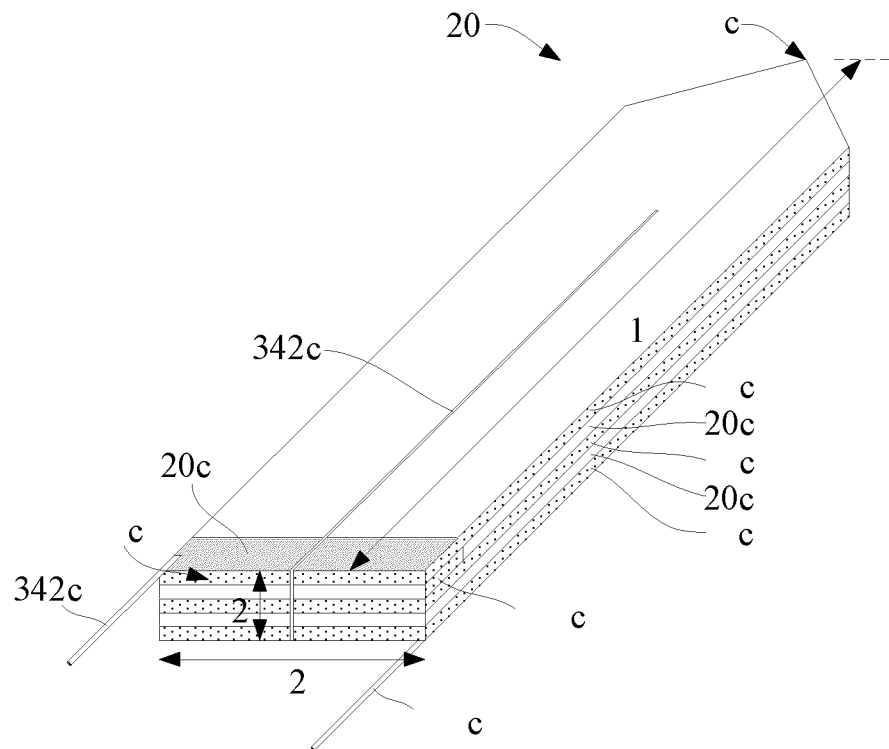


FIG. 9

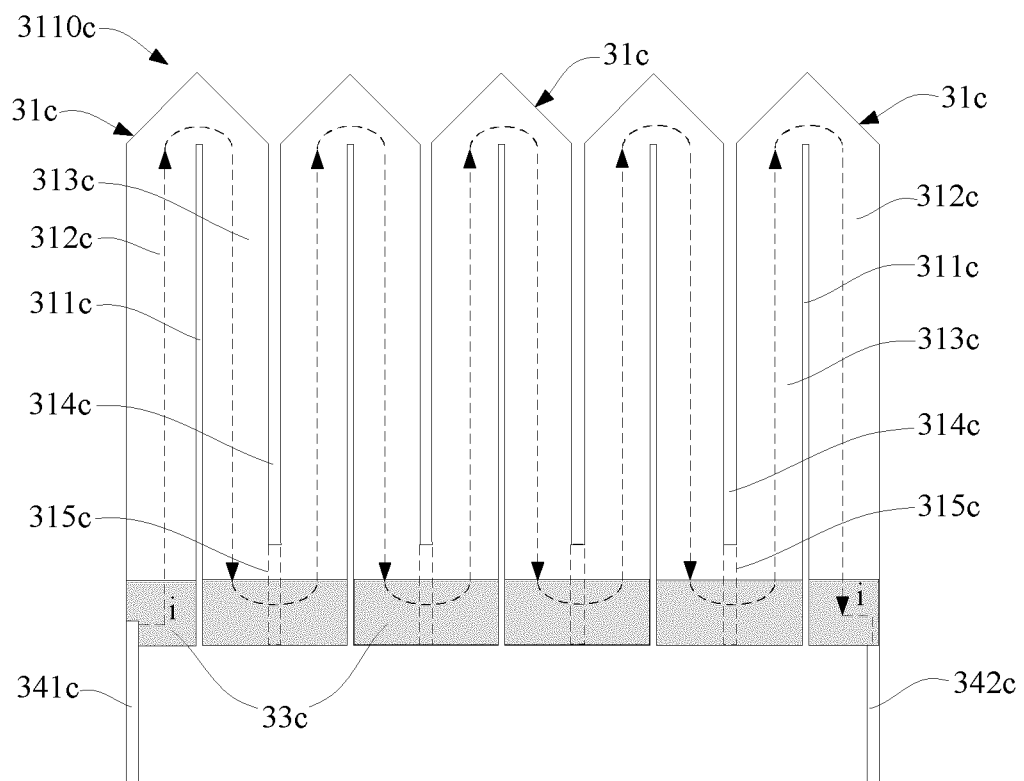


FIG. 10

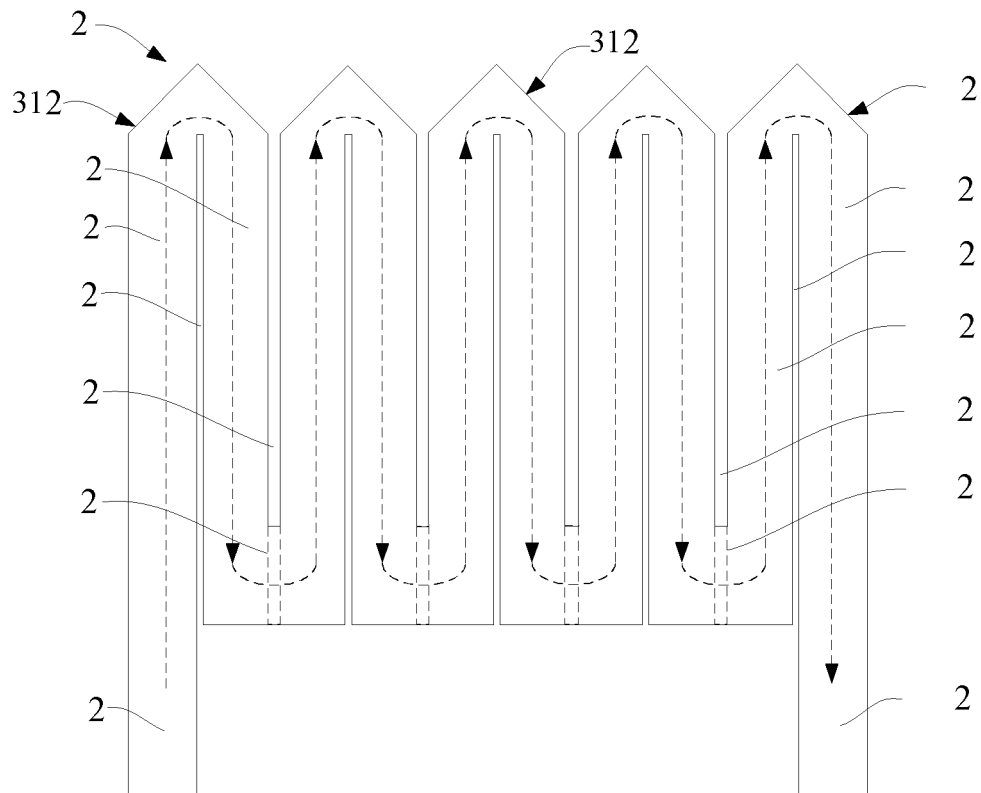


FIG. 11

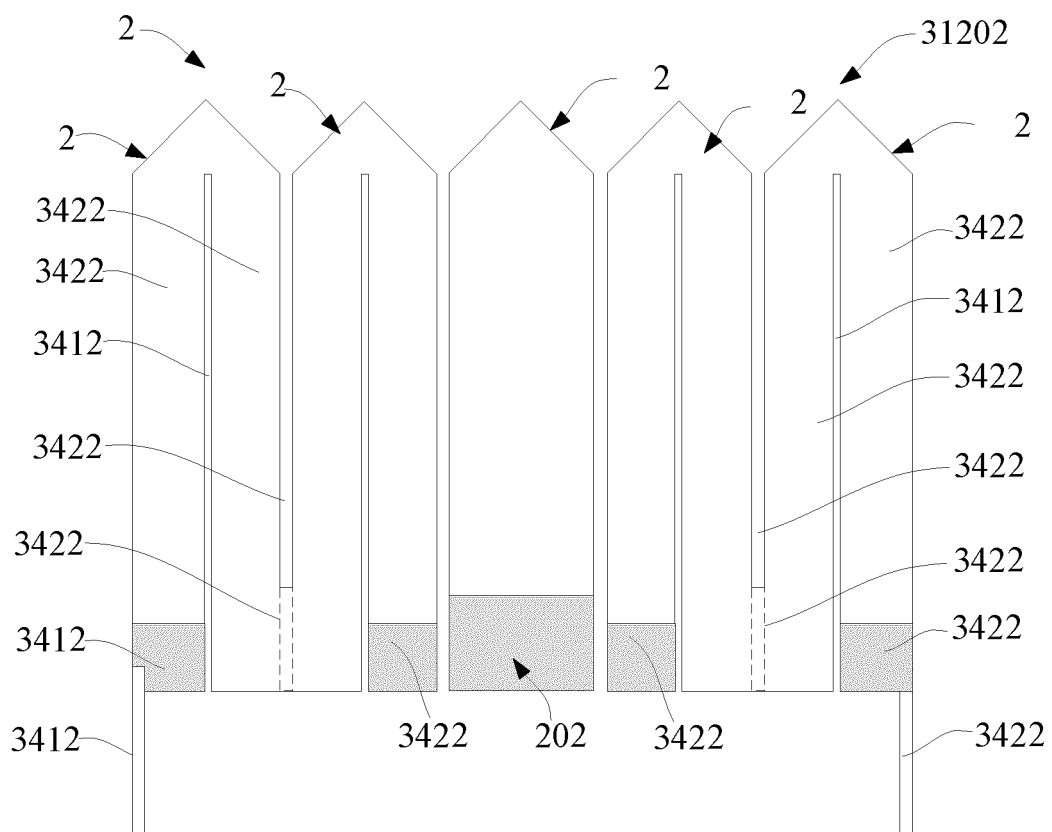


FIG. 12

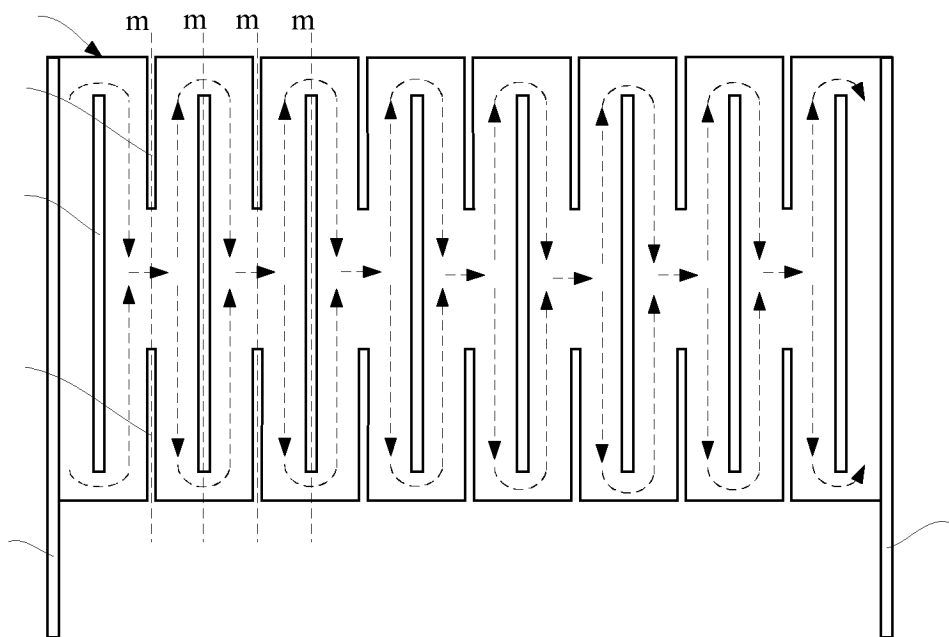


FIG. 13

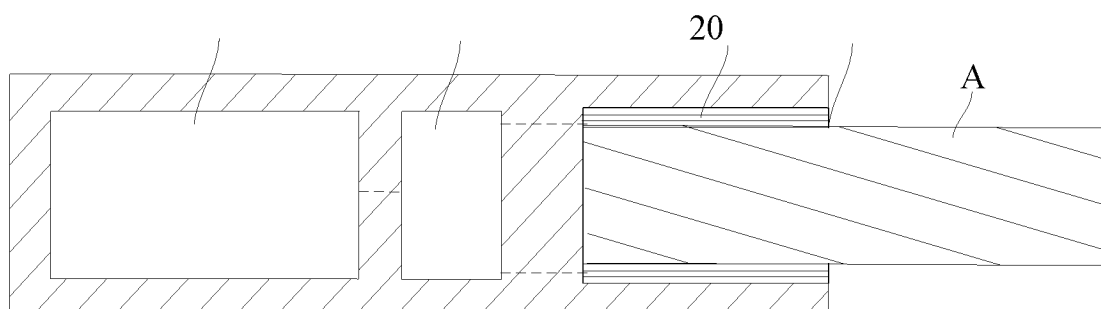


FIG. 14

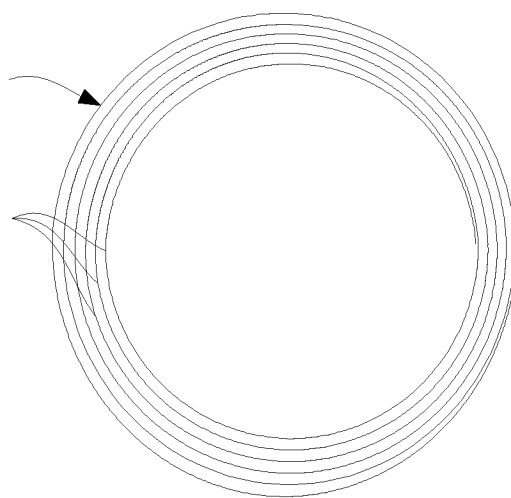


FIG. 15

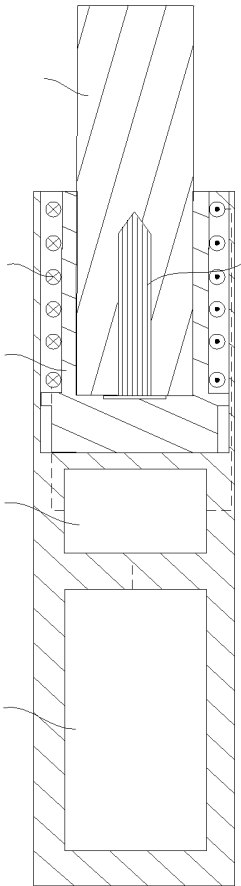


FIG. 16

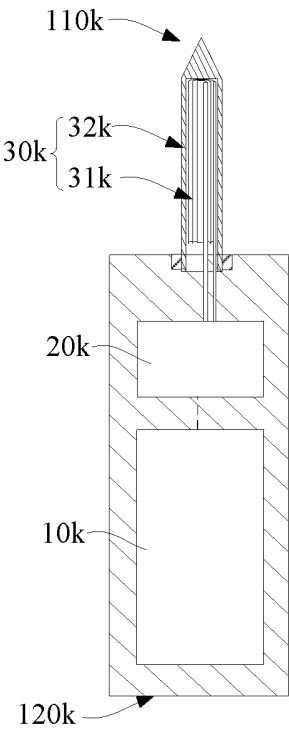


FIG. 17

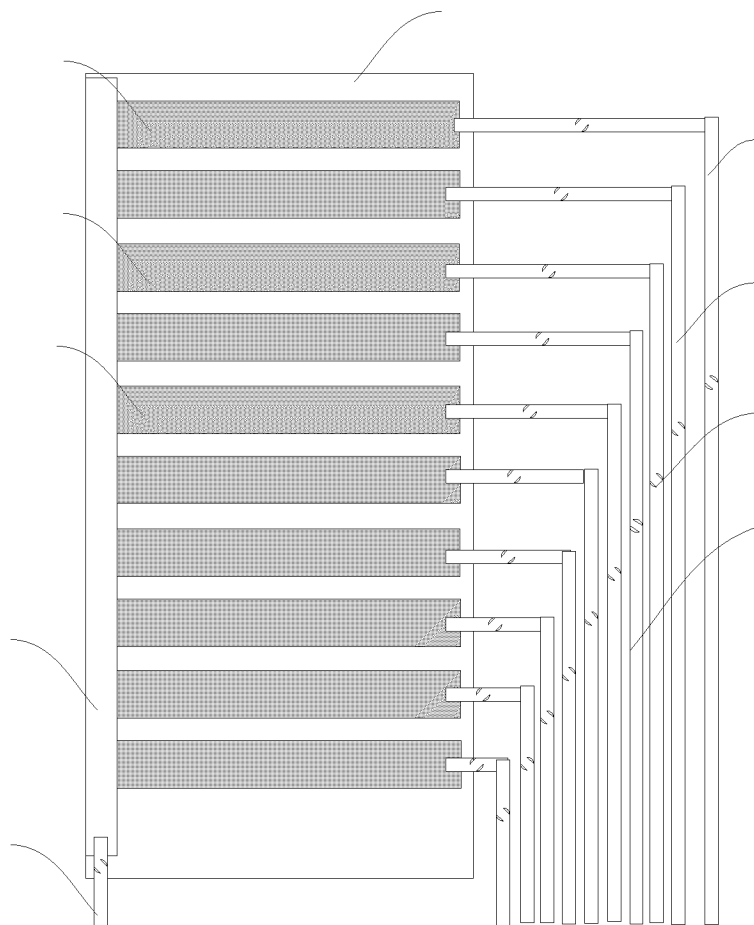


FIG. 18

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2023/071621

A. CLASSIFICATION OF SUBJECT MATTER

