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

(11) **EP 4 287 768 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.12.2023 Bulletin 2023/49

(21) Application number: **23171464.3**

(22) Date of filing: **04.05.2023**

(51) International Patent Classification (IPC):
H05B 6/10 *(2006.01)* ***A24F 40/465*** *(2020.01)*

(52) Cooperative Patent Classification (CPC):
H05B 6/108; A24F 40/465

(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: **02.06.2022 CN 202221366482 U**

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(54) ELECTROMAGNETIC HEATING COIL, HEATING ASSEMBLY, AND ELECTRONIC ATOMIZING DEVICE

(57) The present application relates to an electromagnetic coil, a heating assembly, and an electronic atomizing device. The electromagnetic heating coil is at least one wire bundle helically wound about an axis. In an extending direction of the axis, the electromagnetic heating coil comprises at least one turn. Each wire bundle comprises at least two conducting wires. Each turn has a first size in the extending direction of the axis and a second size in a first direction perpendicular to the extending direction of the axis. The first size is greater than the second size.

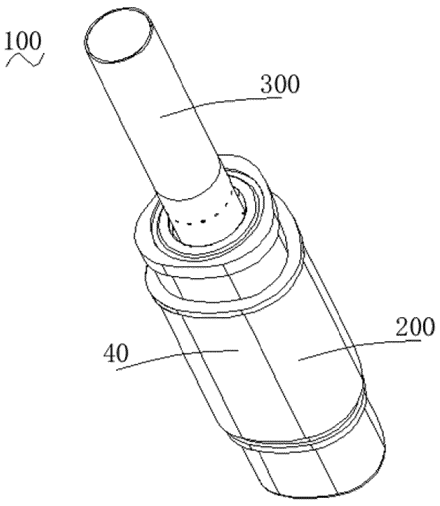

FIG. 1

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Description

TECHNICAL FIELD

[0001] The present application relates to the field of atomization technology, and particularly to electromagnetic heating coils, heating assemblies, and electronic atomizing devices.

BACKGROUND

[0002] An aerosol is a colloidal dispersion system formed by dispersing and suspending small solid or liquid particles in a gas medium. The aerosol can be absorbed by the human body through the respiratory system, providing users with a new alternative absorption method. For example, an electronic atomizing device that can generate aerosols by heating herbal or ointment aerosol-generating substrates can be used in different fields to deliver inhalable aerosols to the users, replacing conventional product forms and absorption methods.

[0003] The electronic atomizing device heats an aerosol-generating substrate through a heating assembly to generate an aerosol for the user to inhale. As for the electronic atomizing device using an electromagnetic heating way, the heating assembly includes an electromagnetic heating coil and a heat-generating body. A magnetic field is generated by the electromagnetic heating coil conducting an electric current. The temperature of the heat-generating body located in the magnetic field generated by the electromagnetic heating coil is increased. The aerosol-generating substrate is in contact with the heat-generating body, and thus heated and atomized by the heat-generating body.

[0004] The electromagnetic heating coil is usually composed of helically wound conducting wires. The size of the conventional helical coil in the radial direction is large, so that the size of the entire electronic atomizing device in the radial direction is large, which is not conducive to the miniaturization of the electronic atomizing device.

SUMMARY

[0005] In view of this, aiming to address the problem that the conventional electromagnetic heating coil is not conducive to the miniaturization of the electronic atomizing device, there is a need to provide an electromagnetic heating coil, a heating assembly, and an electronic atomizing device that are conducive to the miniaturization of the electronic atomizing device.

[0006] An electromagnetic heating coil which is adapted to be used in an electronic atomizing device includes at least one wire bundle helically wound about an axis. In an extending direction of the axis, the electromagnetic heating coil includes at least one turn. Each wire bundle includes at least two conducting wires. The at least one wire bundle has a first size in the extending direction of the axis and a second size in a first direction perpendicular to the extending direction of the axis. The first size is greater than the second size.

[0007] In an embodiment, a cross-sectional shape of the at least one wire bundle is a rectangle or an ellipse.

[0008] In an embodiment, the each wire bundle includes 15 to 300 conducting wires, and a diameter of each conducting wire is 0.02 mm to 0.5 mm.

