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(54) **AEROSOL GENERATION APPARATUS AND INDUCTION COIL**

(57) An aerosol generation apparatus and an induction coil. The aerosol generation device includes: a chamber used to receive or store an aerosol generation substrate (A); an induction coil (50) used to generate a changing magnetic field; and a susceptor (30) configured to be penetrated by the changing magnetic field and generate heat, thereby heating the aerosol generation substrate (A) to generate an aerosol. The induction coil (30) is structured as a solenoid coil, and a cross section of a wire material forming the induction coil (50) has a first dimension extending along a radial direction and a second dimension extending along an axial direction, the first dimension being greater than the second dimension. The wire material of the induction coil (50) has a smaller or thinner size in the axial direction, and compared with a coil wound by a wire with a circular cross section, there are more coil turns or windings per unit length, which is beneficial to increasing the inductance value.

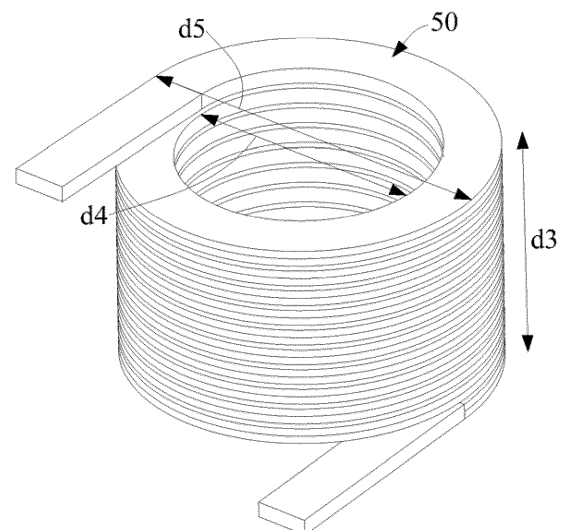


FIG. 2

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Application No. 202111351739.3, entitled "AEROSOL GENERATION APPARATUS AND INDUCTION COIL" filed on November 16, 2021 with the China National Intellectual Property Administration, which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] Embodiments of this application relate to the technical field of aerosol generation, and in particular, to an aerosol generation apparatus and an induction coil.

BACKGROUND

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

[0004] An example of this type of products is a heating apparatus that releases compounds by heating rather than burning materials. For example, the materials may be tobacco or other non-tobacco products. These non-tobacco products may include or not include nicotine. As a known heating apparatus, an induction coil is used to generate a magnetic field, which induces a susceptor to generate heat to heat the tobacco product to release compounds to generate an aerosol. In the known heating apparatus, the number of turns of the induction coil is limited by space or length, so the induction coil cannot have a high inductance value.

SUMMARY

[0005] An embodiment of this application provides an aerosol generation apparatus, including:

a chamber used to receive or store an aerosol generation substrate;
an induction coil used to generate a changing magnetic field; and
a susceptor configured to be penetrated by the changing magnetic field and generate heat, thereby heating the aerosol generation substrate to generate an aerosol, where
the induction coil is structured as a solenoid coil, and a cross section of a wire material forming the induction coil has a first dimension extending along a radial direction and a second dimension extending along an axial direction, the first dimension being greater than the second dimension.

[0006] Another embodiment of this application further

provides an induction coil, used to generate a changing magnetic field, where the induction coil is structured as a solenoid coil, and a cross section of a wire material forming the induction coil has a first dimension extending along a radial direction and a second dimension extending along an axial direction, the first dimension being greater than the second dimension.

[0007] In the foregoing aerosol generation apparatus, the wire material of the induction coil has a smaller or thinner size in the axial direction, and compared with a coil wound by a wire material with a circular cross section, there may be more coil turns or windings per unit length, which is beneficial to increasing the inductance value.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] 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 generation apparatus according to an embodiment;
FIG. 2 is a schematic diagram of an induction coil in FIG. 1 from a perspective;
FIG. 3 is a schematic cross-sectional diagram of an induction coil in FIG. 2 from a perspective;
FIG. 4 is a schematic diagram of an induction coil according to another embodiment;
FIG. 5 is a schematic diagram of an induction coil according to another embodiment;
FIG. 6 is a schematic diagram of an induction coil according to another embodiment;
FIG. 7 is a schematic diagram of an aerosol generation apparatus according to another embodiment;
FIG. 8 is a schematic diagram of an atomization assembly according to another embodiment.

DETAILED DESCRIPTION

[0009] For ease of understanding this application, this application is described in more detail below with reference to the accompanying drawings and specific embodiments.

