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(54) **ATOMIZING CORE, ATOMIZER, AND ELECTRONIC CIGARETTE**

(57) An atomizing core includes an atomizing body including a porous material. The atomizing body includes a first side surface, a second side surface, and a heating element. The first side surface is configured to absorb e-liquid. The second side surface is configured for smoke emission. The heating element is disposed on the second side surface.

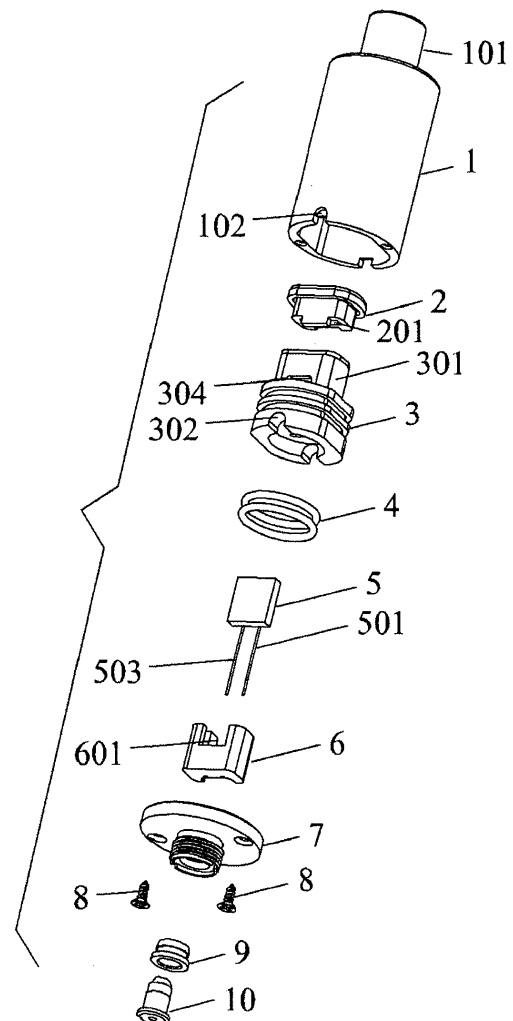


FIG. 1

Description

[0001] The disclosure relates to an atomizing core, an atomizer, and an electronic cigarette.

[0002] Conventional atomizers include an atomizing core in the shape of a hollow cylinder. The heating element is spirally disposed in the hollow cylinder, which blocks the flow of vapor/smoke in the atomizers. The distance between two adjacent spiral coils varies, which leads to the uneven heating area of the heating elements, thus adversely affecting the taste of the e-liquid.

[0003] The first objective of the disclosure is to provide an atomizing core; the atomizing core comprises an atomizing body comprising a porous material; the atomizing body comprises a first side surface, a second side surface, and a heating element; the first side surface is configured to absorb e-liquid; the second side surface is configured for smoke emission; the heating element is disposed on the second side surface. The porous material is configured to facilitate diffusion of e-liquid from the first side surface to the second side surface; the smoke generated has no space to escape when the heating element is disposed in a middle portion of the atomizing body; the atomizing body is in the form of a hollow tube or is thin in the shape of a film, a sheet, a layer, which facilitates heat transfer to the e-liquid and leads to an even temperature distribution; the heating element comprises at least one first pin and at least one second pin for conducting electricity, preferably one first pin and one second pin; the at least one first pin and the at least one second pin are electrically connected to the heating element through welding, riveting, contacting, sticking, threading, or a combination thereof, preferably welding.

[0004] In a class of this embodiment, the heating element is embedded in or exposed out of the second side surface. The term "embedded in" means that the whole heating element is embedded in second side surface to prevent oxidization and erosion of the heating element, thus extending the service life of the heating element. The term "exposed out of" means that the whole heating element is disposed on the second side surface; the term "exposed out of" can also mean that the second side surface is curved inward to form a concave segment and the heating element is partially disposed in the concave segment.

[0005] In a class of this embodiment, the heating element is in the shape of a string and/or a sheet embedded in or exposed out of the second side surface. The string or the sheet structure increases surface area for atomization and contributes to an even heating of the e-liquid by the heating element, thus improving the taste of the e-liquid.

[0006] In a class of this embodiment, the heating element is in the form of a metal layer or a conductive pathway coated on the second side surface. Such a deployment is simple, fast, and low cost.