[0009] In an embodiment, the electromagnetic heating coil includes one to three wire bundles, each of which includes 100 conducting wires, and a diameter of each conducting wire is 0.1 mm.

[0010] A heating assembly includes a heat-generating body and the above-described electromagnetic heating coil. The electromagnetic heating coil is sleeved outside the heat-generating body. The heat-generating body is provided with an accommodating cavity, and the heat-generating body defines an opening that is in communication with the accommodating cavity. The opening is disposed at one end of the accommodating cavity in the extending direction of the axis.

[0011] In an embodiment, the heating assembly further includes a mounting frame. The electromagnetic heating coil surrounds the mounting frame. The heat-generating body is disposed inside the mounting frame and is at least partially opposite to the electromagnetic heating coil in the first direction.

[0012] In an embodiment, the heating assembly further includes a magnetic shield, and the magnetic shield is arranged outside the electromagnetic heating coil.

[0013] In an embodiment, an operating current frequency of the electromagnetic heating coil is 20 KHz to 1 MHz.

[0014] In an embodiment, the operating current frequency of the electromagnetic heating coil is 100 KHz to 600 KHz.

[0015] An electronic atomizing device includes the heating assembly.

[0016] In the above-described electromagnetic coil, heating assembly, and electronic atomizing device, the size of the at least one wire bundle in the radial direction is smaller than the size of the at least one wire bundle in the axial direction. Compared with prior art in which the cross-sectional shape of the wire bundle of the electromagnetic heating coil is circular, the size of the electromagnetic heating coil of the present application in the radial direction is reduced, thereby reducing the size of the electronic atomizing device in the radial direction, which is beneficial to the miniaturization of the electronic atomizing device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is an axonometric view of an electronic atomizing device provided by an embodiment of the present application.

FIG. 2 is a cross-sectional view of the electronic atomizing device shown in FIG. 1.

FIG. 3 is a cross-sectional view of a heating assembly of the electronic atomizing device shown in FIG. 1.

FIG. 4 is a cross-sectional view of an electromagnetic heating coil of the heating assembly shown in FIG. 3.

Reference signs:

[0018] 100, electronic atomizing device; 200, heating assembly; 300, aerosol-generating substrate; 10, heat-generating body; 11, accommodating cavity; 12, opening; 20, electromagnetic heating coil; 21, turn; H, first size; W, second size; 30, mounting frame; 40, magnetic shield.

DETAILED DESCRIPTION

[0019] In order to make the above objectives, features and advantages of the present application more clear and understandable, embodiments of the present disclosure will be described in detail below with reference to the accompanying drawings. In the following description, many specific details are described to make the present disclosure fully understandable. However, the present disclosure can be implemented in many other ways different from those described herein, and those skilled in the art can make similar improvements without departing from the connotation of the present disclosure. Therefore, the present disclosure is not limited by the specific embodiments disclosed below.

[0020] In the description of the present disclosure, it should be understood that the terms "central", "longitudinal", "transverse", "length", "width", "thickness", "upper", "lower", "front", "rear", "left", "right", "vertical", "horizontal", "top", "bottom", "inner", "outer", "clockwise", "counterclockwise", "axial" , "radial", "circumferential", etc. indicate the orientations or positional relationships on the basis of the drawings. These terms are only for describing the present disclosure and simplifying the description, rather than indicating or implying that the related devices or elements must have the specific orientations, or be constructed or operated in the specific orientations, and therefore cannot be understood as limitations of the present disclosure.

[0021] In addition, the terms "first" and "second" are used merely as labels to distinguish one element having a certain name from another element having the same name, and cannot be understood as indicating or implying any priority, precedence, or order of one element over another, or indicating the quantity of the element. Therefore, the element modified by "first" or "second" may explicitly or implicitly includes at least one of the elements. In the description of the present disclosure, "a plurality of" means at least two, such as two, three, etc., unless otherwise specifically defined.