A24F40/40(2020.01)i; A24F40/465(2020.01)i; A24F40/51(2020.01)i; A24F40/57(2020.01)i; A24F40/50(2020.01)i; A24F40/20(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:A24F40,A24F47

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, VEN: 加热, 发热, 电阻, 片, 板, 层, 卷绕, 涡卷, 螺旋, 折叠, 堆叠, heat+, resisistance, sheet, flat, layer, winding, folding, scroll

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 216983603 U (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 19 July 2022 (2022-07-19) claims 1-31	1-31
X	CN 210017883 U (CHANGZHOU PAITENG ELECTRONIC TECHNOLOGY SERVICE CO., LTD.) 07 February 2020 (2020-02-07) description, paragraphs 31-49, and figures 1-5	1-30
Y	CN 210017883 U (CHANGZHOU PAITENG ELECTRONIC TECHNOLOGY SERVICE CO., LTD.) 07 February 2020 (2020-02-07) description, paragraphs 31-49, and figures 1-5	31,
Y	CN 215347073 U (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 31 December 2021 (2021-12-31) description, paragraphs 4-9 and 39-52, and figures 1-3	31
Y	CN 212461792 U (SHIDA BATTERY TECHNOLOGY CO., LTD.) 02 February 2021 (2021-02-02) description, paragraphs 23-30, and figures 1-3	1-30

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

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“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

06 June 2023

Date of mailing of the international search report

06 June 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

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2023/071621

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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 112369719 A (SHENZHEN WOODY VAPES TECHNOLOGY CO., LTD.) 19 February 2021 (2021-02-19) description, paragraphs 17 and 50-65, and figures 1-17	1-30
A	WO 2021084746 A1 (JAPAN TOBACCO INC.) 06 May 2021 (2021-05-06) entire document	1-31

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2023/071621

Patent document cited in search report			Publication date (day/month/year)		Patent family member(s)			Publication date (day/month/year)	
CN	216983603	U	19 July 2022		None				
CN	210017883	U	07 February 2020		None				
CN	215347073	U	31 December 2021		None				
CN	212461792	U	02 February 2021		None				
CN	112369719	A	19 February 2021		None				
WO	2021084746	A1	06 May 2021		TW	202119862	A	16 May 2021	
					JPWO	2021084746	A1	06 May 2021	

REFERENCES CITED IN THE DESCRIPTION

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- CN 202010054217 [0004]