



(11)

EP 4 487 703 A1

(12)

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

(43) Date of publication:
08.01.2025 Bulletin 2025/02

(21) Application number: **23778478.0**

(22) Date of filing: **31.03.2023**

(51) International Patent Classification (IPC):
A24F 40/10 ^(2020.01) **A24F 40/40** ^(2020.01)
A24F 40/46 ^(2020.01) **A24F 40/42** ^(2020.01)
A24F 40/51 ^(2020.01)

(52) Cooperative Patent Classification (CPC):
A24F 40/10; A24F 40/40; A24F 40/42; A24F 40/46;
A24F 40/51

(86) International application number:
PCT/CN2023/085541

(87) International publication number:
WO 2023/186114 (05.10.2023 Gazette 2023/40)

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

(30) Priority: **02.04.2022 CN 202210357372**

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(54) **ATOMIZER AND ELECTRONIC ATOMIZATION DEVICE**

(57) An atomizer (100) and an electronic atomization device. The atomizer (100) comprises: a liquid storage cavity (12) used for storing a liquid matrix; a heating element (40) configured to be in the shape of a cylinder extending in the longitudinal direction of the atomizer (100) for heating the liquid matrix to generate an aerosol; and a support (50) at least partially located in the heating element (40) and configured to at least partially provide support for the heating element (40) from the interior of the heating element (40). In the atomizer (100), the support (50) at least partially extends into the cylindrical heating element (40) so as to provide support for the heating element (40).

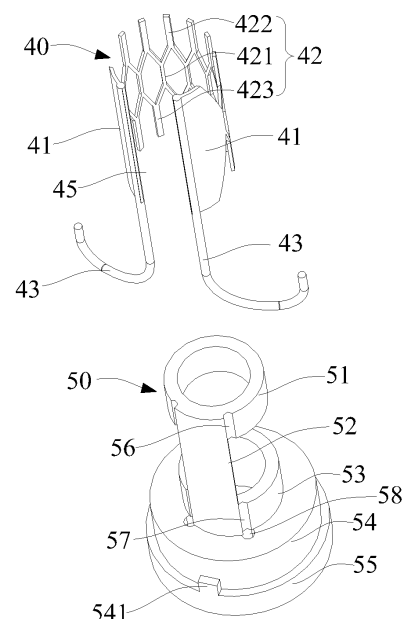


FIG. 6

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Chinese Patent Application No. 202210357372.4, filed with the China National Intellectual Property Administration on April 2, 2022 and entitled "ATOMIZER AND ELECTRONIC ATOMIZATION DEVICE", which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] Embodiments of this application relate to the field of electronic atomization technologies, and in particular, to an atomizer and an electronic atomization device.

BACKGROUND

[0003] Tobacco products (for example, cigarettes and cigars) burn tobacco during use to produce tobacco smoke. Attempts are made to replace these tobacco-burning products by manufacturing products that release compounds without being burnt.

[0004] An example of the products is a heating device that releases a compound by heating rather than burning a material. For example, the material may be tobacco or other non-tobacco products. These non-tobacco products may or may not include nicotine. For another example, there are so-called electronic atomization devices. These devices generally include a liquid, and the liquid is heated to vaporize, to generate an inhalable aerosol. The liquid may contain nicotine, and/or aromatics, and/or aerosol-generation substances (such as glycerin). In a known electronic atomization device, for example, in the patent CN202022447740.3, a heating mesh wound into a cylindrical shape is wrapped, surrounded, and supported from the outside by an annular liquid guide element, so that the heating mesh is stably retained in the electronic atomization device.

SUMMARY

[0005] According to a first aspect, an embodiment of this application provides an atomizer, including:

- a liquid storage cavity, configured to store a liquid substrate;
- a heating element, constructed in a cylindrical shape extending along a longitudinal direction of the atomizer, to heat the liquid substrate to generate an aerosol; and
- a holder, at least partially surrounded by the heating element to be positioned inside the heating element, and is configured to at least partially provide support for the heating element from the inside of the heating element.

[0006] In a preferred embodiment, the heating element is made by a sheet material wound around at least a part of the holder.

[0007] In a preferred embodiment, the atomizer further includes:

- an inhalation port; and
- an air inlet and an airflow channel located between the air inlet and the inhalation port, where the air inlet, the inhalation port, and the airflow channel are arranged to define an airflow path from the air inlet to the inhalation port through the heating element, to transfer the aerosol to the inhalation port, and the airflow channel at least partially passes through the holder along the longitudinal direction of the atomizer.

[0008] In a preferred embodiment, the holder includes a first part surrounded by the heating element and a second part exposed outside the heating element, the first part is configured to provide support for the heating element from the inside of the heating element, and the second part abuts against the heating element to provide stop.

[0009] In a preferred embodiment, the atomizer further includes:

- a liquid guide element, extending along an axial direction of the heating element and surrounding the heating element, and configured to conduct the liquid substrate in the liquid storage cavity to the heating element.

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

- a tubular element, extending along the longitudinal direction of the atomizer, and at least partially defining the liquid storage cavity, where the tubular element is constructed to surround and retain the liquid guide element and abut against the holder to be stopped.

[0011] In a preferred embodiment, the liquid guide element is flexible, and is at least partially radially squeezed or compressed between the tubular element and the heating element.

[0012] In a preferred embodiment, the tubular element is provided with a first notch, groove, or hole; and the holder is provided with a positioning clamping protrusion extending into the first notch, groove, or hole, to prevent the tubular element from rotating relative to the holder.

[0013] In a preferred embodiment, the heating element includes a first end and a second end facing away from each other along an axial direction;

- the holder includes a first support part and a second support part spaced apart along a longitudinal direction, and the first support part is in an annular shape and is arranged to provide support for the heating element from the inside close to a first end of the heating element; and
- the second support part is in an annular shape and is

arranged to provide support for the heating element from the inside close to a second end of the heating element.

[0014] In a preferred embodiment, the heating element defines a side opening extending along an axial direction, to enable the heating element to be non-closed along a circumferential direction.

[0015] In a preferred embodiment, the holder further includes a third support part extending along the longitudinal direction, and the third support part is at least partially located in the side opening of the heating element, to provide support for the heating element.

[0016] In a preferred embodiment, the heating element includes a conductive lead for supplying power to the heating element; and

an inner surface or an outer surface of the holder is provided with a lead groove, and the conductive lead is at least partially accommodated and retained in the lead groove.

[0017] In a preferred embodiment, the atomizer further includes:

a lead fastener, at least partially shielding or covering the conductive lead accommodated in the lead groove, to prevent the conductive lead from leaving the lead groove.

[0018] In a preferred embodiment, the lead fastener is substantially constructed in an annular shape.

[0019] In a preferred embodiment, the liquid storage cavity is provided with an open end, and the atomizer further includes:

a flexible sealing base, configured to cover the open end to seal the liquid storage cavity, where the sealing base accommodates and retains at least a part of the holder.

[0020] In a preferred embodiment, the atomizer further includes:

an end support member, configured to support the sealing base, where

the sealing base includes a first surface for sealing or covering the open end, and the sealing base is further provided with a through hole extending to the first surface; and

the end support member is provided with an extension arm at least partially extending in the through hole, and an air channel is defined between the extension arm and the through hole, to provide a path for air to enter the liquid storage cavity.

[0021] In a preferred embodiment, the air channel includes an air groove provided on an outer surface of the extension arm and/or an inner surface of the through hole.

[0022] In a preferred embodiment, the heating element includes a first end and a second end facing away from each other along an axial direction, and the heating element further includes:

a heating portion, configured to generate Joule heat;

a first tooth portion or wing portion, extending from the heating portion toward the first end and terminating at the first end; and

a second tooth portion or wing portion, extending from the heating portion toward the second end and terminating at the second end, where

the holder is arranged to provide support for the first tooth portion or wing portion and/or the second tooth portion or wing portion and avoid the heating portion.

[0023] In a preferred embodiment, the heating element includes a first end and a second end facing away from each other along an axial direction, and the heating element further includes:

a first joint portion combined on the holder, and located at the first end;

a second joint portion combined on the holder, and located at the second end; and

a heating portion, located between the first joint portion and the second joint portion along an axial direction, and configured to generate Joule heat, where the heating portion avoids the holder, and is exposed in the airflow channel.

[0024] According to a second aspect, an embodiment of this application further provides another atomizer, including:

a tubular element, constructed to extend along a longitudinal direction of the atomizer;

a liquid storage cavity, at least partially defined by the tubular element, and configured to store a liquid substrate, where the liquid storage cavity is provided with an open end;

a heating element, located in the tubular element, and constructed to extend along the longitudinal direction of the atomizer, to heat the liquid substrate to generate an aerosol;

a flexible sealing base, configured to cover the open end to seal the liquid storage cavity, where the sealing base accommodates and surrounds at least a part of the tubular element;

an end support member, configured to support the sealing base, where the sealing base includes a first surface for sealing or covering the open end, and the sealing base is further provided with a through hole extending to the first surface, and

the end support member is provided with an extension arm at least partially extending in the through hole, and an air channel is defined between the extension arm and the through hole, to provide a path for air to enter the liquid storage cavity.

[0025] In some specific embodiments, the end support member may be an end cap component of the atomizer.

[0026] According to a third aspect, an embodiment of this application further provides an electronic atomization

device, including an atomizer configured to atomize a liquid substrate to generate an aerosol, and a power supply device configured to supply power to the atomizer. The atomizer includes the atomizer described above.

[0027] In the atomizer, the holder at least partially extends into the cylindrical heating element, to provide support for the heating element.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] One or more embodiments are exemplarily described with reference to the corresponding figures in the accompanying drawings, and the descriptions do not constitute a limitation to the embodiments. Components in the accompanying drawings that have same reference numerals are represented as similar components, and unless otherwise particularly stated, the figures in the accompanying drawings are not drawn to scale.