[0022] In the present disclosure, unless otherwise clearly specified and defined, the terms "installed", "connected", "coupled", "fixed" and other terms should be interpreted broadly. For example, an element, when being referred to as being "installed", "connected", "coupled", "fixed" to another element, unless otherwise specifically defined, may be fixedly connected, detachably connected, or integrated to the other element, may be mechanically connected or electrically connected to the other element, and may be directly connected to the other element or connected to the other element via an intermediate element. For those of ordinary skill in the art, the specific meaning of the above-mentioned terms in the present disclosure can be understood according to specific circumstances.

[0023] In the present disclosure, unless otherwise specifically defined, an element, when being referred to as being located "on" or "under" another element, may be in direct contact with the other element or contact the other element via an intermediate element. Moreover, the element, when being referred to as being located "on", "above", "over" another element, may be located right above or obliquely above the other element, or merely located at a horizontal level higher than the other element; the element, when being referred to as being located "under", "below", "beneath" another element, may be located right below or obliquely below the other element, or merely located at a horizontal level lower than the other element.

[0024] It should be noted that an element, when being referred to as being "fixed" or "mounted" to another element, may be directly fixed or mounted to the other element or via an intermediate element. Such terms as "vertical", "horizontal", "up", "down", "left", "right" and the like used herein are for illustrative purposes only and are not meant to be the only ways for implementing the present disclosure.

[0025] As mentioned in the background section, the radial size of the conventional electromagnetic heating coil is relatively large, resulting in a relatively large radial size of the entire electronic atomizing device, which is not conducive to the miniaturization of the electronic atomizing device.

[0026] The inventors have found through research that the fundamental cause of the above problem is that the heating assembly of the electronic atomizing device using electromagnetic heating includes an electromagnetic heating coil and a heat-generating body, and the electromagnetic heating coil is sleeved outside the heat-generating body and helically wound about the axis direction. In the electromagnetic heating coil formed by the helically wound conducting wires, the cross-sectional shape of the conducting wires is circular, so that the size of the electromagnetic heating coil in the radial direction will be relatively large, resulting in relatively large size of the entire electronic atomizing device in the radial direction, which is not conducive to the miniaturization of the electronic atomizing device.

[0027] FIG. 1 is an axonometric view of an electronic atomizing device 100 provided by an embodiment of the present application. In view of the above problems, referring to FIG. 1, the present application provides an electronic atomizing device 100, which can be used for heating and atomizing an aerosol-generating substrate 300 which is a liquid, solid, or ointment of flowers, leaves, herbs, or synthetics.

[0028] FIG. 2 is a cross-sectional view of the electronic atomizing device 100 shown in FIG. 1, and FIG. 3 is a cross-sectional view of a heating assembly 200 of the electronic atomizing device 100 shown in FIG. 1. Referring to FIG. 2 and FIG. 3, the electronic atomizing device 100 includes a heating assembly 200. The heating assembly 200 includes a heat-generating body 10 and an electromagnetic heating coil 20 sleeved outside the heat-generating body 10. The electromagnetic heating coil 20 is adapted to conduct an electric current thereby generating a magnetic field. The heat-generating body 10 is disposed in the magnetic field generated by the electromagnetic heating coil 20, thereby generating heat. The heat-generating body 10 is configured to heat the aerosol-generating substrate 300.

[0029] Specifically, the heat-generating body 10 is provided with an accommodating cavity 11. The heat-generating body 10 defines an opening 12 that is in communication with the accommodating cavity 11. An aerosol-generating substrate 300 can be accommodated in the accommodating cavity 11 through the opening 12. The electromagnetic heating coil 20 is adapted to conduct an electric current to generate a magnetic field, and the heat-generating body 10 is disposed in the magnetic field to generate heat. Since the aerosol-generating substrate 300 is accommodated in the accommodating cavity 11, at this time, the heat-generating body 10 transfers heat to the aerosol-generating substrate 300, and the temperature of the aerosol-generating substrate 300 rises and the aerosol-generating substrate 300 is atomized to form an aerosol.

[0030] In an embodiment, the electromagnetic heating coil 20 is at least one wire bundle helically wound about an axis. The opening 12 is disposed at one end of the accommodating cavity 11 in the extending direction of the axis and thus at one end of the heat-generating body 10 in the extending direction of the axis. Each wire bundle includes at least two strands of conducting wires, i.e., each wire bundle incudes at least two conducting wires. Each wire bundle is formed by twisting the at least two conducting wires (two strands of conducting wires) together.