[0010] An embodiment of this application provides an aerosol generation apparatus, whose structure may be shown with reference to FIG. 1 and which includes:

a chamber, where an aerosol generation substrate A is removably received in the chamber;
an induction coil 50 used to generate a changing magnetic field under an alternating current;
a susceptor 30, where at least a part of the susceptor extends in the chamber, and the susceptor is con-

figured to be inductively coupled to the induction coil 50, and be penetrated by the changing magnetic field to generate heat, to heat the aerosol generation substrate A such as a cigarette, so that at least a component of the aerosol generation substrate A is evaporated, to form an aerosol for inhalation; a cell 10, being a rechargeable direct current cell, and be capable of outputting a direct current; and a circuit 20, connected to the rechargeable cell 10 through a suitable current, and configured to convert the direct current outputted by the cell 10 into an alternating current with a suitable frequency and supply the alternating current to the induction coil 50.

[0011] Further, in an optional embodiment, the aerosol generation substrate A is preferably made of a tobacco-containing material that releases a volatile compound from a substrate when being heated, or a non-tobacco material suitable for electric heating and smoking after being heated. The aerosol generation substrate A is preferably made of a solid substrate. The solid substrate may include one or more of powders, particles, fragmented strips, strips, or flakes of one or more of vanilla leaves, tobacco leaves, homogeneous tobacco, and expanded tobacco. Alternatively, the solid substrate may include additional tobacco or non-tobacco volatile aroma compounds to be released when the substrate is heated.

[0012] In a more preferred embodiment, the frequency of the alternating current supplied by the circuit 20 to the induction coil 50 ranges from 80 KHz to 500 KHz; and more specifically, the frequency may be in a range of approximately 200 KHz to 300 KHz.

[0013] In a preferred embodiment, the direct-current voltage provided by the cell 10 ranges from about 2.5 V to about 9.0 V, and the direct current provided by the cell 10 ranges from about 2.5 A to about 20 A. The cell 10 is usually a rechargeable battery. As an alternative solution, the cell 10 may be a charge storage apparatus in another form, for example, a capacitor. The cell 10 may need to be recharged, and may have capacity allowing sufficient energy to be stored for one or more times of inhalation. For example, the cell 10 may have sufficient capacity to allow aerosol to be continuously generated in a time period of approximate six minutes or a time period of a multiple of six minutes. In another example, the cell 10 may have sufficient capacity to allow a predetermined quantity of inhalation or discontinuous starting of the susceptor 30.

[0014] In a preferred embodiment, the susceptor 30 is in a shape of a pin or a needle or a rod or a blade in general, which is conducive to insertion into the aerosol generation substrate A. In addition, the susceptor 30 may have a length of about 19 mm, a width of about 4 mm, and a thickness of about 0.5 mm, and may be made of stainless steel of level 430 (SS430). In an alternative embodiment, the susceptor 30 may have a length of about 15 mm, a width of about 5 mm, and a thickness of about 0.5 mm, and may be made of stainless steel of level 430

(SS430). In other variant embodiments, the susceptor 30 may be constructed as a cylindrical or tubular shape surrounding the chamber and /or the aerosol generation substrate A; and an internal space of the susceptor during use forms the chamber configured to receive the aerosol generation substrate A, and the aerosols for inhalation are generated in a manner of heating an outer periphery of the aerosol generation substrate A. The susceptor 30 may also be made of stainless steel of level 420 (SS420) and an alloy material (such as permalloy) containing iron/nickel.

[0015] In an embodiment shown in FIG. 1, the aerosol generation device further includes a holder 40 configured to arrange the induction coil 50 and the susceptor 30, and a material of the holder 40 may include a non-metal material with high temperature resistance such as PEEK or ceramic. In this embodiment, the induction coil 50 is fixed on an outer wall of the holder 40 in a winding manner. In addition, as shown in FIG. 1, the holder 40 is in a shape of a hollow tube, and some space of the hollow tube forms the chamber configured to receive the aerosol generation substrate A.

[0016] In an optional embodiment, the susceptor 30 is prepared by using the above susceptible material, or is obtained by forming a susceptible material coating on an outer surface of a substrate material with high temperature resistance, such as ceramic, by electroplating, deposition, or in other manners.

[0017] In this embodiment, the induction coil 50 is made of a metal or alloy material with low resistivity, for example, gold, silver, copper, or an alloy thereof. In addition, in some preferred implementations, the wire material of the induction coil 50 is made of a Litz wire or Litz cable. In the Litz material, the wire or cable is made of a plurality of or a plurality of bundles of conductive threads, for example, individually isolated wires bundled in a winding manner or braiding manner. The Litz material is particularly suitable for carrying an alternating current. An individual wire is designed to reduce loss of the surface effect and the near field effect in a conductor under a high frequency, and allow the inside of the wire material of the induction coil 50 to contribute to conductivity of the induction coil 50.

[0018] In some embodiments, the circuit 20 may include a controller. The controller may include a microprocessor, and the microprocessor may be a programmable microprocessor. The controller may include other electronic components. The controller may be configured to regulate power supplied to the induction coil 50, so that the induction coil 50 generates a changing magnetic field.

[0019] In some embodiments, the changing magnetic field generated by the induction coil 50 may be continuously supplied to the susceptor 30 or may be intermittently supplied, for example, supplied inhalation by inhalation after the apparatus is started. The changing magnetic field is supplied to the susceptor 30 in a pulse form.