[0007] In a class of this embodiment, the heating element comprises conductive metal, graphene, carbon na-

notubes, carbon nanofibers, or a combination thereof. The conductive metal includes, but is not limited to, copper, silver, platinum, nickel, palladium, chromium, or a combination thereof, preferably copper, and more preferably silver; the conductive metal can also comprise conductive alloys, preferably iron-chromium-aluminum (FeCrAl) alloys or nickel-chromium (NiCr) alloys.

[0008] In a class of this embodiment, the atomizing body comprises ceramic, mica, glass, or a combination thereof, preferably ceramic.

[0009] In a class of this embodiment, the heating element is disposed outside the second side surface and is coated with a passivation layer. The passivation layer is configured to prevent oxidization and erosion of the heating element, thus extending the service life of the heating element.

[0010] In a class of this embodiment, the passivation layer comprises gold, glass, ceramic, mica, or a combination thereof, preferably glass or ceramic.

[0011] In a class of this embodiment, the heating element is embedded in second side surface; a ratio of a distance between the heating element and the second side surface to a thickness of the heating element is $\leq 1/3$, preferably $\leq 1/4$, more preferably $\leq 1/5$, and most preferably $\leq 1/10$, and in particular $\leq 1/20$. When the ratio of a distance between the heating element and the second side surface to a thickness of the heating element is within a range of $1/20$ to $1/5$, the aerosol release is unimpeded.

[0012] In a class of this embodiment, the atomizing body further comprises a plurality of macropores and a plurality of micropores disposed around the plurality of macropores. The plurality of micropores is configured to absorb the e-liquid; the plurality of macropores is configured to diffuse the e-liquid from the plurality of micropores to the second side surface.

[0013] In a class of this embodiment, the plurality of macropores has a diameter within a range of 0.05-0.5 mm and the plurality of micropores has a diameter within a range of 0.01-10 μm .

[0014] In a class of this embodiment, the atomizing body further comprises a thermostat configured to maintain the atomization temperature of the e-liquid.

[0015] In a class of this embodiment, the heating element is a resistive heating element; and the atomization temperature of the e-liquid is maintained through operations comprising measuring a resistance of the heating element and supplying a corresponding current to the heating element. The heating element comprises a positive temperature coefficient (PTC) thermistor or metals having electrical resistance, preferably a PTC thermistor.

[0016] The second objective of the disclosure is to provide an atomizer; the atomizer comprises the atomizing core and an e-liquid tank configured to supply the e-liquid for the atomizing core; the e-liquid tank comprises an air passage and an e-liquid chamber configured to store the e-liquid; the atomizing body is disposed between the e-liquid chamber and the air passage; the second side sur-

face is disposed towards the air passage; the first side surface is disposed towards the e-liquid chamber.

[0017] In a class of this embodiment, the e-liquid tank is hollow and comprises a bottom opening; the atomizer further comprises a seal member disposed in the bottom opening to seal the e-liquid tank; the e-liquid tank further comprises an open top functioning as a mouthpiece; the mouthpiece extends downward to form an air conduction tube; the seal member comprises a seal body and a hollow column protruding from the seal body to the air conduction tube; the hollow column communicates with the air conduction tube; the air conduction tube, the hollow column, and the seal body form the e-liquid chamber; the hollow column and/or the air conduction tube comprises a peripheral wall and an e-liquid inlet disposed on the peripheral wall; the atomizing body is next to the e-liquid inlet or is opposite to the e-liquid inlet; the hollow column is integrated with the air conduction tube, or the hollow column is connected to the air conduction tube through tight coupling.

[0018] In a class of this embodiment, the atomizer further comprises a first seal portion and a second seal portion; the first seal portion is disposed between the air conduction tube and the hollow column; the seal body comprises a concave portion communicating with the hollow column; the second seal portion is disposed in the concave portion; the atomizing body is in the shape of a sheet and is disposed between the first seal portion and the second seal portion; the e-liquid inlet is disposed on the hollow column; the concave portion comprises a bottom wall and a first air inlet disposed on the bottom wall; the first seal portion comprises a second air inlet; an air chamber is defined by the first seal portion, the atomizing body, the second seal portion, and the seal member; the air chamber communicates with the first air inlet and the second air inlet; the air conduction tube, the second air inlet, the air chamber, and the first air inlet constitute the air passage. The number of the e-liquid inlet is not limited, preferably one. The seal member is a T-shaped structure; the concave portion is disposed under the hollow column.