[0031] FIG. 4 is a cross-sectional view of the electromagnetic heating coil 20 of the heating assembly 200 shown in FIG. 3. Referring to FIG. 4, in the extending direction of the axis, the electromagnetic heating coil 20 includes at least one turn 21. That is to say, in the axial direction of the electromagnetic heating coil 20, the electromagnetic heating coil 20 includes at least one turn 21. In each turn 21, the at least one wire bundle has a first size H in the extending direction of the axis and a second size W in a first direction (i.e., a radial direction) perpendicular to the extending direction of the axis. The first size H is greater than the second size W.

[0032] In the electromagnetic heating coil 20, the size of the at least one wire bundle in the radial direction is smaller than the size of the at least one wire bundle in the axial direction. Compared with prior art in which the electromagnetic heating coil composed of a wire bundle with a circular cross-section, so that the radial size and the axial size of the wire bundle are equal to each other, the electromagnetic heating coil 20 has the following advantages:

1. The size of the electromagnetic heating coil 20 in the radial direction is reduced, so that the size of the electronic atomizing device 100 in the radial direction (e.g., a horizontal direction) is reduced, which is beneficial to the miniaturization of the electronic atomizing device 100.
2. On the condition that the diameter of the entire electromagnetic heating coil 20 is the same as that in the prior electromagnetic heating coil, the outer surface area of the electromagnetic heating coil 20 is relatively large, which is more conducive to the heat dissipation of the electromagnetic heating coil 20, thus reduces the temperature of the electromagnetic heating coil 20 and the loss of the electromagnetic heating coil 20, and improves the service life of the electromagnetic heating coil 20.
3. On the condition that the diameter of the entire electromagnetic heating coil 20 is the same as that the prior electromagnetic heating coil, the area of the orthographic projection of the electromagnetic heating coil 20 on the outer surface of the heat-generating body 10 is relatively large, which can increase the heating area and improve the uniformity of the magnetic field.

[0033] Meanwhile, in the present embodiment, the electromagnetic heating coil 20 is formed by at least one wire bundle helically wound about the axis, and each wire bundle includes at least two conducting wires. Compared with prior art in which the electromagnetic heating coil is formed by helically wound flat metal strips, the AC resistance of the electromagnetic heating coil 20 under a high-frequency alternating current can be reduced, and the energy loss of the electronic atomizing device 100 can be reduced.

[0034] In an embodiment, the cross-sectional shape of the wire bundle is a rectangle. In the rectangle, the length of one pair of sides is greater than the length of the other pair of sides. When the cross-sectional shape of the wire bundle is a rectangle, the pair of longer sides is arranged along the extending direction of the axis, and the pair of shorter sides is arranged along the first direction (i.e., the radial direction), which can ensure that the size of the wire bundle in the axial direction is larger than

the size of the wire bundle in the radial direction, i.e., ensure that the first size H is larger than the second size W.

[0035] In another embodiment, the cross-sectional shape of the wire bundle is an ellipse. The ellipse has a major axis and a minor axis. When the cross-sectional shape of the wire bundle is an ellipse, the major axis is arranged along the extending direction of the axis, and the minor axis is arranged along the first direction (i.e., the radial direction), which can ensure that the size of the wire bundle in the axial direction is larger than the size of the wire bundle in the radial direction, i.e., ensure that the first size H is larger than the second size W.

[0036] It can be understood that, in some other embodiments, the cross-sectional shape of the wire bundle is not limited to the above-described rectangle and ellipse, and can be set as needed.

[0037] In an embodiment, the electromagnetic heating coil 20 is a wire bundle helically wound about the axis. Each wire bundle includes 15 to 300 conducting wires, and a diameter of each conducting wire is 0.02 mm to 0.5 mm. In an embodiment, each wire bundle includes 100 conducting wires, and the diameter of each conducting wire is 0.1 mm. In preparation of the electromagnetic heating coil 20, 100 conducting wires with a diameter of 0.1 mm are twisted together to form the wire bundle, then the wire bundle is compressed into the required cross-sectional shape by using a special equipment, and finally the wire bundle is helically wound about the axis to form the electromagnetic heating coil 20.