FIG. 1 is a schematic diagram of an electronic atomization device according to an embodiment;

FIG. 2 is a schematic diagram of an embodiment of an atomizer in FIG. 1;

FIG. 3 is a schematic exploded view of the atomizer in FIG. 2 from an angle;

FIG. 4 is a schematic exploded view of the atomizer in FIG. 2 from another angle;

FIG. 5 is a schematic cross-sectional view of the atomizer in FIG. 2 from an angle;

FIG. 6 is a schematic exploded view of a heating element and a holder in FIG. 3 before assembly from another angle;

FIG. 7 is a schematic diagram of the heating element and the holder in FIG. 6 after assembly;

FIG. 8 is a schematic diagram of the heating element in FIG. 7 wrapped with a liquid guide element;

FIG. 9 is a schematic diagram of a lead fastener assembled in the holder in FIG. 8;

FIG. 10 is a schematic diagram of the liquid guide element in FIG. 9 further sleeved with a tubular element;

FIG. 11 is a schematic exploded view of a heating element and a holder before assembly according to another embodiment;

FIG. 12 is a schematic diagram of the heating element and the holder in FIG. 11 after assembly;

FIG. 13 is a schematic exploded view of a heating element, a holder, and a fastening base before assembly according to another embodiment;

FIG. 14 is a schematic diagram of the heating element and the holder in FIG. 13 after assembly;

FIG. 15 is a schematic diagram of the holder further assembled with a fastening base in FIG. 14;

FIG. 16 is a schematic diagram of the heating element further wrapped a liquid guide element and sleeved with a tubular element in FIG. 15;

FIG. 17 is a schematic diagram of the tubular element in FIG. 16 after assembly;

FIG. 18 is a schematic diagram of an end cap in FIG. 3 from another angle; and

FIG. 19 is a schematic diagram of an air channel defined between the end cap and a sealing base in FIG. 18.

DETAILED DESCRIPTION

[0029] For ease of understanding of this application, this application is described in further detail below with reference to the accompanying drawings and specific embodiments.

[0030] An embodiment of this application provides an electronic atomization device. Referring to FIG. 1, the electronic atomization device includes an atomizer 100 for storing a liquid substrate and atomizing the liquid substrate to generate an aerosol, and a power supply mechanism 200 for supplying power to the atomizer 100.

[0031] In an optional embodiment, as shown in FIG. 1, the power supply mechanism 200 includes: a receiving cavity 270, arranged on an end along a length direction and configured to receive and accommodate at least a part of the atomizer 100; and a first electrical contact 230, at least partially exposed in the receiving cavity 270, configured to be electrically connected to the atomizer 100 to supply power to the atomizer 100 when at least a part of the atomizer 100 is received and accommodated in the power supply mechanism 200.

[0032] According to a preferred embodiment shown in FIG. 1, a second electrical contact 21 is arranged on an end portion of the atomizer 100 opposite to the power supply mechanism 200 along the length direction, so that when at least a part of the atomizer 100 is received in the receiving cavity 270, the second electrical contact 21 is in contact with and abuts against the first electrical contact 230 to conduct electricity.

[0033] A seal element 260 is arranged in the power supply mechanism 200, and at least a part of an internal space of the power supply mechanism 200 is separated through the seal element 260 to form the receiving cavity 270. In the preferred embodiment shown in FIG. 1, the sealing member 260 is constructed to extend along a longitudinal direction perpendicular to the power supply mechanism 200, and is preferably made by a flexible material such as silica gel, to prevent the liquid substrate seeping from the atomizer 100 to the receiving cavity 270 from flowing to a controller 220, a sensor 250, and other components inside the power supply mechanism 200.

[0034] In the preferred embodiment shown in FIG. 1, the power supply mechanism 200 further includes: a battery cell 210, located at another end facing away from the receiving cavity 270 along a length direction, and configured to supply power; and a controller 220, arranged between the battery cell 210 and the receiving cavity 270, and the controller 220 operably guides a current between the battery cell 210 and the first electrical contact 230.

[0035] During use, the power supply mechanism 200

includes a sensor 250, configured to sense an inhalation flow generated by the atomizer 100 during inhalation, so that the controller 220 controls the battery cell 210, based on a detection signal of the sensor 250, to supply power to the atomizer 100.

[0036] Further, in the preferred embodiment shown in FIG. 1, a charging interface 240 is arranged on another end of the power supply mechanism 200 facing away from the receiving cavity 270, and is configured to supply power to the battery cell 210.

[0037] The embodiments in FIG. 2 to FIG. 5 are schematic structural diagrams of the atomizer 100 in FIG. 1 according to an embodiment. The atomizer 100 includes: a main housing 10. As shown in FIG. 2 to FIG. 3, the main housing 10 is substantially in a flat cylindrical shape. The main housing 10 has a proximal end 110 and a distal end 120 opposite to each other along a length direction. According to a common use requirement, the proximal end 110 is configured as an end for a user to inhale an aerosol. The proximal end 110 is provided with an inhalation port A for the user to inhale. The distal end 120 is used as an end combined with the power supply mechanism 200. The distal end 120 of the main housing 10 is an open end on which a detachable end cap 20 is mounted. The open end structure is configured to mount necessary functional components inside the main housing 10.

[0038] Further, in the specific embodiments shown in FIG. 2 to FIG. 5, the second electrical contact 21 penetrates into the atomizer 100 from a surface of the end cap 20, to at least partially exposed on the end cap 20/atomizer 100/distal end 120. When the atomizer 100 is received in the receiving cavity 270 of the power supply mechanism 200, the second electrical contact 21 may be in contact with the first electrical contact 230 to conduct electricity. In addition, the end cap 20 is further provided with a first air inlet 23 for external air to enter into the atomizer 100 during inhalation.

[0039] Further, referring to FIG. 3 to FIG. 5, the interior of the main housing 10 is provided with a liquid storage cavity 12 configured to store the liquid substrate and an atomization assembly configured to absorb the liquid substrate from the liquid storage cavity 12 and heat and atomize the liquid substrate. The atomization assembly generally includes a capillary liquid guide element 30 configured to absorb the liquid substrate and a heating element 40 combined on the liquid guide element 30. The heating element 40 heats at least a part of the liquid substrate of the liquid guide element 30 during energization, to generate the aerosol. In an optional embodiment, the liquid guide element 30 includes flexible fibers, such as cotton fibers, non-woven fabrics, or fiberglass cords, or includes porous materials with a micro-porous structure, for example, porous ceramics. The heating element 40 may be combined on the liquid guide element 30 by printing, deposition, sintering, or physical assembly, or wound around the liquid guide element 30.

[0040] Further, in the specific embodiments shown in FIG. 3 to FIG. 5, the interior of the main housing 10 is

provided with an air tube 13 extending from the proximal end 110 toward the distal end 120 and a tubular element 11 extending along the longitudinal direction, spaced apart from the air tube 13, and connected to the air tube 13. After assembly, the air tube 13 and the tubular element 11 jointly define an output channel for outputting the aerosol.

[0041] In the specific embodiment shown in FIG. 5, the tubular element 11 is an independent component, and is preferably made of a thin rigid material, such as ceramic or stainless steel. The air tube 13 is integrally molded with the main housing 10 by using a moldable material.

[0042] After assembly, the liquid storage cavity 12 configured to store the liquid substrate is defined between an outer surface of the air tube 13, an outer surface of the tubular element 11, and an inner wall of the main housing 10, that is, the tubular element 11 at least partially defines the liquid storage cavity 12.

[0043] In the embodiments shown in FIG. 3 to FIG. 5, the liquid storage cavity 12 defined in the main housing 10 is closed by the main housing 10 at the proximal end 110. An end portion of the liquid storage cavity 12 toward the distal end 120 is open. Further, as shown in FIG. 3 to FIG. 5, the atomizer 100 further includes:

a flexible sealing base 60, configured to close the open end of the liquid storage cavity 12 toward the distal end 120, and configured to provide sealing between the end cap 20 and the main housing 10, to prevent the liquid substrate from seeping out. In a specific structure, referring to FIG. 3 to FIG. 5, the flexible sealing base 60 includes:

a peripheral side wall 610 and a sealing part 620 located in the peripheral side wall 610. There is a spacing space 630 between the sealing part 620 and the peripheral side wall 620. The spacing space 630 is open toward a side facing the end cap 20. During assembly, the end cap 20 is inserted into or extends into the spacing space 630 for assembly. After assembly, the peripheral side wall 610 partially surrounds or encloses the end cap 20, and is supported by the end cap 20 from the inside, to provide sealing between the end cap 20 and the main housing 10. After assembly, the sealing part 620 extends into or is accommodated in the end cap 20.

[0044] The sealing base 60 is provided with a contact hole 62 penetrating into the sealing base along an axial direction or a longitudinal direction. After assembly, the second electrical contact 21 penetrates into or extends into the contact hole 62. As shown in FIG. 5, after assembly, the second electrical contact 21 extends to the liquid storage cavity 12 after penetrating into the contact hole 62. Preferably, the second electrical contact 21 is flush with a surface of the sealing base 60. The second electrical contact 21 does not protrude or recess relative to the surface of the sealing base 60.

[0045] Further, referring to FIG. 3 to FIG. 5, the tubular element 11 is assembled with an atomization assembly, and the tubular element 11 is provided with several liquid guide holes 111 spaced apart along the circumferential

direction, for the liquid storage cavity 12 to enter. Therefore, the atomization assembly is in fluid communication with the liquid storage cavity 12 through the liquid guide hole 111 to receive the liquid substrate.

[0046] Further, referring to FIG. 3 to FIG. 5, the atomization assembly includes:

the liquid guide element 30, flexible in the embodiments, for example, made of flexible fibers such as cotton fibers, non-woven fabrics, or sponges. The liquid guide element 30 is constructed in an annular shape arranged along the longitudinal direction of the main housing 10. The liquid guide element 30 is coaxial with the tubular element 11 and located in the tubular element 11.

[0047] During embodiment, an outer surface of the liquid guide element 30 along a radial direction blocks or communicates with the liquid guide hole 111, so that the outer surface of the liquid guide element 30 is configured as a liquid absorbing surface, to receive and absorb the liquid substrate in the liquid storage cavity 12 through the liquid guide hole 111. An inner surface of the liquid guide element 30 along the radial direction is configured as an atomization surface, and the atomization surface is combined with/attached to/abuts against the heating element 40, so that after being transferred to the atomization surface, the liquid substrate is heated and atomized by the heating element 40 to generate and release the aerosol. The liquid guide element 30 extends along the axial direction of the heating element 40 and surrounds the heating element 40, and is configured to conduct the liquid substrate in the liquid storage cavity 12 to the heating element 40.