[0020] In some embodiments, the power supplied by

the circuit 20 to the induction coil 50 may be triggered by an inhalation detection system. Alternatively, the power supplied to the induction coil 50 may be triggered by pressing an on/off button, so that in a process of keeping pressing the on/off button, the circuit 20 continuously supplies power to the induction coil 50. The inhalation detection system may use a sensor as a carrier, and the sensor may be configured as an airflow sensor, and may measure an airflow rate. The airflow rate is a parameter representing an amount of air inhaled by a user through an airflow path of the aerosol generation apparatus each time. When the airflow exceeds a predetermined threshold, the airflow sensor may detect beginning of inhalation. When the user activates the button, beginning may also be detected. The sensor may alternatively be configured as a pressure sensor, to measure pressure of air in the aerosol generation apparatus, and the air is inhaled by the user through the airflow path of the apparatus during inhalation.

[0021] Further, FIG. 2 and FIG. 3 show schematic structural diagrams of the induction coil 50. The induction coil 50 is a solenoid coil wound by a long wire material; and is arranged around the chamber and /or the susceptor 30 after assembly. The wire material of the induction coil 50 has a first dimension d1 extending along the radial direction and a second dimension d2 extending along the axial direction of the coil; and the first dimension d1 is greater than the second dimension d2, so that the wire material of the induction coil 50 is a flat structure perpendicular to the axial direction, which is beneficial to increasing turns of the induction coil 50 per unit length thereby increasing the inductance value.

[0022] In some embodiments, the first dimension d1 approximately ranges from 1 mm to 5 mm; and the second dimension d2 approximately ranges from 0.3 mm to 1 mm. For example, in a specific embodiment, the first dimension d1 is 2 mm; and the second dimension d2 is 0.6 mm.

[0023] In some embodiments, a total length d3 of the induction coil 50 along the axial direction approximately ranges from 5 mm to 20 mm. In a specific embodiment, a total length d3 of the induction coil 50 along the axial direction is 12 mm.

[0024] In some embodiments, an inner diameter dimension d4 of the induction coil 50 ranges from 8 mm to 15 mm. In a specific embodiment, an inner diameter dimension d4 of the induction coil 50 is 12.5 mm.

[0025] In some embodiments, an outer diameter dimension d5 of the induction coil 50 ranges from 10 mm to 20 mm. In a specific embodiment, an outer diameter dimension d5 of the induction coil 50 is 15.7 mm.

[0026] As shown in FIG. 2 and FIG. 3, the number of turns or windings of the induction coil 50 wound into the solenoid is approximately in a range of 8 to 30. A spacing between adjacent turns or windings in the induction coil 50 approximately ranges from 0.1 mm to 0.5 mm. Correspondingly, an inner volume may range from about 0.10 cm³ to about 2.50 cm³.

[0027] In the embodiments shown in FIG. 2 and FIG. 3, the cross section of the wire material of the induction coil 50 is substantially in a shape of a rectangle.

[0028] Alternatively, in some more variant embodiments, the cross section of the wire material of the induction coil 50 may be in another regular or irregular shape. For example, FIG. 4 is a schematic diagram of an induction coil 50a according to another variant embodiment. A cross section of a wire material of the induction coil 50a is substantially in a shape of an ellipse. Similarly, an extending dimension d1 of the wire material of the induction coil 50a along a radial direction is greater than an extending dimension d2 along an axial direction. In another example, FIG. 5 is a schematic diagram of an induction coil 50b according to another variant embodiment. A cross section of a wire material of the induction coil 50b is substantially in a shape of a trapezoid.

[0029] In the foregoing shown embodiments, a spacing between adjacent turns or windings in the induction coil 50/50a/50b is the same.

[0030] Alternatively, in some other variant embodiments, a spacing between adjacent turns or windings in the induction coil 50/50a/50b is changing. For example, in some embodiments, a spacing between adjacent turns or windings in the induction coil 50/50a/50b gradually increases or decreases along the axial direction. A smaller spacing (a smaller distance between windings) may result in generation of a stronger magnetic field. A larger spacing (a larger distance between windings) may result in generation of a weaker magnetic field. Magnetic fields with different strengths result in eddy currents with different strengths and different temperatures in adjacent parts of the susceptor 30. Therefore, during operations of induction and heating, different spacings may result in generation of a temperature gradient in the susceptor 30.

[0031] Compared with a conventional coil wound by a wire material whose cross section is circular, for the foregoing induction coil 50 /50a/50b, the wire material occupies a smaller dimension in the axial direction, so that the induction coil 50 /50a/50b may have more coil turns or windings per unit length. Specifically, for example, when the induction coil 50 made of a wire whose second dimension d2 in the cross section is 0.6 mm is used, if the cross-sectional area is the same as that of an ordinary circular wire whose diameter is 1 mm, the first dimension d1 for lateral extending is 1.3 mm; and if the same height is, for example, 6 mm, the conventional circular coil is wound by 6 turns, but this flat wire may be wound by 9 to 10 turns using this winding method. Further, a formula for calculating inductance of a coil in a magnetic circuit is: $L=N^2/R_z$. In the formula, N is the number of turns or windings of the coil, and R_z is equivalent magnetic resistance of the entire magnetic circuit. Compared with the coil wound by the circular wire material, when the number of turns of the foregoing induction coil 50 /50a/50b increases twofold, the inductance value can increase fourfold, which has larger frequency adaptability in the induction and heating process.