[0019] In a class of this embodiment, the atomizer further comprises a first conductive member disposed in the bottom opening of the e-liquid tank to abut against the seal member; the atomizer further comprises at least one groove disposed between the first conductive member and the seal member; the e-liquid tank further comprises an outer wall and at least one third air inlet disposed on the outer wall; the at least one groove communicates with the at least one third air inlet and the air passage. The number of the third air inlet is matched to demand, preferably two.

[0020] In a class of this embodiment, the first conductive member comprises a bottom plate; the bottom plate comprises a through hole and a hollow cylinder communicating with the through hole; the atomizer further comprises a second conductive member and an insulating ring; the second conductive member is disposed into the hollow cylinder of the first conductive member; the insu-

lating ring is disposed between the first conductive member and the second conductive member. The hollow column comprises a threaded outer surface configured to connected to a battery assembly; the first conductive member is also configured to conduct electricity.

[0021] In a class of this embodiment, the heating element is connected to at least one first pin and at least one second pin; the at least one first pin and the at least one second pin are electrically connected to the first conductive member and the second conductive member, respectively.

[0022] In a class of this embodiment, the atomizing body is in the form of a hollow tube; the hollow tube comprises a hollow channel constituting a part of the air passage; the atomizing body constitutes a part of a side wall of the e-liquid chamber.

[0023] The third objective of the disclosure is to provide an electronic cigarette; the electronic cigarette comprises the atomizer and a battery assembly; the atomizer is fixedly or detachably connected to the battery assembly. The atomizer is formed integrally with the battery assembly or it is affixed thereto using magnets, threads, plugs, or a combination thereof.

[0024] In a class of this embodiment, the seal member, the first seal portion, and the second seal portion separately comprise rubber, silica gel, or plastic; the seal member can also comprise a hard material, such as hard plastic and hard glass.

[0025] The following advantages are associated with the atomizing core, the atomizer, and the electronic cigarette of the disclosure: the atomizing core comprises the porous materials configured to absorb the e-liquid, which increases surface area for atomization and contributes to an even temperature distribution, thus improving the taste of the e-liquid.

FIG. 1 is an exploded view of an atomizer according to one embodiment of the disclosure;

FIG. 2 is a perspective view of an atomizer according to one embodiment of the disclosure;

FIG. 3 is a cross-sectional view of an atomizer according to one embodiment of the disclosure;

FIG. 4 is a perspective view of an atomizing core according to one embodiment of the disclosure; and

FIG. 5 is a cross-sectional view including arrows showing the direction of e-liquid and airflow according to one embodiment of the disclosure.

[0026] In the drawings, the following reference numbers are used: 1. E-liquid tank; 2. First seal portion; 3. Seal member; 4. Seal ring; 5. Atomizing body; 6. Second seal portion; 7. First conductive member; 8. Screw; 9. Insulating ring; 10. Second conductive member; 101. Mouthpiece; 102. Third air inlet; 103. E-liquid chamber;

104. Air conduction tube; 201. Second air inlet; 301. Hollow column; 302. Groove; 303. Air chamber; 304. E-liquid inlet; 501. First pin; 502. Heating element; 503. Second pin; 601. Gap; and 602. First air inlet.

[0027] To further illustrate, embodiments detailing an atomizing core, an atomizer, and an electronic cigarette are described below. It should be noted that the following embodiments are intended to describe and not to limit the disclosure.

[0028] A first example of an electronic cigarette is described below. The electronic cigarette comprises an atomizer and a battery assembly; the atomizer is formed integrally with or detachably connected to the battery assembly; the atomizer comprises an atomizing core comprising an atomizing body; the atomizing body is in a shape of a sheet, a hollow tube, etc.