[0048] Further, referring to FIG. 3 to FIG. 6, in the embodiments, the heating element 40 is constructed to extend along the longitudinal direction of the main housing 10/liquid guide element 30. The heating element 40 is arranged co-axially with the liquid guide element 30. In some optional embodiments, the heating element 40 is a resistive heating mesh, a resistive heating coil, or the like. In the embodiments, the heating element 40 is a heating element wound by a sheet-shaped or mesh-shaped substrate, that is, the heating element 40 is wound by a sheet material. The wound heating element 40 is in a non-closed tubular shape along the circumferential direction, and is in a cylindrical shape with a side opening 45 along the longitudinal direction. The heating element 40 includes electrode parts 41 located at two sides of the side opening 45, a mesh-shaped resistive heating part 42 extending between the electrode parts 41, and conductive leads 43 connected to the electrode parts 41. It is cleared that, there are two electrode parts 41 and two conductive leads 43, one being used as a positive end and the other being used as a negative end.

[0049] The resistive heating part 42 is in a mesh shape with mesh holes. The electrode parts 41 have no mesh holes.

[0050] Further, referring to FIG. 3 to FIG. 7, the heating element 40 is wound or fixed on the holder 50. Correspondingly, the sealing base 60 is further provided with a

holder hole 61 penetrating into the sealing base 60 along the longitudinal direction. The holder 50 is accommodated or mounted in the holder hole 61. It is cleared that, in a conventional embodiment, an inner diameter of the holder hole 61 is non-constant. Specifically, an inner diameter of the holder hole 61 close to the distal end 120 is less than an inner diameter away from the distal end 120. Therefore, there is an abutting step in the holder hole 61. After assembly, the holder 50 extends into the holder hole 61 from a side close to the liquid storage cavity 12 and then abuts against the step to form stop.

[0051] Further, as shown in FIG. 3 to FIG. 10, a shape or a structure of the holder 50 includes:

a support part 51, a support part 52, a support part 53, a support part 54, and a support part 55 arranged along the axial direction sequentially. The support part 51, the support part 53, the support part 54, and the support part 55 are all constructed in annular shapes, and are coaxially arranged. The support part 51 and the support part 53 have a same outer diameter and/or inner diameter. An outer diameter of the support part 54 is greater than an outer diameter of the support part 53, and an outer diameter of the support part 55 is greater than the outer diameter of the support part 54.

[0052] Because the outer diameter of the support part 54 is greater than the outer diameter of the support part 53, after assembly, an end surface of the heating element 40 abuts against an end surface of the support part 54. The support part 54 provides stop for the heating element 40. The support part 51, the support part 52, and the support part 53 may be first parts, and the support part 54 and the support part 55 may be second parts. It may be understood that, the holder 50 includes a first part surrounded by the heating element 40 and a second part exposed outside the heating element 40. The first part is configured to provide support for the heating element 40 from the inside of the heating element 40, and the second part abuts against the heating element 40 to provide stop.

[0053] Because the heating element 40 surrounds the first part, the heating element is made of a sheet material wound around the first part of the holder 50, that is, the heating element 40 is made of the sheet material wound around at least a part of the holder 50.

[0054] The support part 52 is an elongated shape extending along an axial direction of the holder 50, rather than an annular shape, and is further configured to connect the support part 51 to the support part 53 in addition to providing support.

[0055] In some embodiments, the holder 50 is made of an electrically insulating rigid material, for example, ceramic, PEEK, polytetrafluoroethylene, or a surface-insulated metal or alloy.

[0056] Further, referring to FIG. 6, the resistive heating part 42 of the heating element 40 includes a heating portion 421 located at a central part along the axial direction. The heating portion 421 mainly generates Joule heat when a direct current flows through the heating portion 421. The direct current substantially mainly

flows through the heating portion 421. The heating portion 421 is constructed in a mesh shape with mesh holes.

[0057] The resistive heating part 42 further includes a first tooth portion or wing portion 422 extending from the heating portion 421 toward an upper end along the axial direction. The resistive heating part 42 further includes a second tooth portion or wing portion 423 extending from the heating portion 421 toward a lower end along the axial direction. The upper end and the lower end are a first end and a second end of the heating element 40 respectively. The first tooth portion or wing portion 422 terminates at the upper end of the heating element 40, and a plurality of first tooth portions or wing portions are provided and discrete from each other. The second tooth portion or wing portion 423 terminates at the lower end of the heating element 40, and a plurality of second tooth portions or wing portions are provided and discrete from each other. During power supply, a current flows less through the first tooth portion or wing portion 422 and the second tooth portion or wing portion 423, and the first tooth portion or wing portion 422 and the second tooth portion or wing portion 423 are substantially less Joule heated, so that a heating region of the resistive heating part 42 is mainly located at the heating portion 421.

[0058] Correspondingly, during assembly, the first tooth portion or wing portion 422 surrounds and is combined on the support part 51 of the holder 50, and the second tooth portion or wing portion 423 surrounds and is combined on the support part 53 of the holder 50. After assembly, the first tooth portion or wing portion 422 is configured as a first joint portion combined on the holder 50, and the second tooth portion or wing portion 423 is configured as a second joint portion combined on the holder 50. It may be understood that, the first joint portion and the second joint portion are located at the first end and the second end of the heating element 40 respectively. After assembly, the support part 51 and the support part 53 of the holder 50 are supported from the inside at two ends of the heating element 40 respectively, and the main heating portion 421 of the heating element 40 is exposed in the air channel. In other words, the holder 50 is at least partially surrounded by the heating element 40 to be positioned inside the heating element 40, and is configured to at least partially provide support for the heating element 40 from the inside of the heating element 40. After assembly, the holder 50 substantially avoids the main heating portion 421, which is beneficial to preventing a large amount of heat of the heating element 40 from being transferred to the holder 50.

[0059] Alternatively, in some other variant embodiments, the heating element 40 is in a tubular shape, includes an annular first joint portion at the upper end along the axial direction, and is configured to surround and be combined on the support part 51 of the holder 50. The lower end of the heating element 40 along the axial direction includes an annular second joint portion, and is configured to surround and be combined on the support part 53 of the holder 50. The heating element 40 further

includes a heating portion extending between the first joint portion and the second joint portion. The heating portion is mainly configured to perform resistive heating. The support part 51 is a first support part, and the support part 53 is a second support part. In the foregoing content, the support part 51 and the support part 53 are both annular. The first joint portion is configured to surround and be combined on the support part 51, the second joint portion is configured to surround and be combined on the support part 53, and the heating element 40 further includes a heating portion extending between the first joint portion and the second joint portion. Therefore, it may be understood that, the first support part is arranged to provide support for the heating element 40 from the inside at a first end close to the heating element 40, and the second support part is arranged to provide support for the heating element from the inside at a second end close to the heating element 40. Similarly, the heating portion may be in a spiral wire structure or in a mesh shape. After assembly, the holder 50 avoids the heating portion, and the heating portion is exposed in a hollow of the holder 50, so that the heating portion is exposed in the airflow channel.

[0060] A process of supporting and assembling the heating element 40, the liquid guide element 30, and the tubular element 11 in the holder 50 includes the following steps.

[0061] S10: An unwound/flat unwound heating element 40 is wound around the support part 51, the support part 52, and the support part 53, as shown in FIG. 7. It is cleared that, after winding, an extension length of the heating element 40 extends from the support part 51 to the support part 53. After winding, the support part 51 provides support for the heating element 40 from the inside at the upper end of the heating element 40. The support part 53 provides support for the heating element 40 from the inside at the lower end of the heating element 40. After winding, the electrode parts 41 of the heating element 40 abut against the support part 42. After winding, the support part 42 extends into the side opening 45 between the electrode parts 41. The support part 42 is a third support part. The third support part is at least partially located in the side opening of the heating element 40 to provide support for the heating element 40. After assembly, the lower end of the heating element 40 abuts against the support part 44.

[0062] Referring to FIG. 7 and FIG. 6, a surface of the support part 51 is provided with a lead groove 56, and a surface of the support part 53 is provided with a lead groove 57. The lead groove 56 and the lead groove 57 extend along the axial direction of the holder 50 and are close to the support part 52. The holder 50 is further provided with a lead hole 58 penetrating into the support part 54 and the support part 55. After assembly, the conductive leads 43 of the heating element 40 are retained in the lead groove 56 and the lead groove 57, and extend to the outside of the support part 55 after penetrating into the lead hole 58.

[0063] S20: The liquid guide element 30 is further wrapped, wound, or sleeved outside the heating element 60 in FIG. 7, as shown in FIG. 8. The liquid guide element 30 may be wound by a closed annular flexible fiber, or by a flexible fiber strip. A lower end of the liquid guide element 30 abuts against the support part 44.

[0064] S30: A lead fastener 70 is further mounted on a lower end of the holder 50 in FIG. 8, to fasten or abut the conductive leads 43 against an inner wall of the support part 45, to prevent the conductive leads 43 from bending, entangling, or contacting to cause a short circuit or the like. As shown in FIG. 9, the lead hole 58 is at least partially formed on an inner surface of the support part 55.

[0065] S40: The tubular element 11 is further sleeved outside the liquid guide element 30 in FIG. 9, to form an assembled state in FIG. 10. As shown in FIG. 10, a lower end of the tubular element 11 surrounds and is sleeved on the support part 54, and abuts against the support part 55 to form support and stop, that is, the tubular element 11 abuts against the holder 50 to be stopped. In addition, the holder 50 is further provided with a positioning protrusion 541, which may also be referred to as a positioning clamping protrusion, extending from the support part 55 toward the support part 54. The lower end of the tubular element 11 is provided with a positioning notch 112, which may also be referred to as a first notch, groove, or hole. During assembly, the positioning protrusion 541 cooperates with the positioning notch 112, to provide positioning. After assembly, the positioning protrusion 541 and the positioning notch 112 cooperate to prevent rotation of the tubular element 11 relative to the holder 50. In other words, the holder 50 is provided with the positioning clamping protrusion extending into the first notch, groove, or hole, to prevent the tubular element 11 from rotating relative to the holder 50.

[0066] Alternatively, in some other variant embodiments, the positioning notch 112 may be a positioning groove, a positioning hole, or the like that provides positioning and prevents rotation.