[0032] Alternatively, FIG. 4 is a schematic diagram of an induction coil 50d according to another preferred embodiment. The induction coil 50d of this embodiment includes:

a part 510d and a part 520d sequentially arranged along an axial direction. In addition, the number of windings or turns per unit length in the part 520d of the coil is less than the number of windings or turns per unit length in the part 510d. In this embodiment, eddy currents with different strengths and different temperatures are caused in adjacent parts of the susceptor 30. Therefore, during operations of induction and heating, different spacings may result in generation of a temperature gradient in the susceptor 30. The direction of the temperature gradient may depend on orientations of relative positions of the susceptor 30 and the induction coil 520d in the axial direction.

[0033] In addition, in the induction coil 50d shown in FIG. 6, the part 510d is close to a first end of the induction coil 50d; and the induction coil 50d further includes a part 530d close to a second end, and the part 520d is located between the part 510d and the part 530d. Similarly, the number of windings or turns per unit length in the part 520d is less than the number of windings or turns per unit length in the part 530d. Therefore, in this embodiment, a temperature of a central region where heat dissipation is difficult in the susceptor 30 and temperatures of parts where heat dissipation is fast at two ends may tend to be uniform.

[0034] As shown in FIG. 6, the extending length of the part 510d and/or part 530d of the induction coil 50d is greater than that of the part 520d. In addition, the number of turns or windings of the part 510d and/or part 530d of the induction coil 50d is greater than that of the part 520d.

[0035] FIG. 7 is a schematic diagram of an aerosol generation apparatus according to another embodiment. The aerosol generation apparatus of this embodiment includes:

an atomizer 200e storing a liquid aerosol generation substrate and evaporating the liquid aerosol generation substrate to generate an aerosol, and a power supply assembly 100e supplying power to the atomizer 200e. In this embodiment, the aerosol generation substrate is liquid, usually includes liquid nicotine or nicotine salt, glycerol, propylene glycol, and the like, and is evaporated, when being heated, to generate the aerosol available for inhalation.

[0036] The atomizer 200e includes:

a liquid storage cavity 210e, configured to store a liquid aerosol generation substrate;
a liquid guide element 220e, at least partially extending into the liquid storage cavity 210e to absorb the liquid aerosol generation substrate; and
a susceptor 30e, combined with the liquid guide element 220e, to generate, when being penetrated by a changing magnetic field, heat to heat a part of the

liquid substrate in the liquid guide element 220e to generate an aerosol. In some optional embodiments, the liquid guide element 220e is in a shape of a rod or a tube or a pole; the liquid guide element 220e may be made of a porous material such as fibrous cotton, sponge, or a porous ceramic body, thereby absorbing and transferring the liquid aerosol generation substrate through an internal capillary action; and the susceptor 30e may be a susceptible strip, tube, or mesh surrounding the liquid guide element 220e.

[0037] The power supply assembly 100e includes:

a receiving cavity 130e arranged at an end along a length direction, where during use, at least part of the atomizer 200e is removably received in the receiving cavity 130e;
an induction coil 50e, at least partially surrounding the receiving cavity 130e, to generate a changing magnetic field;
a cell 110e for supplying power; and
a circuit 120e, connected to the rechargeable cell 110e through a suitable current, and configured to convert the direct current outputted by the cell 110e into an alternating current with a suitable frequency and supply the alternating current to the induction coil 50e.

[0038] Similarly, an extending dimension of the wire material of the induction coil 50e along a radial direction is greater than an extending dimension along an axial direction.

[0039] Alternatively, in another variant embodiment, FIG. 8 is a schematic diagram of a liquid guide element 220f according to another embodiment. At least part of a surface of the liquid guide element 220f is used to be in fluid communication with a liquid storage cavity 210e, to receive a liquid aerosol generation substrate; the liquid guide element 220f has an atomization surface 221f that extends flat; and a susceptor 30f is combined with the atomization surface 221f in a manner such as surface mounting, co-firing, or deposition, and generates, by being penetrated by a changing magnetic field, heat to heat the liquid aerosol generation substrate to generate an aerosol. The susceptor 30f has a hollow part 31f, thereby defining a passage used for the aerosol to overflow from the atomization surface 221f. Alternatively, in some embodiments, the susceptor 30f may be in a shape of a mesh, a strip, or a zigzag.

[0040] Alternatively, in some other variant embodiments, the liquid guide element 220f may be in a shape of a flat plate, or in a shape of a concave block whose surface has a cavity, or in a shape of an arch with an arched structure.