Example 1

[0029] Referring to FIGS. 1-4, the atomizer comprises an e-liquid tank 1, a first seal portion 2, a seal member 3, a seal ring 4, an atomizing body 5, a second seal portion 6, a first conductive member 7, a plurality of screws 8, an insulating ring 9, and a second conductive member 10. Referring to FIG. 4, the atomizing body 5 comprises a heating element 502 configured to absorb and atomize e-liquid. The heating element 502 is in the form of a conductive wire, a conductive sheet, or a conductive ink. The heating element 502 can be any shape including a spiral shape, a wavy shape, or other shape. The heating element 502 comprises a first pin 501 and a second pin 503 for conducting electricity. The first pin 501 and the second pin 503 are disposed on both ends of the heating element 502. The e-liquid tank 1 comprises an e-liquid chamber 103 and an air conduction tube 104. The e-liquid chamber 103 is configured store the e-liquid and the air conduction tube 104 is configured to allow air and smoke to flow through. The e-liquid tank 1 further comprises a narrow-necked top functioning as a mouthpiece 101. The air conduction tube 104 comprises a top portion communicating with the mouthpiece and configured to conduct air and smoke. The mouthpiece extends downward to form the air conduction tube 104. The seal member 3 is a T-shaped structure comprising a seal body 300 and a hollow column 301. The hollow column 301 protrudes from the seal body 300. The seal member 3 is disposed in a bottom opening of the e-liquid tank 1. The seal body 300 comprises a concave portion communicating with the hollow column 301.

[0030] The heating element 502 is in the shape of a sheet and is disposed between the first seal portion 2 and the second seal portion 6. The second seal portion 6 is disposed in the concave portion. The concave portion comprises a bottom wall and a first air inlet 602 is disposed on the bottom wall. The first seal portion 2 comprises a second air inlet 201. An air chamber 303 is defined by the first seal portion 2, the atomizing body 5, the second seal portion 6, and the seal member 3. The air

chamber 303 communicates with the first air inlet 602 and the second air inlet 201. The air conduction tube 104, the second air inlet 201, the air chamber 303, and the first air inlet 602 constitute the air passage.

[0031] The air conduction tube 104 is disposed on the top end of the hollow column 301 and communicates with the air passage; the first seal portion 2 is disposed between the air conduction tube 104 and the hollow column 301. The first seal portion 2 is T-shaped and is disposed in a bottom portion of the air conduction tube 104 to prevent leakage of the e-liquid and air. The hollow column 301 comprises a peripheral wall and an e-liquid inlet 304 disposed on the peripheral wall. The e-liquid inlet 304 communicates with the e-liquid chamber 103 so as to conduct the e-liquid into the heating element 502.

[0032] The atomizing body 5 further comprises a first side surface directly opposite to the e-liquid inlet 304 and configured to absorb the e-liquid. The atomizing body 5 further comprises a second side directly opposite to the first side surface and configured for smoke emission. The heating element 502 is disposed on the second side surface and the air chamber 303 extends along a side of the second side surface. A gap 601 is formed between the first seal portion 2 and the second seal portion 6 and is disposed between the e-liquid inlet 304 and the first side surface. The e-liquid flows through the gap 601 into the atomizing body 5.

[0033] The seal ring 4 is disposed around the seal member 3 to seal the e-liquid chamber 103. The seal member 3 further comprises an outer surface and at least one groove 302 disposed on the outer surface. The e-liquid tank 1 comprises an outer wall and at least one third air inlet 102 disposed on the outer wall. The at least one groove 302 and the at least one third air inlet 102 are directly opposite each other and communicate with the air chamber 303.

[0034] The first conductive member 7 is disposed in the bottom opening of the e-liquid tank 1 by the plurality of screws 8. The first conductive member 7 comprises a hollow cylinder and the second conductive member 10 is disposed in the hollow cylinder. The insulating ring 9 is disposed between the first conductive member 7 and the second conductive member 10. The first conductive member 7 and the second conductive member 10 are electrically connected to the first pin 501 and the second pin 503, respectively.

[0035] Referring to FIG. 5, the e-liquid in the e-liquid chamber 103 flows through the e-liquid inlet 304 and the gap 601 successively, and enters the atomizing body 5. The e-liquid is atomized to produce smoke and the smoke is discharged to the air chamber 303. Outside air flows through the at least one third air inlet 102 and enters the at least one groove 302 into the air chamber 303, causing the smoke to flow through the second air inlet 201. Then the smoke passes through the air conduction tube 104 and the mouthpiece 101, and is inhaled by a user.