[0067] Further referring to FIG. 10, in an assembled module, the liquid guide hole 111 of the tubular element 11 is opposite to the resistive heating part 42 of the heating element 40 along the radial direction. The support strength of the resistive heating part 42 of the heating element 40 is stronger at the part of the liquid guide element 30 opposite to the liquid guide hole 111, to better control liquid transfer.

[0068] Further, in FIG. 10, the tubular element 11, the atomization assembly, the holder 50, and the lead fastener 70 are assembled into a module, which is beneficial for modular production and assembly of the atomizer 100. Then, the assembled module in FIG. 10 extends into the holder hole 61 of the sealing base 60 to be fixed. Further, after the module in FIG. 10 is assembled with the sealing base 60, the conductive leads 43 pass through the holder hole 61 to the outside of the sealing base 60, and are bent into the contact hole 62 to contact with the second electrical contact 21 or welded to conduct elec-

tricity.

[0069] Further, according to a preferred embodiment shown in FIG. 10, the liquid guide element 30 made of flexible fibers or sponges is squeezed or compressed by the tubular element 11 and the heating element 40/holder 50 from the inside and the outside, so that the liquid guide element 30 is stably limited and retained between the tubular element 11 and the heating element 40/holder 50. In other words, the liquid guide element 30 is radially squeezed or compressed between the tubular element 11 and the heating element 40. The liquid guide element 30 may be entirely squeezed or compressed, or may be partially squeezed or compressed as long as the liquid guide element 30 is stably limited and retained between the tubular element 11 and the heating element 40/holder 50. In addition, because the tubular element 11 squeezes the liquid guide element 30 inward, it can be learned that, the tubular element 11 is constructed to surround and retain the liquid guide element 30.

[0070] Further, referring to FIG. 4 and FIG. 5, after assembly, the lower end of the tubular element 11 is at least partially inserted into the holder hole 61 with the holder 50. An upper end of the tubular element 11 is further provided with a positioning notch 113, for the air tube 13 to be inserted from the upper end of the tubular element 11 and cooperate with the positioning notch 113 to implement positioning. In a preferred embodiment, the air tube 13 is inserted into the tubular element 11 by riveting, tight fitting, or the like, so that the air tube 13 and the tubular element 11 are tightly combined and sealed. This is beneficial to preventing the liquid substrate from seeping between the air tube and the tubular element.

[0071] During inhalation after assembly, referring to an arrow R2 in FIG. 5, air entering through the air inlet 23 of the end cap 20 enters the hollow of the holder 50 through the holder hole 61 of the sealing base 60, passes through the holder 50, and then carries the aerosol released by the atomization surface, and is outputted from the tubular element 11 and the air tube to the inhalation port A to be inhaled. The hollow is the airflow channel. During inhalation, the airflow path or the airflow channel passes through the holder 50. It is cleared that, the airflow path or the airflow channel also passes through the tubular, annular, or wound cylindrical liquid guide element 30. The airflow path or the airflow channel passes through the tubular, annular, or wound cylindrical heating element 40. In other words, the air inlet 23, the inhalation port A, and the airflow channel are arranged to define the airflow path from the air inlet 23 to the inhalation port A through the heating element 40.

[0072] Further, FIG. 11 is a schematic diagram of a holder 50a for support and assembly according to another embodiment. In the variable embodiments, a structure of the holder 50a includes:

a support part 51a, a support part 52a, a support part 53a, and a support part 54a sequentially arranged along the axial direction. The support part 51a, the support part

53a, and the support part 54a are all constructed in annular shapes, and are co-axially arranged. An outer diameter of the support part 51a is the same as an outer diameter of the support part 53a. An outer diameter of the support part 54a is greater than the outer diameter the support part 53a. The support part 52a is in an elongated shape extending between the support part 51a and the support part 53a.

[0073] During assembly, the heating element 40 is combined on the support part 51a, the support part 52a, and the support part 53a by sleeving, winding, coiling, or wrapping. A state after winding is shown in FIG. 12. The support part 51a provides support for the heating element 40 from the inside at the upper end of the heating element 40. The support part 53a provides support for the heating element 40 from the inside at the lower end of the heating element 40. The support part 52a is used for the electrode parts 41 and the conductive leads 43 of the heating element 40 to abut against and be fixed.

[0074] A surface of the support part 51a is further provided with a lead groove 56a. A surface of the support part 53a is further provided with a lead groove 57a. A surface of the support part 54a is further provided with a lead groove 58a. After assembly, the conductive leads 43 are sequentially accommodated in and pass through the lead groove 56a, the lead groove 57a, and the lead groove 58a to be fixed.

[0075] Similarly, in FIG. 12, after the heating element 40 is assembled to the holder 50a, the liquid guide element 30 and the tubular element 11 may be further wrapped, sleeved, or wound, and then assembled into a module. The liquid guide element 30 surrounds and is wrapped around the heating element 40, and abuts against the support part 54a. Similarly, the surface of the support part 54a is provided with a positioning protrusion 541a, for the lower end of the tubular element 11 to abut against and be positioned during assembly.

[0076] Further, FIG. 13 is a schematic diagram of a holder 50b and a lead fastener 70b according to another embodiment. In the various embodiments, the holder 50b includes:

a support part 51b, a support part 52b, and a support part 53b sequentially arranged along the axial direction. The support part 51b and the support part 53b are co-axially positioned and in annular shapes with same outer diameters. The support part 52b is in an elongated shape extending between the support part 51b and the support part 53b.

[0077] During assembly, the heating element 40 is directly wrapped, wound, or sleeved on the holder 50a. Specifically, after assembly, referring to FIG. 14, the support part 51b provides support from the inside at the upper end of the heating element 40. The support part 53b provides support from the inside at the lower end of the heating element 40. The electrode parts 41 and the conductive leads 43 of the heating element 40 abut against the support part 52b.

[0078] A surface of the holder 50b is provided with a

lead groove 56a extending from the upper end to the lower end, to accommodate and assemble the conductive leads 43.

[0079] Further, as shown in FIG. 13 and FIG. 15, the lead fastener 70b is in an annular shape, and an inner diameter of the lead fastener is greater than an outer diameter of the support part 53b, so that the lead fastener 70b can surround or be sleeved outside the support part 53b. A surface of the support part 53b is provided with a positioning protrusion 531b extending outward along a radial direction. The lead fastener 70b is provided with a positioning notch 71b. After assembly, the positioning protrusion 531b extends from the inside of the positioning notch 71b to the outside of the positioning notch 71b along the radial direction, as shown in FIG. 15. After assembly, the lead fastener 70b restricts and fixes the conductive leads 43 accommodated and retained in the lead groove 56a on the surface of the holder 50b from the outside, to prevent the conductive leads 43 from falling out of the lead groove 56a.

[0080] After the assembly in FIG. 15, in FIG. 16 and FIG. 17, the heating element 40 is further sleeved, wrapped, or wound with the liquid guide element 30, and sleeved with the tubular element 11. During assembly, the positioning notch 112 at the lower end of the tubular element 11 cooperates with a part of the positioning protrusion 531b of the support part 53b extending out of the lead fastener 70b to abut against and be positioned. After assembly, a module shown in FIG. 17 is formed, and then the entire module is inserted into the holder hole 61 of the sealing base 60 to complete assembly with the sealing base 60.

[0081] Further, in another preferred embodiment, referring to FIG. 18 and FIG. 19, the end cap 20 is provided with an extension arm 24 extending along the longitudinal direction. The extension arm 24 protrudes relative to another part of the end cap 20. The extension arm 24 is substantially in an elongated cylindrical shape. The extension arm 24 has a length of approximately 3 mm to 8 mm and an outer diameter of approximately 1 mm to 3 mm. A surface of the extension arm 24 is provided with an air groove 241 extending along the axial direction. The air groove 241 has a width of approximately 0.3 mm to 1 mm and a depth of approximately 0.2 mm to 0.5 mm.

[0082] Correspondingly, the sealing base 60 is provided with a through hole 63 penetrating into or extending to an upper end surface. The upper end surface is a first surface for sealing or covering the open end of the liquid storage cavity 12. After assembly, the extension arm 24 is inserted into or extends into the through hole 63, and is defined between the air groove 241 and an inner surface of the through hole 63 to form the air channel for external air to enter the liquid storage cavity 12. Therefore, when a negative pressure in the liquid storage cavity 12 exceeds a threshold, external air entering through an air inlet hole 23 can enter into the liquid storage cavity 12 along the air channel defined by the air groove 241 as shown by an arrow R4 in FIG. 19, to relieve the negative pressure in

the liquid storage cavity 12.

[0083] In some other variant embodiments, the air groove 241 is formed on an inner wall surface of the through hole 63. Correspondingly, the air channel is defined between the air groove 241 on the inner wall surface of the through hole 63 and the extension arm 24.

[0084] It should be noted that, the specification of this application and the accompanying drawings thereof illustrate preferred embodiments of this application, but this application is not limited to the embodiments described in the specification. Further, a person of ordinary skill in the art may make improvements or variations according to the foregoing descriptions, and such improvements and variations shall all fall within the protection scope of the appended claims of this application.

Claims

1. An atomizer, comprising:

a liquid storage cavity, configured to store a liquid substrate;
a heating element, constructed in a cylindrical shape extending along a longitudinal direction of the atomizer, to heat the liquid substrate to generate an aerosol; and
a holder, at least partially surrounded by the heating element to be positioned inside the heating element, and configured to at least partially support the heating element from within the heating element.

2. The atomizer according to claim 1, wherein the heating element is made of a material sheet wound around at least a part of the holder.

3. The atomizer according to claim 1 or 2, further comprising:

an inhalation port; and
an air inlet and an airflow channel located between the air inlet and the inhalation port, wherein the air inlet, the inhalation port, and the airflow channel are arranged to define an airflow path from the air inlet to the inhalation port through the heating element, to transfer the aerosol to the inhalation port, and
the airflow channel at least partially passes through the holder along the longitudinal direction of the atomizer.

4. The atomizer according to claim 1 or 2, wherein the holder comprises a first part surrounded by the heating element and a second part exposed outside the heating element, the first part is configured to provide support for the heating element from the inside of the heating element, and the second part abuts against

the heating element to provide stop.