[0038] In another embodiment, the electromagnetic heating coil 20 includes a plurality of wire bundles helically wound about the axis. Each wire bundle includes 15 to 300 conducting wires, and a diameter of each conducting wire is 0.02 mm to 0.5 mm. In an embodiment, the electromagnetic heating coil 20 is formed by three wire bundles helically wound about the axis, each wire bundle includes 100 conducting wires, and the diameter of each conducting wire is 0.1 mm. In preparation of the electromagnetic heating coil 20, 100 conducting wires with a diameter of 0.1 mm are twisted together to form each wire bundle, then three wire bundles are twisted together, and the three wire bundles as a whole are compressed into the required cross-sectional shape by using a special equipment, and finally the three wire bundles that are compressed into the specific shape are helically wound about the axis to form the electromagnetic heating coil 20.

[0039] Of course, in some other embodiments, the number of the wire bundles in the electromagnetic heating coil 20, the number of conducting wires in each wire bundle, and the diameter of each conducting wire are not specifically limited. For example, in some embodiments, the electromagnetic heating coil 20 is formed by helically winding two wire bundles about the axis, each wire bundle includes 150 conducting wires, and the diameter of each conducting wire is 0.05 mm.

[0040] In an embodiment, also referring to FIG. 2 and FIG. 3, the heating assembly 200 further includes a mounting frame 30. The electromagnetic heating coil 20 surrounds the mounting frame 30, and the heat-generating body 10 is disposed inside the mounting frame 30 and is at least partially opposite to the electromagnetic heating coil 20 in the first direction. In this way, the assembly and fixing of the heat-generating body 10 and the electromagnetic heating coil 20 are facilitated.

[0041] The heating assembly 200 further includes a magnetic shield 40, and the magnetic shield 40 is arranged outside the electromagnetic heating coil 20. On the one hand, the magnetic shield 40 can fix the electromagnetic heating coil 20, and on the other hand, the magnetic shield 40 can prevent the electromagnetic heating coil 20 from radiating electromagnetic waves to the outside.

[0042] In an embodiment, the operating current frequency of the electromagnetic heating coil 20 is 20 KHz to 1 MHz. In this way, the electromagnetic heating coil 20 is adapted to work at a medium-low frequency current. The current density is relatively large at this frequency, so that electric currents can flow through the conducting wires located in the middle of the electromagnetic heating coil 20, and the conducting wires can be effectively used and the skin effect can be reduced.

[0043] Further, the operating current frequency of the electromagnetic heating coil 20 is 100 KHz to 600 KHz. In this way, the electromagnetic heating coil 20 is adapted to work under the electric current with a suitable frequency, so as to ensure that the electric currents flow through all the conducting wires in the electromagnetic heating coil 20, further improving the utilization rate of the conducting wires and reducing the skin effect.

[0044] Another embodiment of the present application further provides the heating assembly 200 included in the above-described electronic atomizing device 100.

[0045] Another embodiment of the present application further provides the electromagnetic heating coil 20 included in the above-described heating assembly 200. The electromagnetic heating coil 20 is at least one wire bundle helically wound about an axis, and each wire bundle includes at least two conducting wires. In the extending direction of the axis, the electromagnetic heating coil 20 includes at least one turn 21. In each turn 21, the at least one wire bundle has a first size H in the extending direction of the axis and a second size W in a first direction perpendicular to the extending direction of the axis. The first size H is greater than the second size W.

[0046] In the above-described electromagnetic heating coil 20, the size of the at least one wire bundle in the radial direction is smaller than the size of the at least one wire bundle in the axial direction. Compared with prior art in which the electromagnetic heating coil composed of a wire bundle with a circular cross-section, the size of the electromagnetic heating coil 20 in the radial direction is reduced, thereby reducing the size of the electronic atomizing device 100 in the radial direction (e.g., a horizontal direction), which is beneficial to the miniaturization

of the electronic atomizing device 100.

[0047] The technical features of the above-mentioned embodiments can be combined arbitrarily. In order to make the description concise, not all possible combinations of the technical features are described in the embodiments. However, as long as there is no contradiction in the combination of these technical features, the combinations should be considered as in the scope of the present disclosure.