Example 2

[0036] A second example of an electronic cigarette is described below, except for the following specific differences. The atomizing body 5 is hollow. The atomizing body 5 comprises an outer wall functioning as the first side surface and configured to absorb the e-liquid. The atomizing body 5 further comprises an inner wall functioning as the second side surface and configured to release the smoke. The heating element 502 is disposed on the second side surface. The atomizing body 5 further comprises a hollow channel communicating with the air conduction tube 104. The e-liquid tank 1 comprises a housing. The e-liquid chamber 103 is formed by the air conduction tube 104, the atomizing body 5, the housing, and the seal member 3. The atomizing body 5 constitutes a part of the air passage. The seal member 3 does not comprise the hollow column 301, the first seal portion 2, and the second seal portion 6. The electronic cigarette comprises a first seal ring 4 and a second seal ring 4 both configured to prevent leakage of the e-liquid. The first seal ring 4 is disposed between the atomizing body 5 and the seal member 3 and the second seal ring 4 is disposed between the atomizing body 5 and the air conduction tube 104. The two seal rings 4 are rings or pads comprising rubber, plastic, or silica gel.

Claims

1. An atomizing core, comprising an atomizing body comprising a porous material; wherein the atomizing body comprises a first side surface, a second side surface, and a heating element; the first side surface is configured to absorb e-liquid; the second side surface is configured for smoke emission; the heating element is disposed on the second side surface.
2. The atomizing core of claim 1, wherein the heating element is embedded in or exposed out of the second side surface.
3. The atomizing core of claim 2, wherein the heating element is in the shape of a string and/or a sheet embedded in or exposed out of the second side surface; or the heating element is in the form of a metal layer or a conductive pathway coated on the second side surface.
4. The atomizing core of claim 1, wherein the heating element comprises conductive metal, graphene, carbon nanotubes, carbon nanofibers, or a combination thereof; and/or the atomizing body comprises ceramic, mica, glass, or a combination thereof.
5. The atomizing core of claim 2, wherein the heating element is disposed outside the second side surface and is coated with a passivation layer; and/or a ratio of a distance between the heating element and the second side surface to a thickness of the heating element is $\leq 1/3$.
6. The atomizing core of claim 5, wherein the passivation layer comprises gold, glass, ceramic, mica, or a combination thereof.
7. The atomizing core of claim 1, wherein the atomizing body further comprises a plurality of macropores and a plurality of micropores disposed around the plurality of macropores; the plurality of micropores is configured to absorb the e-liquid; the plurality of macropores is configured to diffuse the e-liquid from the plurality of micropores to the second side surface.
8. The atomizing core of claim 7, wherein the plurality of macropores has a diameter within a range of 0.05-0.5 mm and the plurality of micropores has a diameter within a range of 0.01-10 μm .
9. The atomizing core of claim 1, wherein the atomizing body further comprises a thermostat configured to maintain an atomization temperature of the e-liquid; or the heating element is a resistive heating element, and the atomization temperature of the e-liquid is maintained through operations comprising measuring a resistance of the heating element and supplying a corresponding current to the heating element.
10. An atomizer, comprising the atomizing core of claim 1 and an e-liquid tank configured to supply the e-liquid for the atomizing core; wherein the e-liquid tank comprises an air passage and an e-liquid chamber configured to store the e-liquid; the atomizing body is disposed between the e-liquid chamber and the air passage; the second side surface is disposed towards the air passage; and the first side surface is disposed towards the e-liquid chamber.
11. The atomizer of claim 10, wherein the e-liquid tank is hollow and comprises a bottom opening; the atomizer further comprises a seal member disposed in the bottom opening to seal the e-liquid tank; the e-liquid tank further comprises an open top functioning as a mouthpiece; the mouthpiece extends downward to form an air conduction tube; the seal member comprises a seal body and a hollow column protruding from the seal body to the air conduction tube; the hollow column communicates with the air conduction tube; the air conduction tube, the hollow column, and the seal body form the e-liquid chamber; the hollow column and/or the air conduction tube comprises a peripheral wall and an e-liquid inlet disposed on the peripheral wall; and the atomizing body is next to the e-liquid inlet or is opposite to the e-liquid inlet.
12. The atomizer of claim 11, wherein the atomizer fur-

ther comprises a first seal portion and a second seal portion; the first seal portion is disposed between the air conduction tube and the hollow column; the seal body comprises a concave portion communicating with the hollow column; the second seal portion is disposed in the concave portion; the atomizing body is in the shape of a sheet and is disposed between the first seal portion and the second seal portion; the e-liquid inlet is disposed on the hollow column; the concave portion comprises a bottom wall and a first air inlet disposed on the bottom wall; the first seal portion comprises a second air inlet; an air chamber is defined by the first seal portion, the atomizing body, the second seal portion, and the seal member; the air chamber communicates with the first air inlet and the second air inlet; and the air conduction tube, the second air inlet, the air chamber, and the first air inlet constitute the air passage.