5. The atomizer according to claim 1 or 2, further comprising:

a liquid guide element, extending along an axial direction of the heating element and surrounding the heating element, and configured to conduct the liquid substrate in the liquid storage cavity to the heating element.

6. The atomizer according to claim 5, further comprising:

a tubular element, extending along the longitudinal direction of the atomizer, and at least partially defining the liquid storage cavity, wherein the tubular element is constructed to surround and retain the liquid guide element and abut against the holder to be stopped.

7. The atomizer according to claim 6, wherein the liquid guide element is flexible, and is at least partially radially squeezed or compressed between the tubular element and the heating element.

8. The atomizer according to claim 6, wherein:

the tubular element is provided with a first notch, groove, or hole; and
the holder is provided with a positioning clamping protrusion extending into the first notch, groove, or hole, to prevent the tubular element from rotating relative to the holder.

9. The atomizer according to claim 1 or 2, wherein:

the heating element comprises a first end and a second end facing away from each other along an axial direction; and
the holder comprises a first support part and a second support part spaced apart along a longitudinal direction, wherein:

the first support part is in an annular shape and is arranged to provide support for the heating element from the inside at a location close to the first end of the heating element; and
the second support part is in an annular shape and is arranged to provide support for the heating element from the inside at a location close to the second end of the heating element.

10. The atomizer according to claim 1 or 2, wherein the heating element defines a side opening extending along an axial direction, to enable the heating element to be non-closed along a circumferential direction.

11. The atomizer according to claim 10, wherein the holder further comprises a third support part extending along the longitudinal direction, and the third support part is at least partially located in the side opening of the heating element, to provide support for the heating element. 5
12. The atomizer according to claim 1 or 2, wherein:
- the heating element comprises a conductive lead for supplying power to the heating element; and 10
- an inner surface or an outer surface of the holder is provided with a lead groove, and the conductive lead is at least partially accommodated and retained in the lead groove. 15
13. The atomizer according to claim 12, further comprising:
- a lead fastener, at least a part of the lead fastener shielding or covering the conductive lead accommodated in the lead groove, to prevent the conductive lead from leaving the lead groove. 20
14. The atomizer according to claim 13, wherein the lead fastener is substantially constructed in an annular shape. 25
15. The atomizer according to claim 1 or 2, wherein the liquid storage cavity is provided with an open end, and the atomizer further comprises:
- a flexible sealing base, configured to cover the open end to seal the liquid storage cavity, wherein the sealing base accommodates and retains at least a part of the holder. 30
16. The atomizer according to claim 15, further comprising:
- an end support member, configured to support the sealing base, wherein: 40
- the sealing base comprises a first surface for sealing or covering the open end, and the sealing base is further provided with a through hole extending to the first surface; and 45
- the end support member is provided with an extension arm at least partially extending in the through hole, and an air channel is defined between the extension arm and the through hole, to provide a path for air to enter the liquid storage cavity. 50
17. The atomizer according to claim 16, wherein the air channel comprises an air groove provided on an outer surface of the extension arm and/or an inner surface of the through hole. 55
18. The atomizer according to claim 1 or 2, wherein the heating element comprises a first end and a second end facing away from each other along an axial direction, and the heating element further comprises:
- a heating portion, configured to generate Joule heat; 5
- a first tooth portion or wing portion, extending from the heating portion toward the first end and terminating at the first end; and
- a second tooth portion or wing portion, extending from the heating portion toward the second end and terminating at the second end, wherein the holder is arranged to provide support for the first tooth portion or wing portion and/or the second tooth portion or wing portion and avoid the heating portion.
19. The atomizer according to claim 3, wherein the heating element comprises a first end and a second end facing away from each other along an axial direction, and the heating element further comprises:
- a first joint portion combined on the holder, and located at the first end;
- a second joint portion combined on the holder, and located at the second end; and
- a heating portion, located between the first joint portion and the second joint portion along an axial direction, and configured to generate Joule heat, wherein the heating portion avoids the holder, and is exposed in the airflow channel.
20. An atomizer, comprising:
- a tubular element, constructed to extend along a longitudinal direction of the atomizer;
- a liquid storage cavity, at least partially defined by the tubular element, and configured to store a liquid substrate, wherein the liquid storage cavity is provided with an open end;
- a heating element, located in the tubular element, and configured to heat the liquid substrate to generate an aerosol;
- a flexible sealing base, configured to cover the open end to seal the liquid storage cavity, wherein the sealing base accommodates and surrounds at least a part of the tubular element; and
- an end support member, configured to support the sealing base, wherein the sealing base comprises a first surface for sealing or covering the open end, and the sealing base is further provided with a through hole extending to the first surface,
- wherein the end support member is provided with an extension arm at least partially extending in the through hole, and an air channel is defined between the extension arm and the through hole, to provide a path for air to enter the liquid

storage cavity.

- 21.** An electronic atomization device, comprising an atomizer configured to atomize a liquid substrate to generate an aerosol, and a power supply device configured to supply power to the atomizer, wherein the atomizer comprises the atomizer according to any one of claims 1 to 20.

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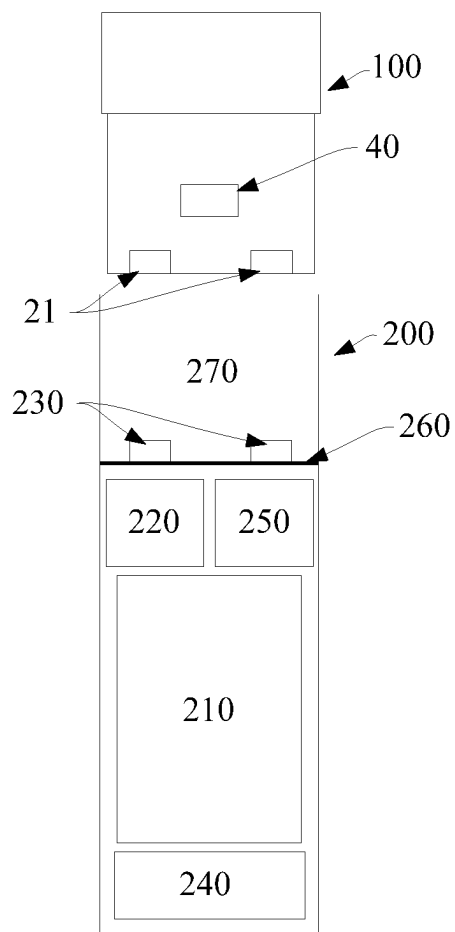