[0041] 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 aerosol generation apparatus, comprising:

a chamber used to receive or store an aerosol generation substrate;
an induction coil used to generate a changing magnetic field; and
a susceptor configured to be penetrated by the changing magnetic field and generate heat, thereby heating the aerosol generation substrate to generate an aerosol, wherein
the induction coil is structured as a solenoid coil, and a cross section of a wire material forming the induction coil has a first dimension extending along a radial direction of the induction coil and a second dimension extending along an axial direction, the first dimension being greater than the second dimension.

2. The aerosol generation apparatus according to claim 1, wherein the cross section of the wire material of the induction coil is in a shape of a rectangle.

3. The aerosol generation apparatus according to claim 1 or 2, wherein the induction coil has 8 to 30 windings.

4. The aerosol generation apparatus according to claim 1 or 2, wherein a spacing between adjacent windings in the induction coil is constant.

5. The aerosol generation apparatus according to claim 1 or 2, wherein a spacing between adjacent windings in the induction coil is changing along the axial direction.

6. The aerosol generation apparatus according to claim 1 or 2, wherein the wire material of the induction coil is made of a Litz wire or Litz cable.

7. The aerosol generation apparatus according to claim 1 or 2, wherein the induction coil comprises a first part and a second part that are arranged along the axial direction, wherein
along the axial direction of the induction coil, the number of windings or turns per unit length in the first part is greater than that of windings or turns per unit length in the second part.

8. The aerosol generation apparatus according to claim

1 or 2, wherein the induction coil comprises a first part close to a first end and a second part close to a second end along the axial direction, and a third part located between the first part and the second part, wherein

along the axial direction of the induction coil, the number of windings or turns per unit length in the third part is less than that of windings or turns per unit length in one or both of the first part and the second part.

9. The aerosol generation apparatus according to claim 1 or 2, wherein the susceptor is arranged into a shape of a pin or a needle or a sheet or a tube at least partially extending in the induction coil.

10. The aerosol generation apparatus according to claim 1 or 2, wherein the first dimension ranges from 1 mm to 5 mm.

11. The aerosol generation apparatus according to claim 1 or 2, wherein the second dimension ranges from 0.3 mm to 1 mm.

12. The aerosol generation apparatus according to claim 1 or 2, wherein an extending length of the induction coil along the axial direction ranges from 5 mm to 20 mm.

13. The aerosol generation apparatus according to claim 1 or 2, wherein a spacing between adjacent windings in the induction coil ranges from 0.1 mm to 0.5 mm.

14. The aerosol generation apparatus according to claim 1 or 2, wherein the induction coil has an inner diameter ranging from 8 mm to 15 mm.

15. The aerosol generation apparatus according to claim 1 or 2, wherein the induction coil has an outer diameter ranging from 10 mm to 20 mm.

16. An induction coil used to generate a changing magnetic field, wherein the induction coil is structured as a solenoid coil, and a cross section of a wire material forming the induction coil has a first dimension extending along a radial direction and a second dimension extending along an axial direction, the first dimension being greater than the second dimension.