[0048] The above-described embodiments are only several implementations of the present disclosure, and the descriptions are relatively specific and detailed, but they should not be construed as limiting the scope of the present disclosure. It should be understood by those of ordinary skill in the art that various modifications and improvements can be made without departing from the concept of the present disclosure, and all fall within the protection scope of the present disclosure. Therefore, the patent protection of the present disclosure shall be defined by the appended claims.

Claims

1. An electromagnetic heating coil adapted to be used in an electronic atomizing device (100), **characterized in that** the electromagnetic heating coil (20) comprises at least one wire bundle helically wound about an axis; in an extending direction of the axis, the electromagnetic heating coil comprises at least one turn (21); each wire bundle comprises at least two conducting wires;
   the at least one wire bundle has a first size in the extending direction of the axis and a second size in a first direction perpendicular to the extending direction of the axis, and the first size is greater than the second size.

2. The electromagnetic heating coil according to claim 1, wherein a cross-sectional shape of the at least one wire bundle is a rectangle or an ellipse.

3. The electromagnetic heating coil according to claim 1, wherein the each wire bundle comprises 15 to 300 conducting wires, and a diameter of each conducting wire is 0.02 mm to 0.5 mm.

4. The electromagnetic heating coil according to any one of claims 1 to 3, wherein the electromagnetic heating coil comprises one to three wire bundles, each wire bundle comprises 100 conducting wires, and a diameter of each conducting wire is 0.1 mm.

5. A heating assembly, comprising a heat-generating body (10) and the electromagnetic heating coil (20) according to any one of claims 1 to 4, wherein the electromagnetic heating coil (20) is sleeved outside the heat-generating body (10);
   the heat-generating body (10) is provided with an accommodating cavity (11), and the heat-generating body (10) defines an opening (12) that is in communication with the accommodating cavity (11), the opening (12) is disposed at one end of the accommodating cavity (11) in the extending direction of the axis.

6. The heating assembly according to claim 5, further comprising a mounting frame (30), wherein the electromagnetic heating coil (20) surrounds the mounting frame (30), and the heat-generating body (10) is disposed inside the mounting frame (30) and is at least partially opposite to the electromagnetic heating coil (20) in the first direction.

7. The heating assembly according to claim 5, further comprising a magnetic shield (40) arranged outside the electromagnetic heating coil (20).

8. The heating assembly according to any one of claims 5 to 7, wherein an operating current frequency of the electromagnetic heating coil (20) is 20 KHz to 1 MHz.

9. The heating assembly according to claim 8, wherein the operating current frequency of the electromagnetic heating coil (20) is 100 KHz to 600 KHz.