FIG. 1

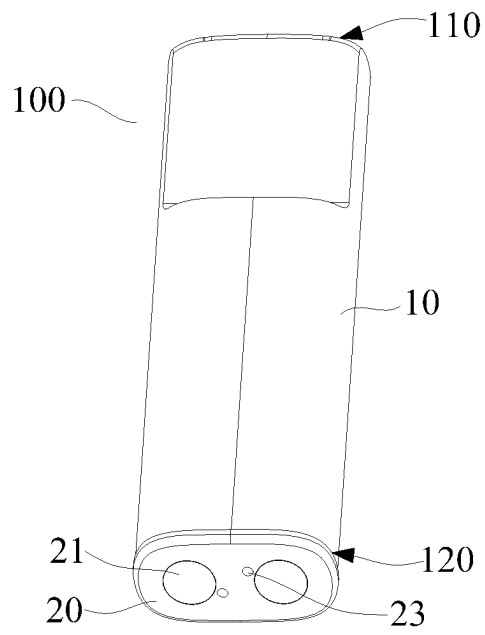


FIG. 2

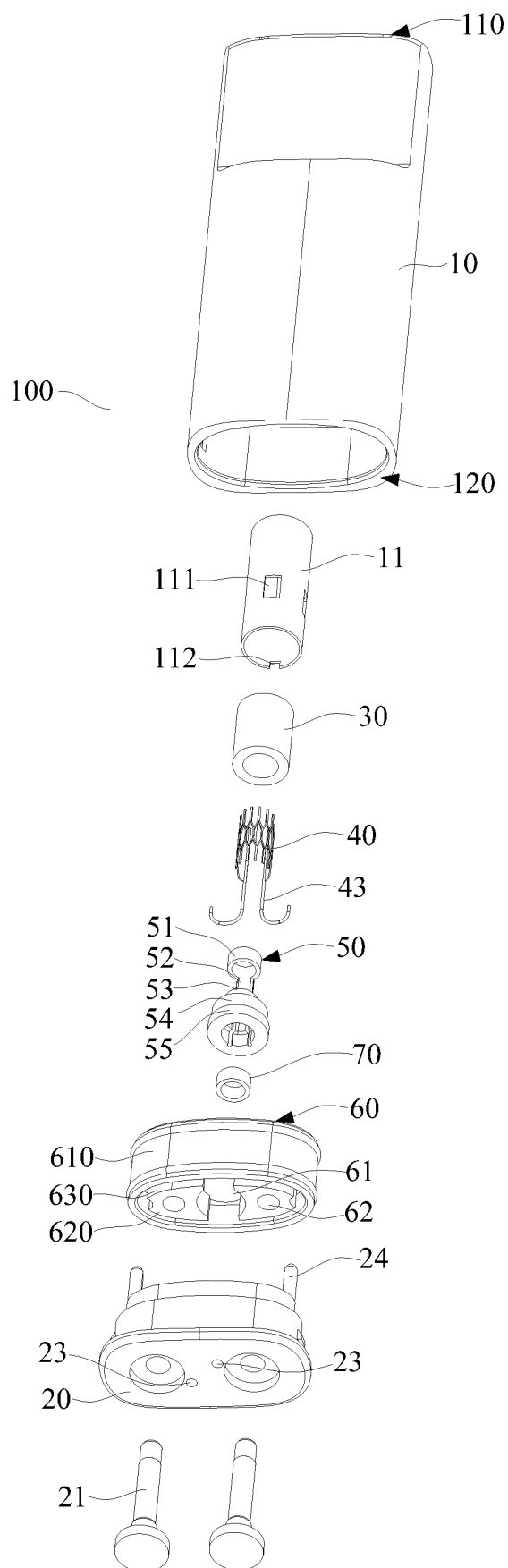


FIG. 3

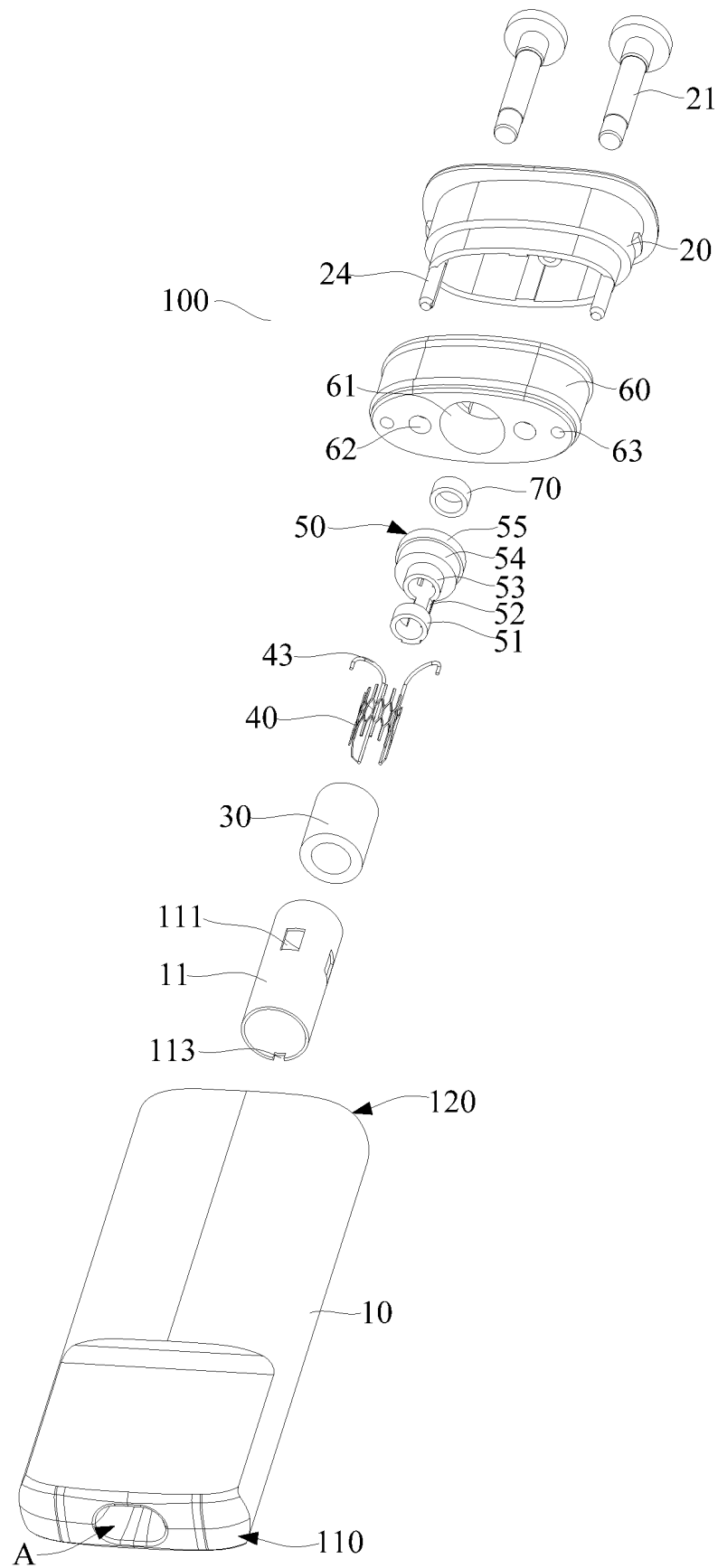


FIG. 4

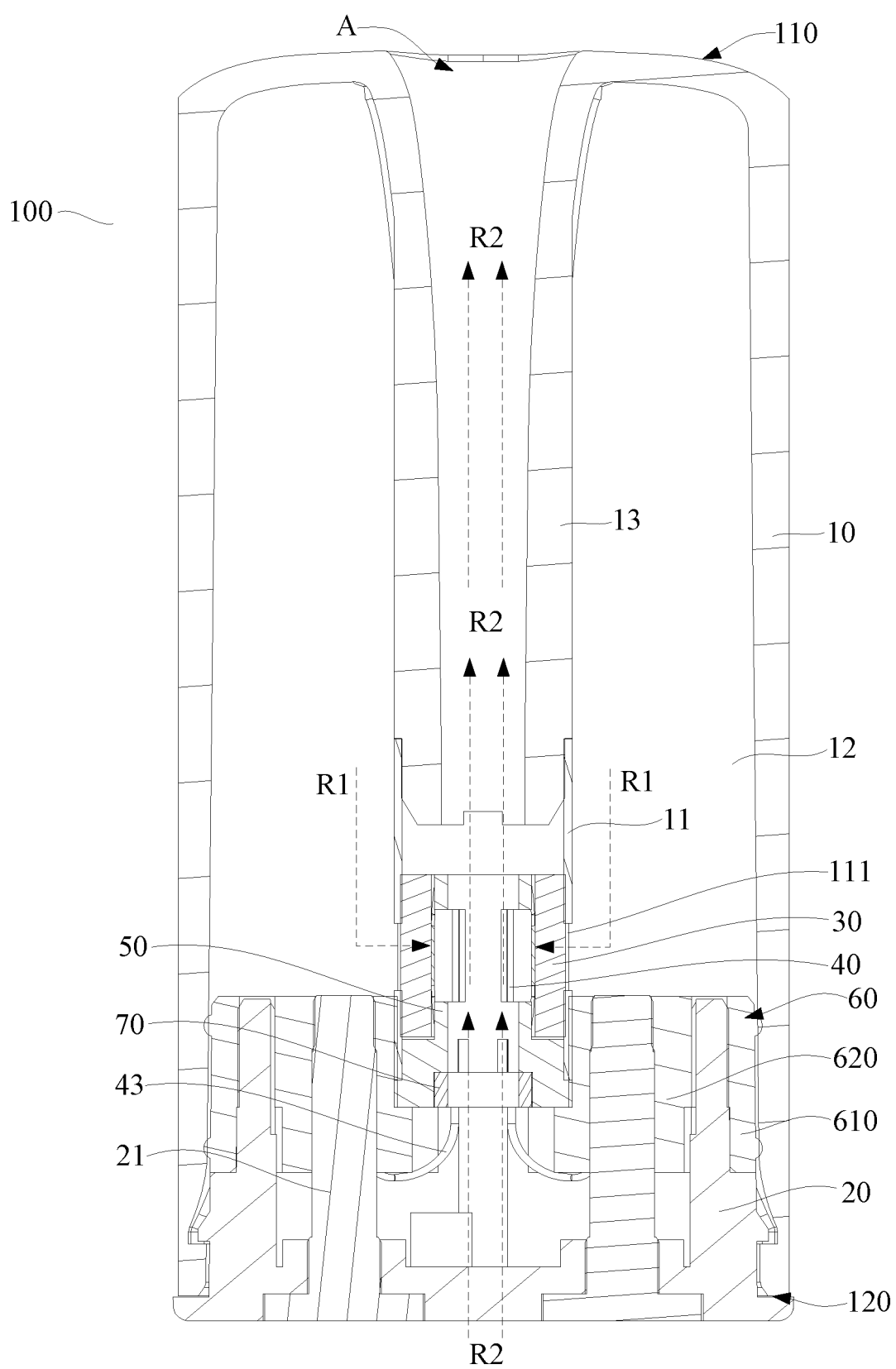


FIG. 5

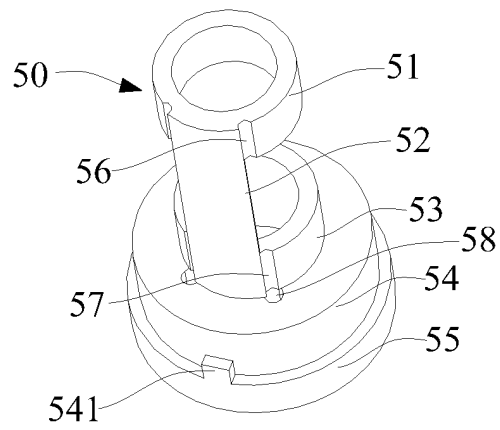
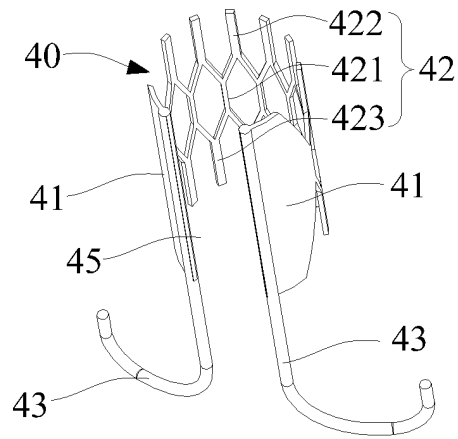