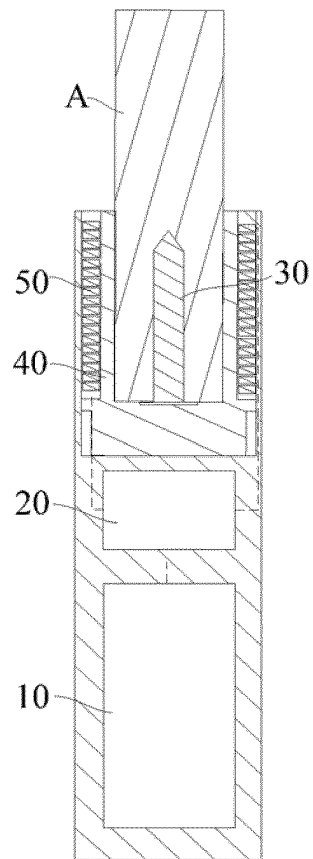


FIG. 1

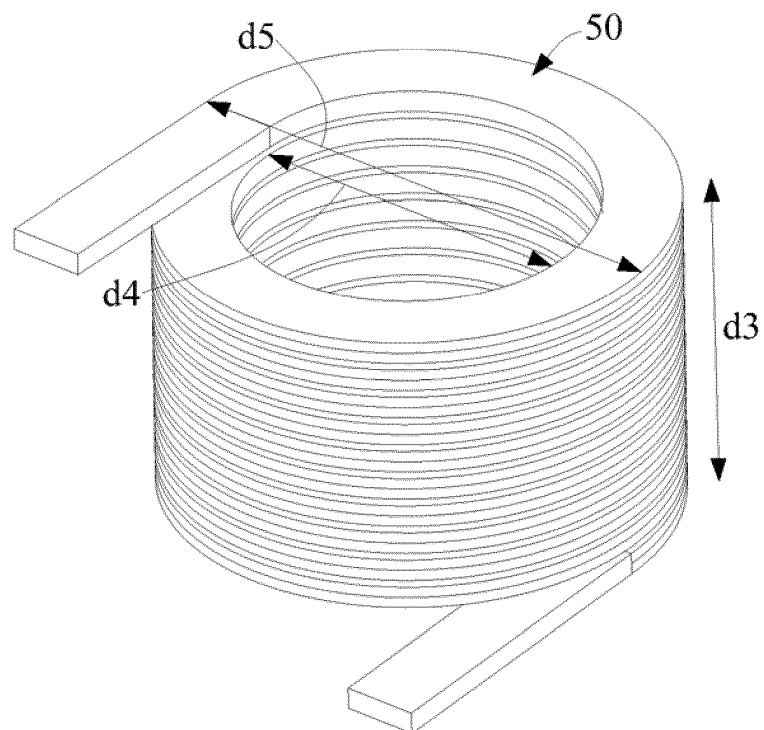


FIG. 2

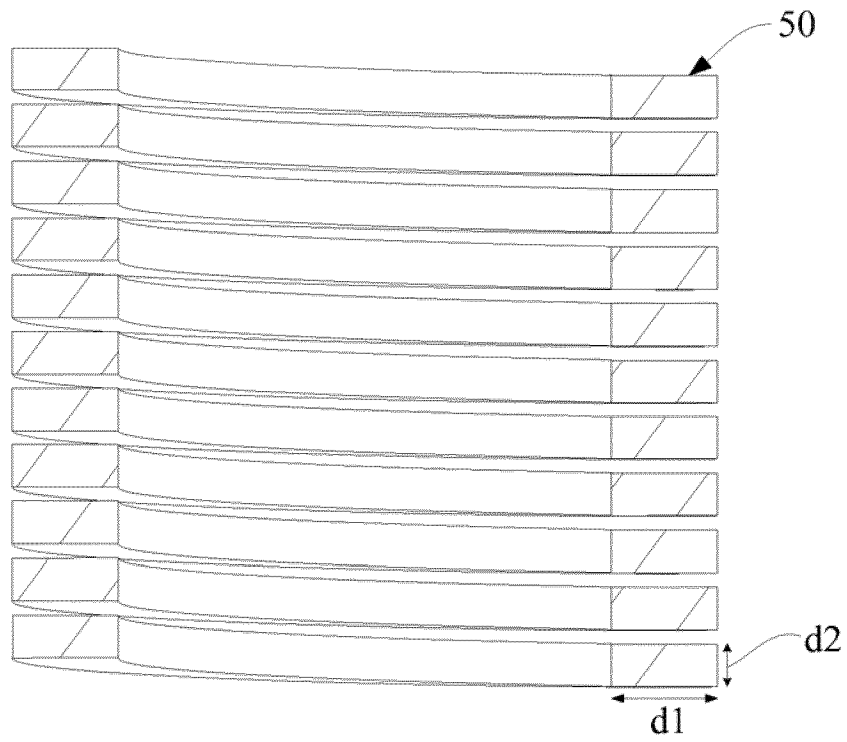


FIG. 3

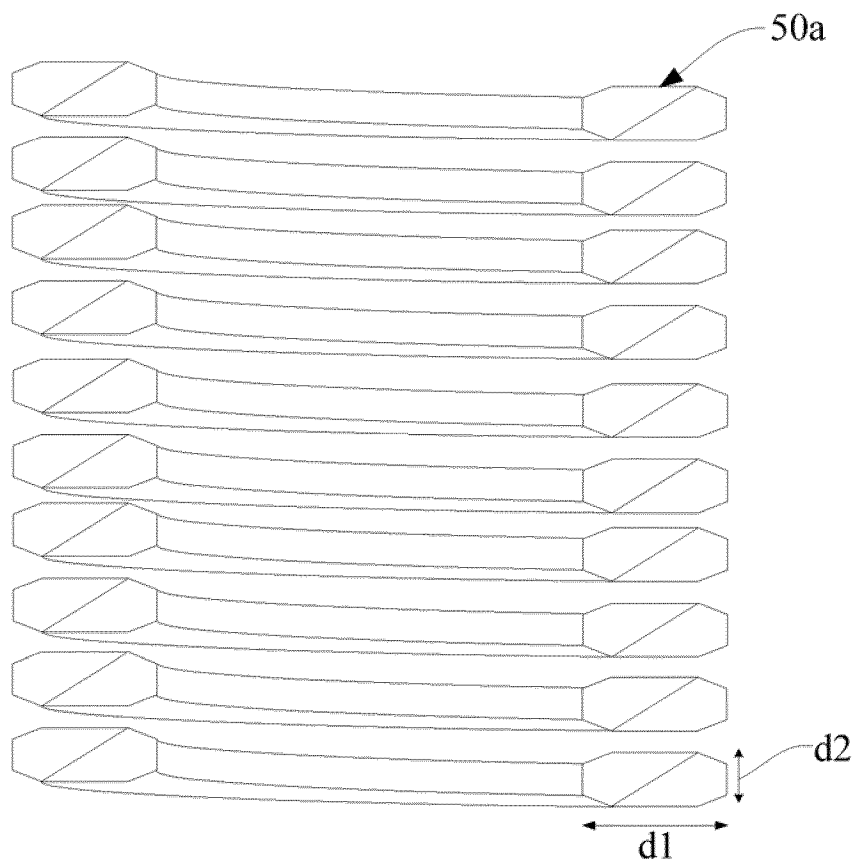


FIG. 4

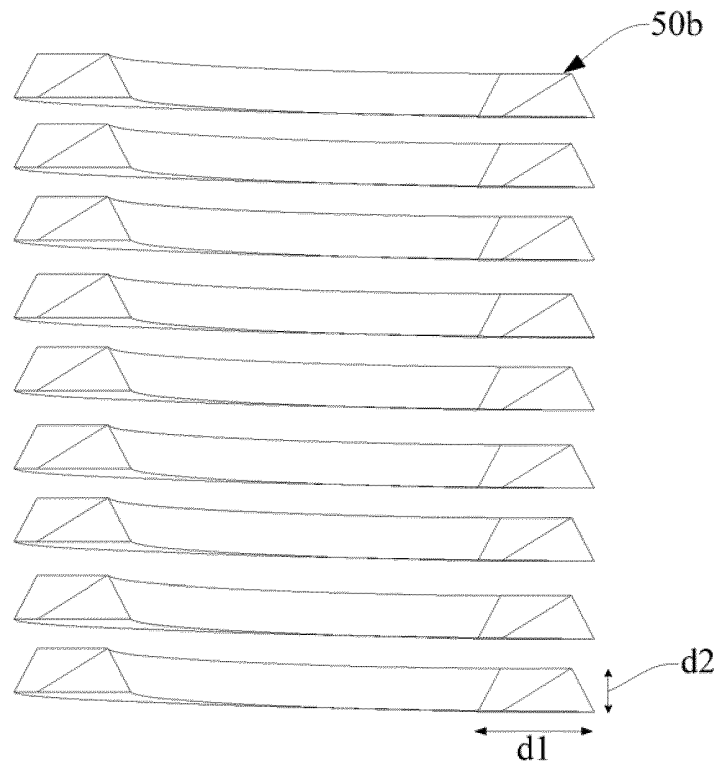


FIG. 5

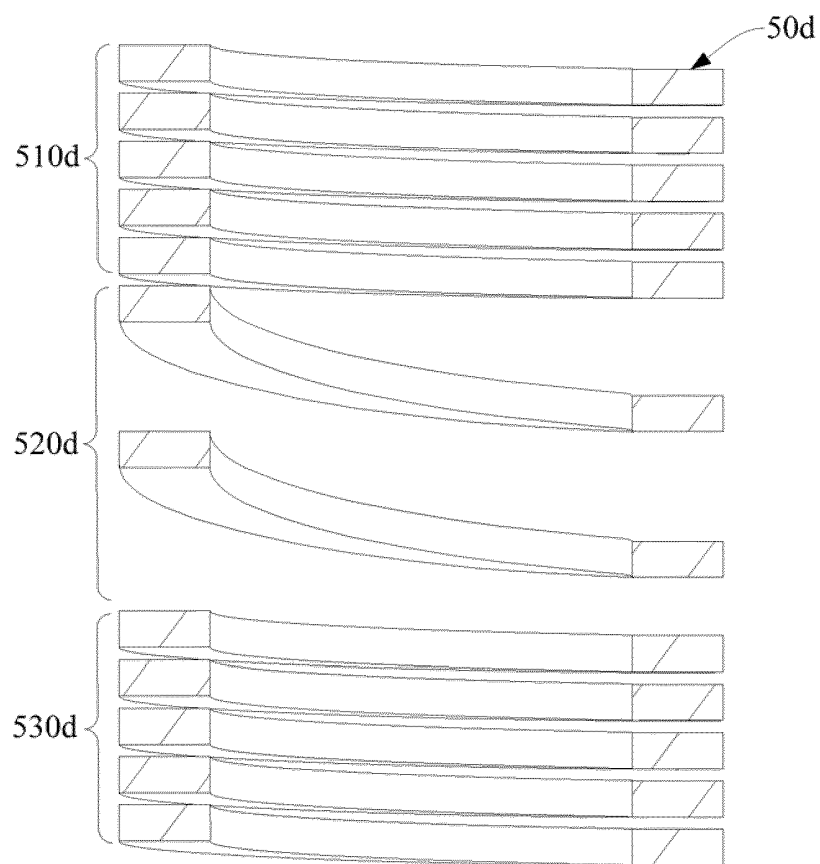


FIG. 6

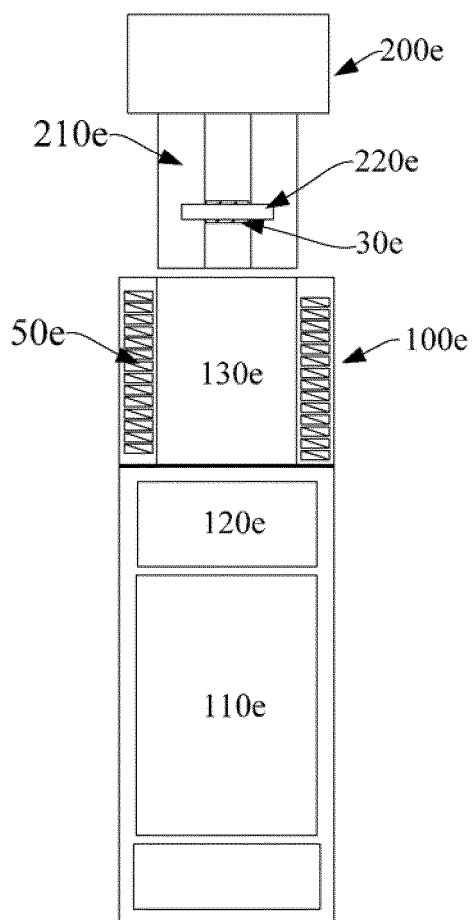


FIG. 7

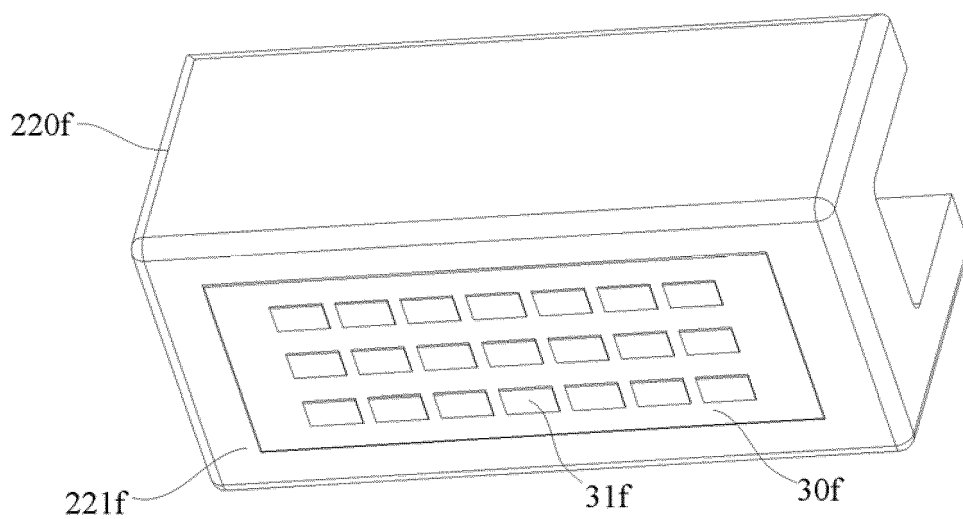


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/132079

A. CLASSIFICATION OF SUBJECT MATTER

A24F 40/465(2020.01);A24F 40/40(2020.01);

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A24F40/-,A24F47/-(IPC)

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

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