10. An electronic atomizing device, comprising the heating assembly (200) according to any one of claims 5 to 9.

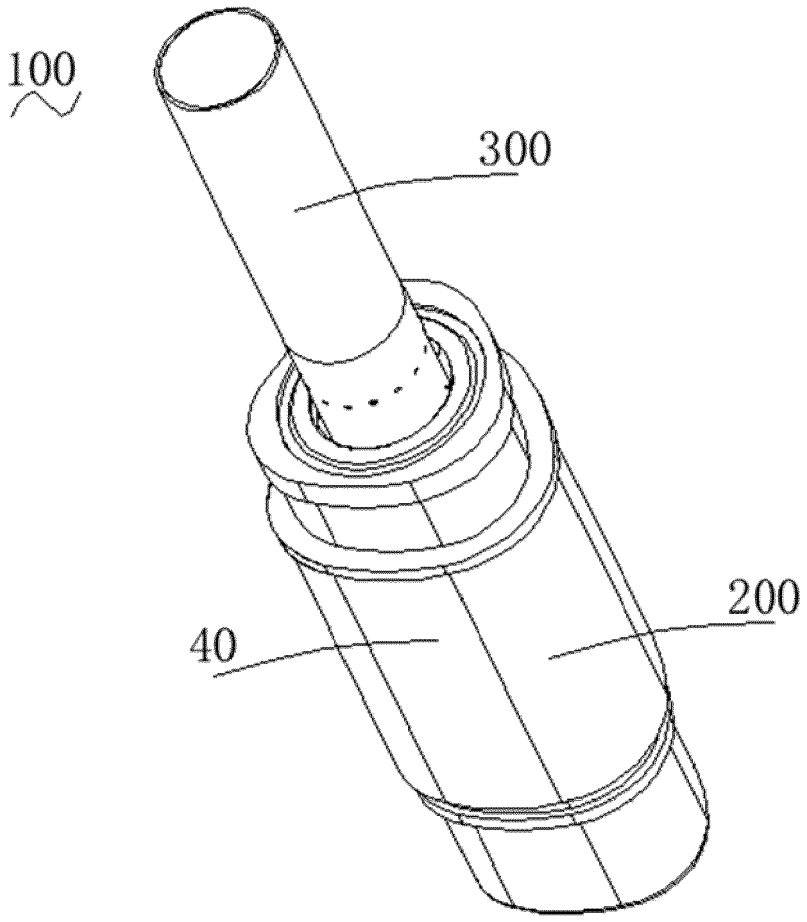

FIG. 1

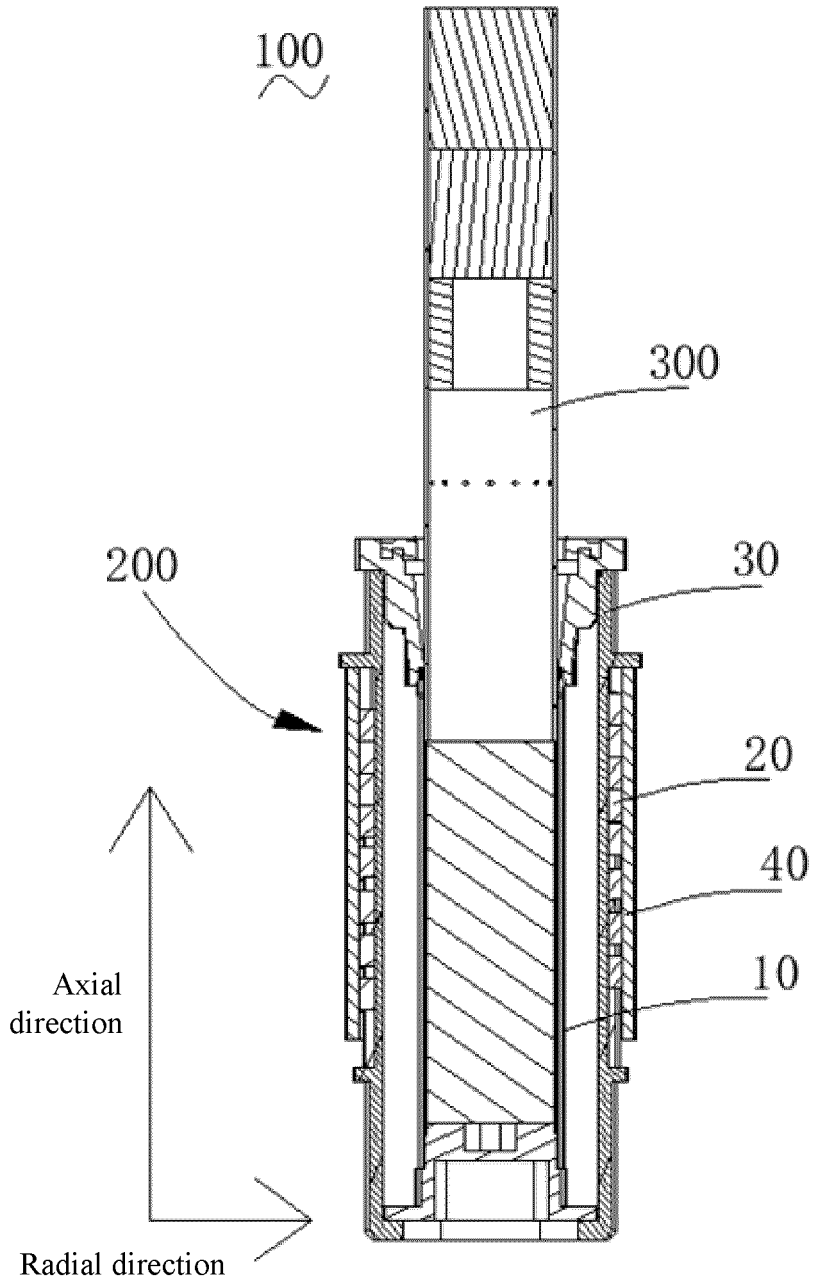

FIG. 2

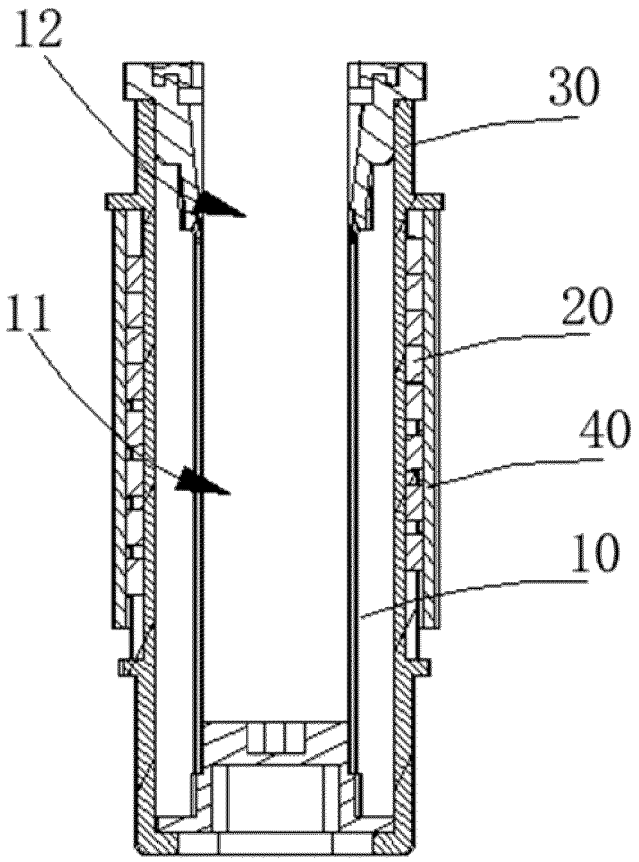

FIG. 3

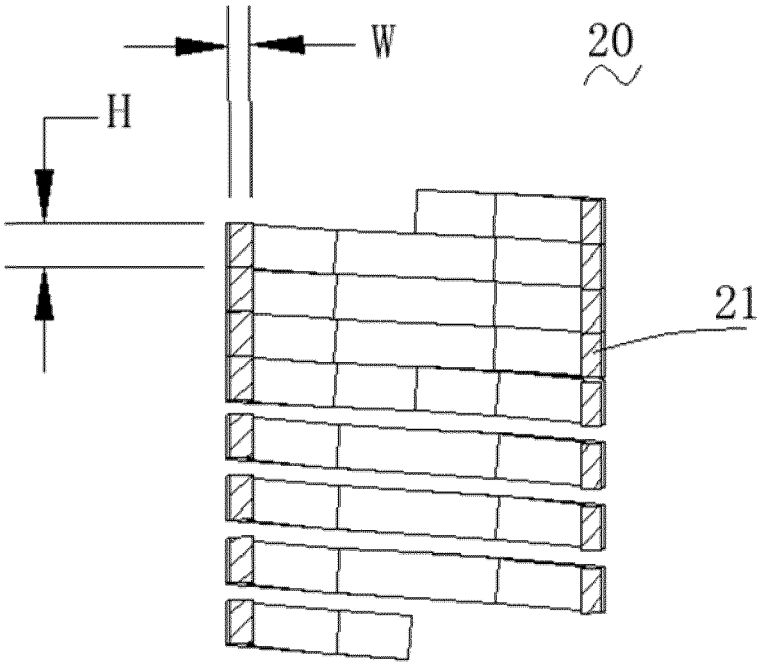

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 23 17 1464

DOCUMENTS CONSIDERED TO BE RELEVANT

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H05B
A24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 October 2023	Pierron, Christophe

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 17 1464

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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