FIG. 6

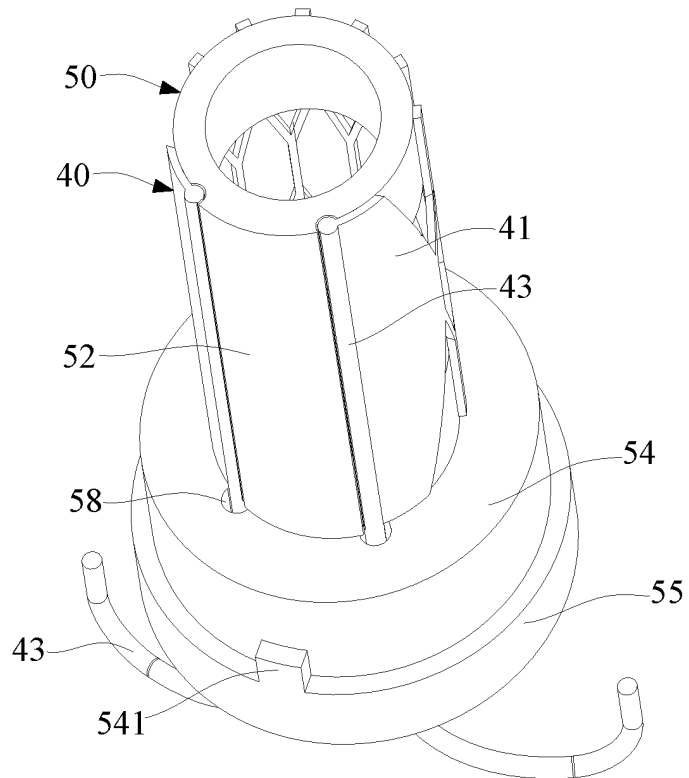


FIG. 7

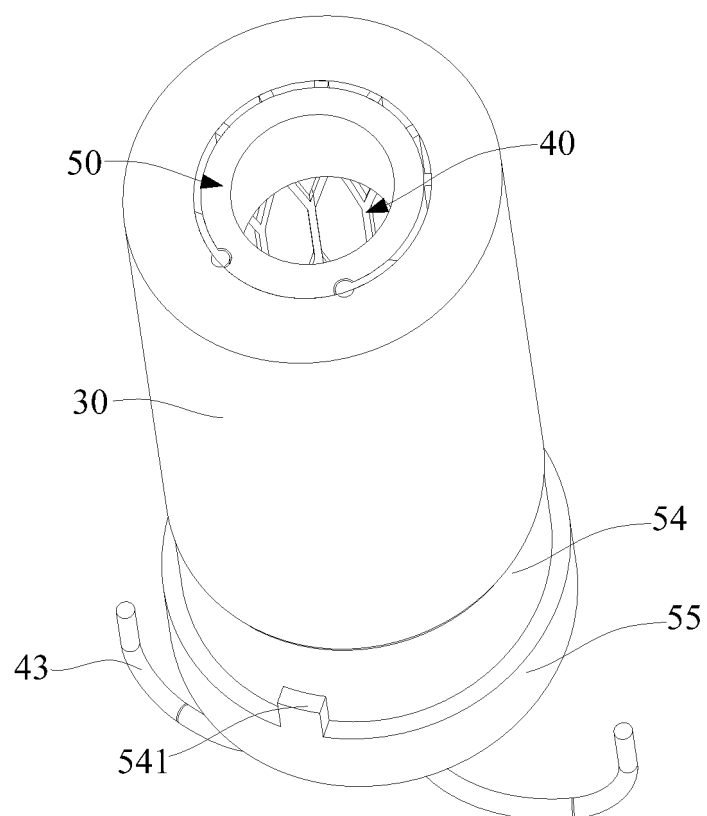


FIG. 8

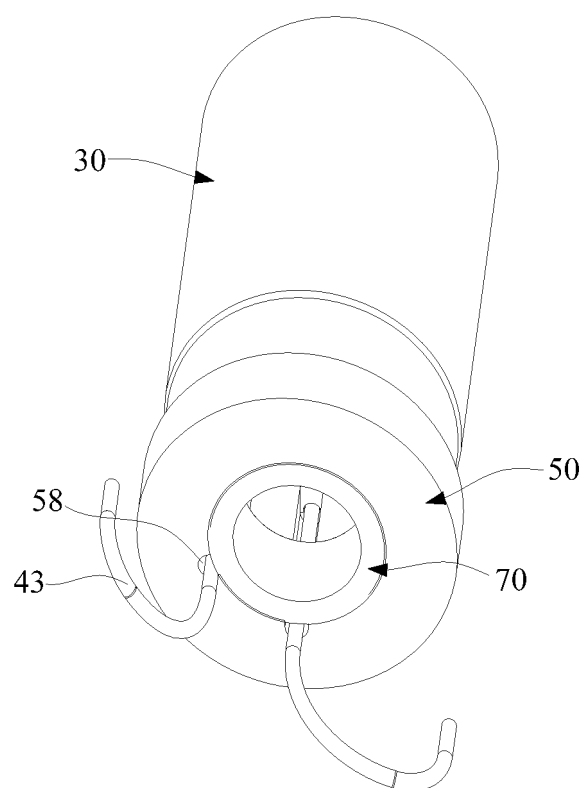


FIG. 9

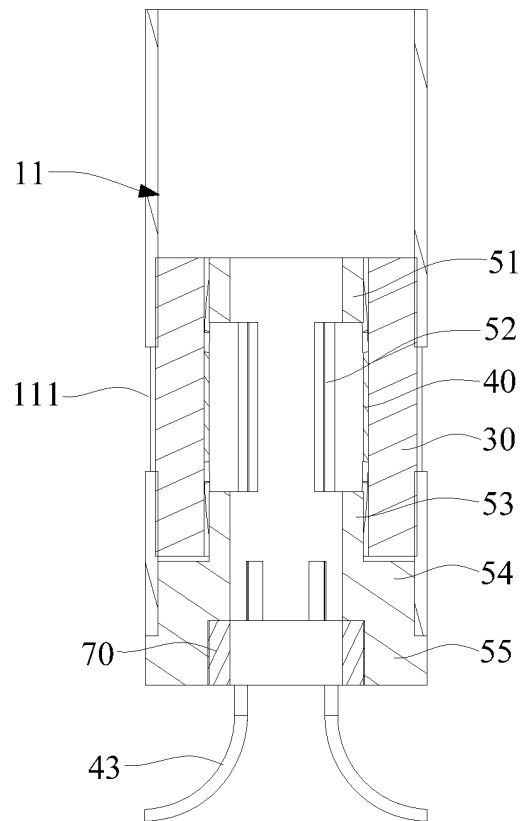


FIG. 10

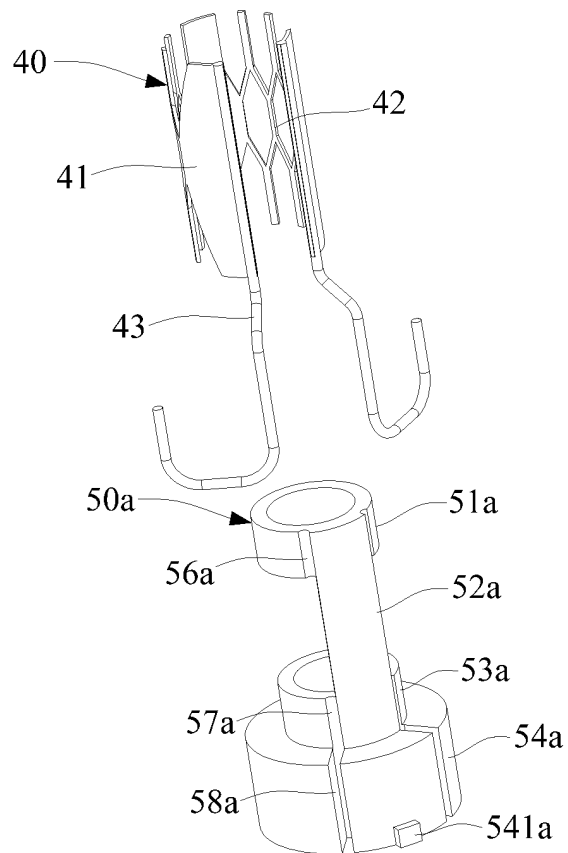


FIG. 11

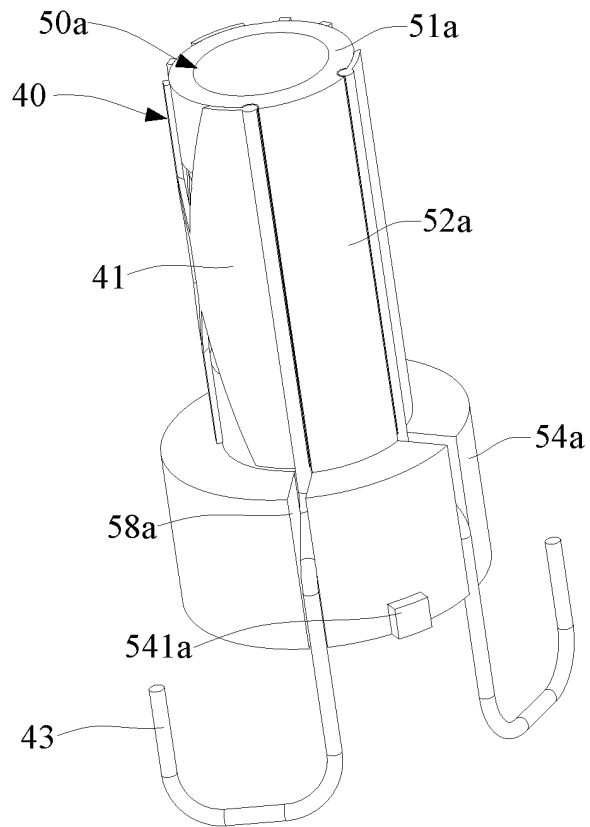


FIG. 12

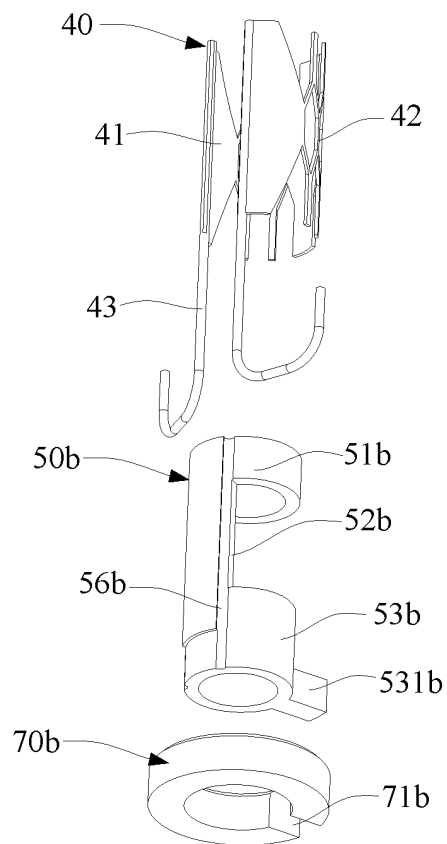


FIG. 13

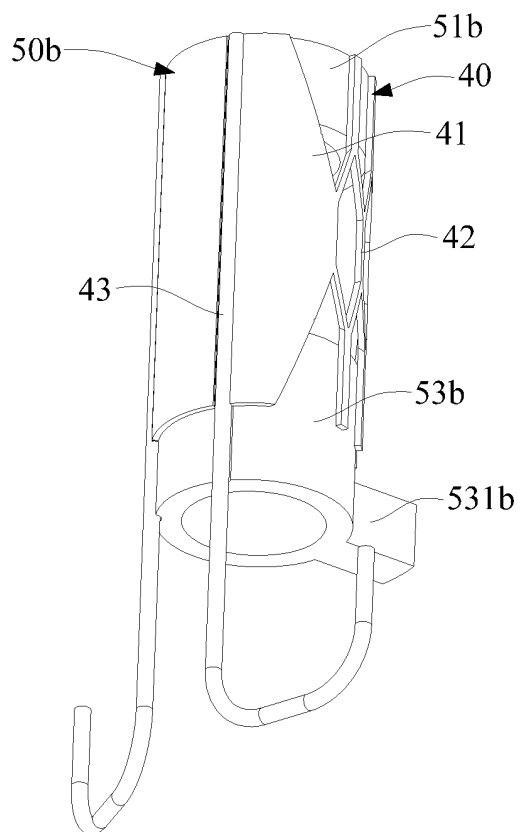


FIG. 14

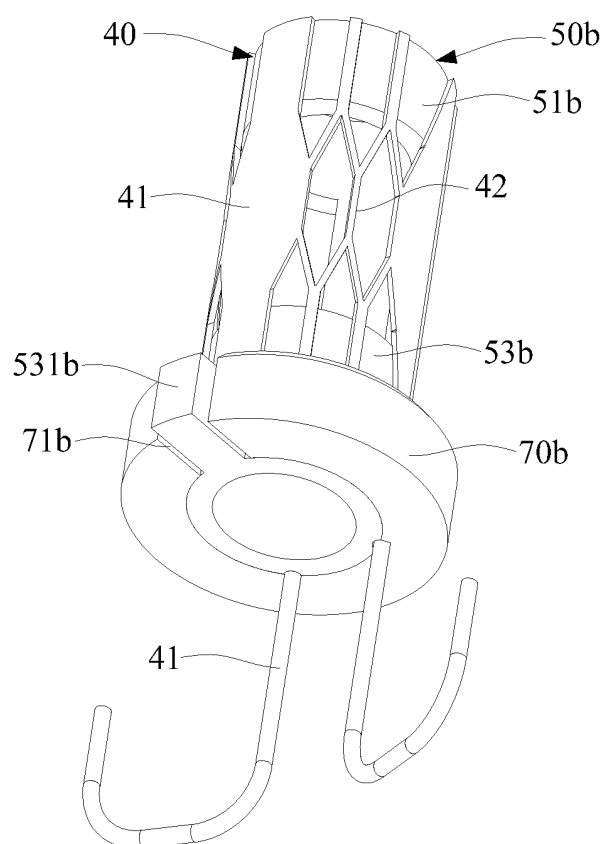


FIG. 15

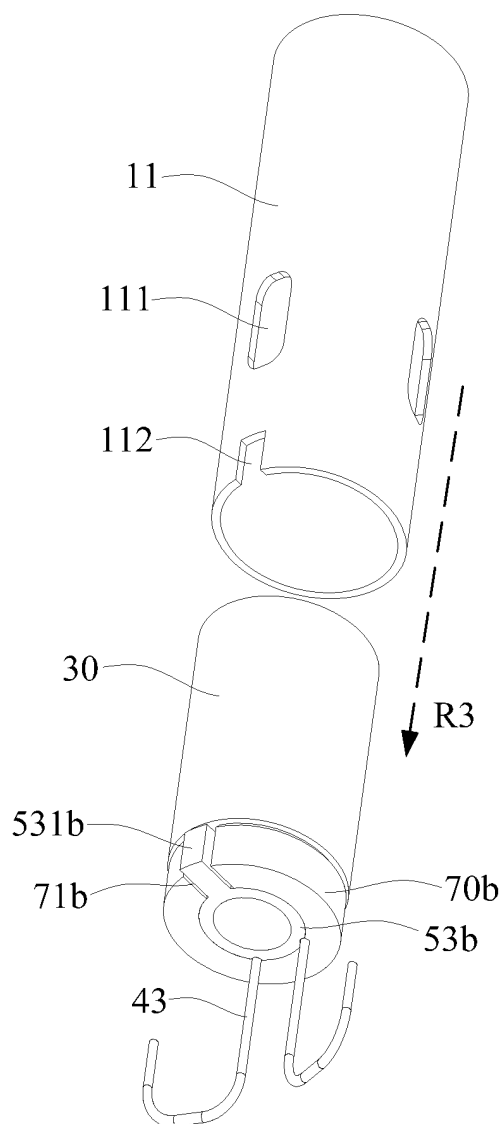


FIG. 16

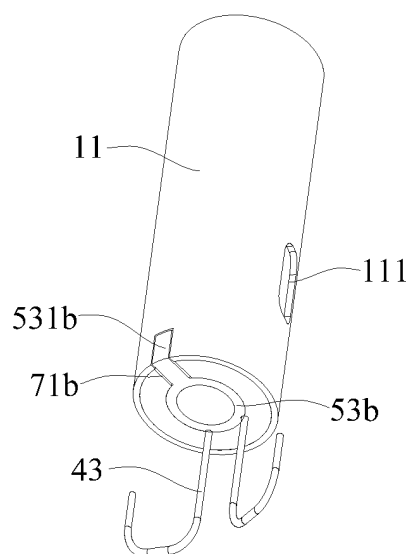


FIG. 17

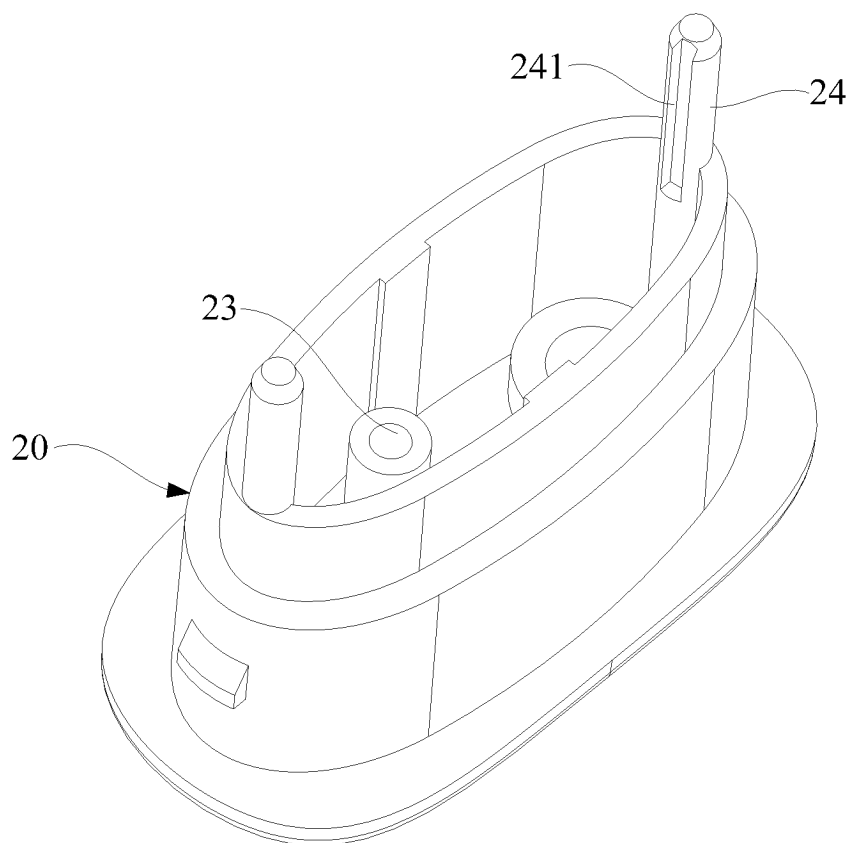


FIG. 18



FIG. 19

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2023/085541

A. CLASSIFICATION OF SUBJECT MATTER

A24F40/10(2020.01)i; A24F40/40(2020.01)i; A24F40/46(2020.01)i; A24F40/42(2020.01)i; A24F40/51(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; ENTXT; VEN: 雾化器, 加热, 发热, 筒状, 管状, 支撑, 支持, atomize, heat, cylinder, tube, support

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 217446658 U (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 20 September 2022 (2022-09-20) claims 1-21	1-21
X	CN 104522891 A (SHENZHEN SMOORE TECHNOLOGY LIMITED) 22 April 2015 (2015-04-22) description, pages 3-7, and figures 1-11	1-19, 21
Y	CN 215736911 U (DONGGUAN YIHI ELECTRONIC CO., LTD.) 08 February 2022 (2022-02-08) description, pages 4-7, and figures 1-9	20
Y	CN 215958315 U (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 08 March 2022 (2022-03-08) description, paragraphs 65-90, and figures 1-10	20
A	CN 113712268 A (SHENZHEN HUACHENGDA PRECISION INDUSTRY CO., LTD.) 30 November 2021 (2021-11-30) entire document	1-21

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

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“D” document cited by the applicant in the international application

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

14 July 2023