CNTXT; CNABS; WPABS; VEN; WEB OF KNOWLEDGE: 电子烟, 雾化装置, 雾化芯, 腔室, 气溶胶生成基质, 感应线圈, 螺线, 截面, 绕组, 内径, 匝数; E-cigarette, e-cigar, atomiz+, atomizing+ , Aerosol-generating substrate, induction coil, spiral, cross-section, winding, inner diameter, number of turns;

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 216701692 U (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 10 June 2022 (2022-06-10) claims 1-16	1-16
X	CN 105307526 A (PHILIP MORRIS PRODUCTS S.A.) 03 February 2016 (2016-02-03) description, paragraphs 32-60, and figures 1-16	1-16
X	CN 211482972 U (SHENZHEN FIRST UNION TECHNOLOGY CO., LTD.) 15 September 2020 (2020-09-15) description, paragraphs 1-57, and figures 1-8	1-16
X	CN 212233104 U (SHENZHEN SMOORE TECHNOLOGY LIMITED) 29 December 2020 (2020-12-29) description, paragraphs 31-49, and figures 1-6	1-16
X	EP 3895559 A2 (PHILIP MORRIS PRODUCTS S.A.) 20 October 2021 (2021-10-20) description, paragraphs 1-157, and figures 1-12	1-16
X	US 2021204603 A1 (PHILIP MORRIS PRODUCTS S.A.) 08 July 2021 (2021-07-08) description, paragraphs 1-90, and figures 1-5	1-16

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

* Special categories of cited documents:

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“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

10 February 2023

Date of mailing of the international search report

13 February 2023

Name and mailing address of the ISA/CN

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Beijing 100088

Facsimile No. (86-10)62019451

Authorized officer

Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/132079

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