Date of mailing of the international search report

14 July 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/CN2023/085541

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 215347028 U (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 31 December 2021 (2021-12-31) entire document	1-21
A	CN 215936292 U (CHANGZHOU PAITENG ELECTRONIC TECHNOLOGY SERVICE CO., LTD.) 04 March 2022 (2022-03-04) entire document	1-21
A	US 2015305408 A1 (KIMREE HI-TECH INC.) 29 October 2015 (2015-10-29) entire document	1-21

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2023/085541

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The same features of independent claim 1 and independent claim 20 are "a liquid storage cavity, which is used for storing a liquid matrix; and a heating element, which is used for heating the liquid matrix to generate aerosol". The above-mentioned features are common means in the art. Therefore, claims 1 and 20 do not have a same or similar special technical feature, and thus claims 1 and 20 lack unity of invention.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

- Remark on Protest**
- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
 - ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
 - ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2023/085541

Patent document cited in search report			Publication date (day/month/year)		Patent family member(s)			Publication date (day/month/year)	
CN	217446658	U	20 September 2022		None				
CN	104522891	A	22 April 2015		None				
CN	215736911	U	08 February 2022		None				
CN	215958315	U	08 March 2022		None				
CN	113712268	A	30 November 2021		None				
CN	215347028	U	31 December 2021		None				
CN	215936292	U	04 March 2022		None				
US	2015305408	A1	29 October 2015		WO	2015161554	A1	29 October 2015	
					US	9955731	B2	01 May 2018	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202210357372 [0001]
- CN 202022447740 [0004]