13. The atomizer of claim 12, wherein

the atomizer further comprises a first conductive member disposed in the bottom opening of the e-liquid tank to abut against the seal member; the atomizer further comprises at least one groove disposed between the first conductive member and the seal member; the e-liquid tank further comprises an outer wall and at least one third air inlet disposed on the outer wall; the at least one groove communicates with the at least one third air inlet and the air passage; the first conductive member comprises a bottom plate; the bottom plate comprises a through hole and a hollow cylinder communicating with the through hole; the atomizer further comprises a second conductive member and an insulating ring; the second conductive member is disposed into the hollow cylinder of the first conductive member; the insulating ring is disposed between the first conductive member and the second conductive member; and the heating element is connected to at least one first pin and at least one second pin; the at least one first pin and the at least one second pin are electrically connected to the first conductive member and the second conductive member, respectively.

14. The atomizer of claim 10, wherein the atomizing body is in the form of a hollow tube; the hollow tube comprises a hollow channel constituting a part of the air passage; the atomizing body constitutes a part of a side wall of the e-liquid chamber.

15. An electronic cigarette, comprising the atomizer of claim 10 and a battery assembly; wherein the atomizer is fixedly or detachably connected to the battery assembly.

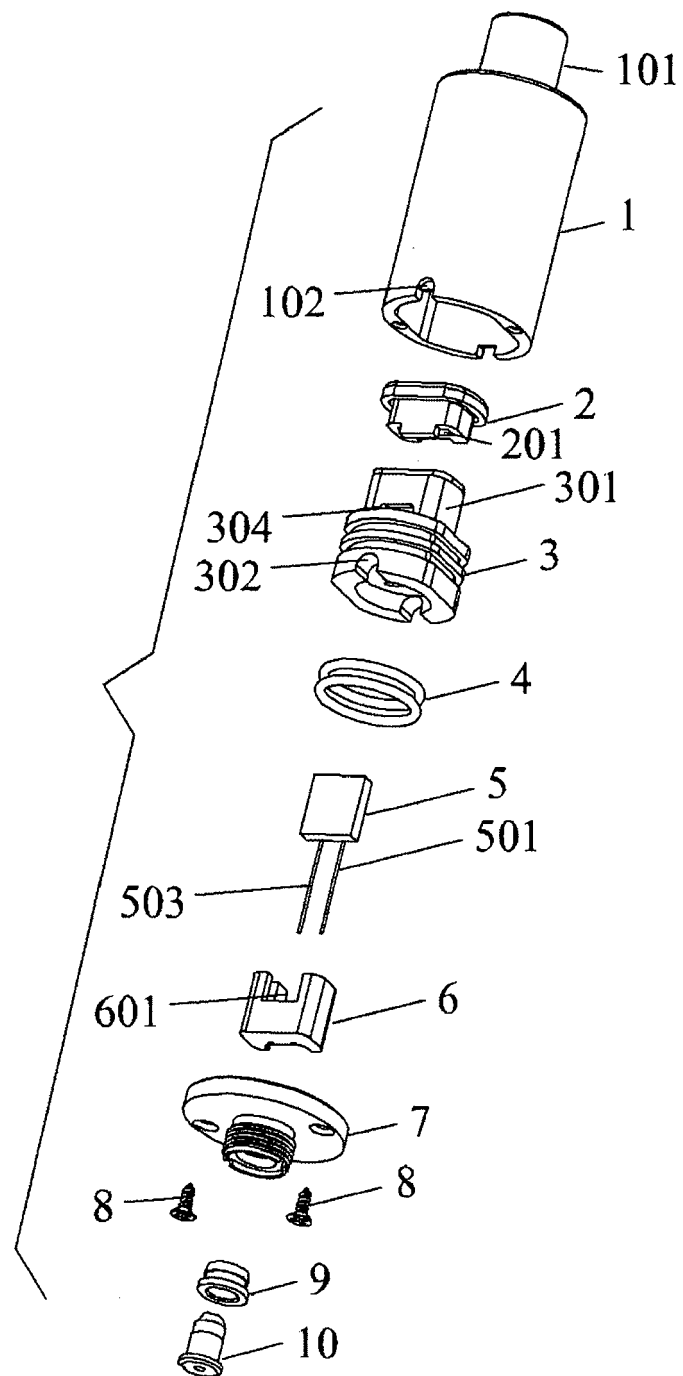


FIG. 1

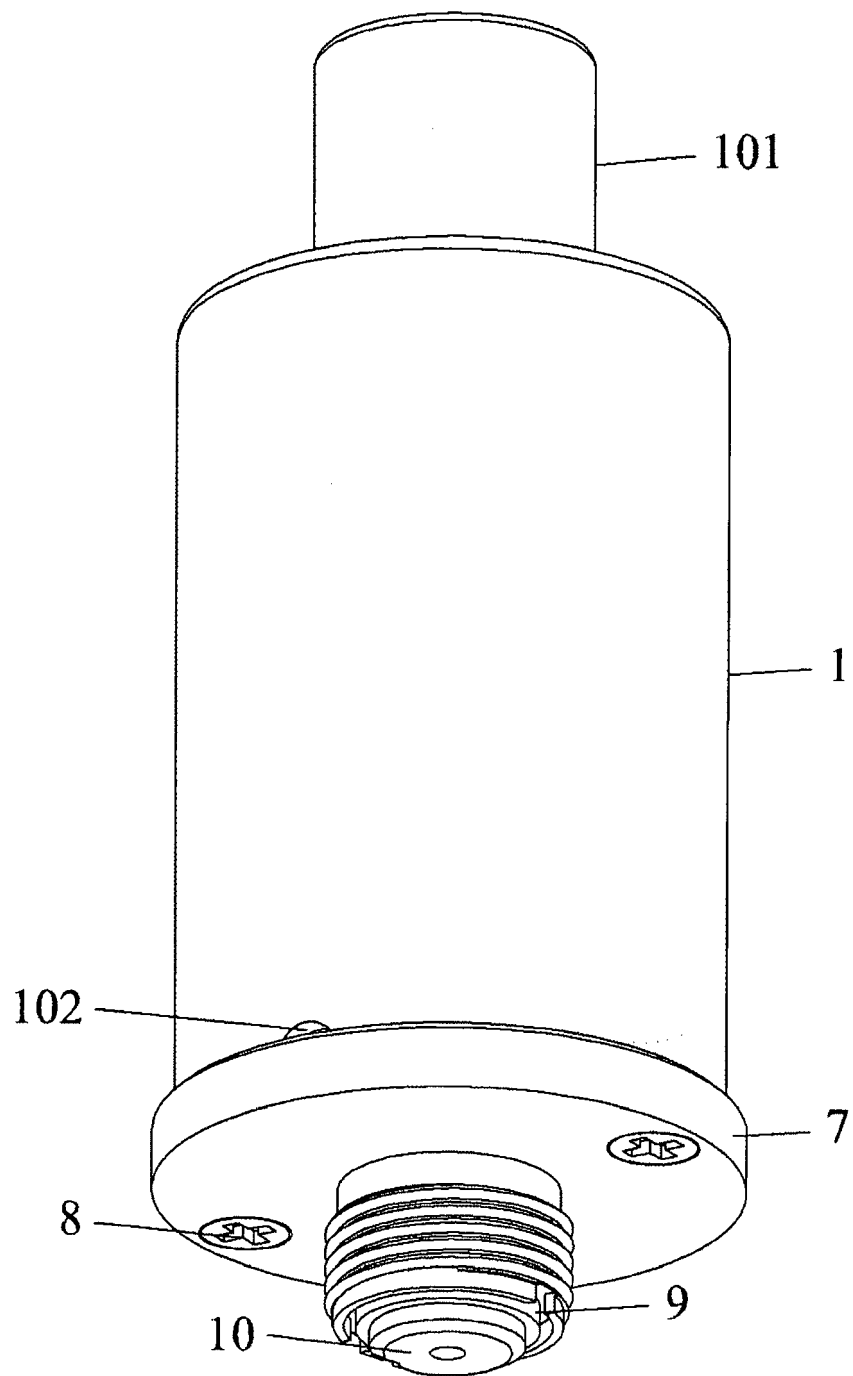


FIG. 2

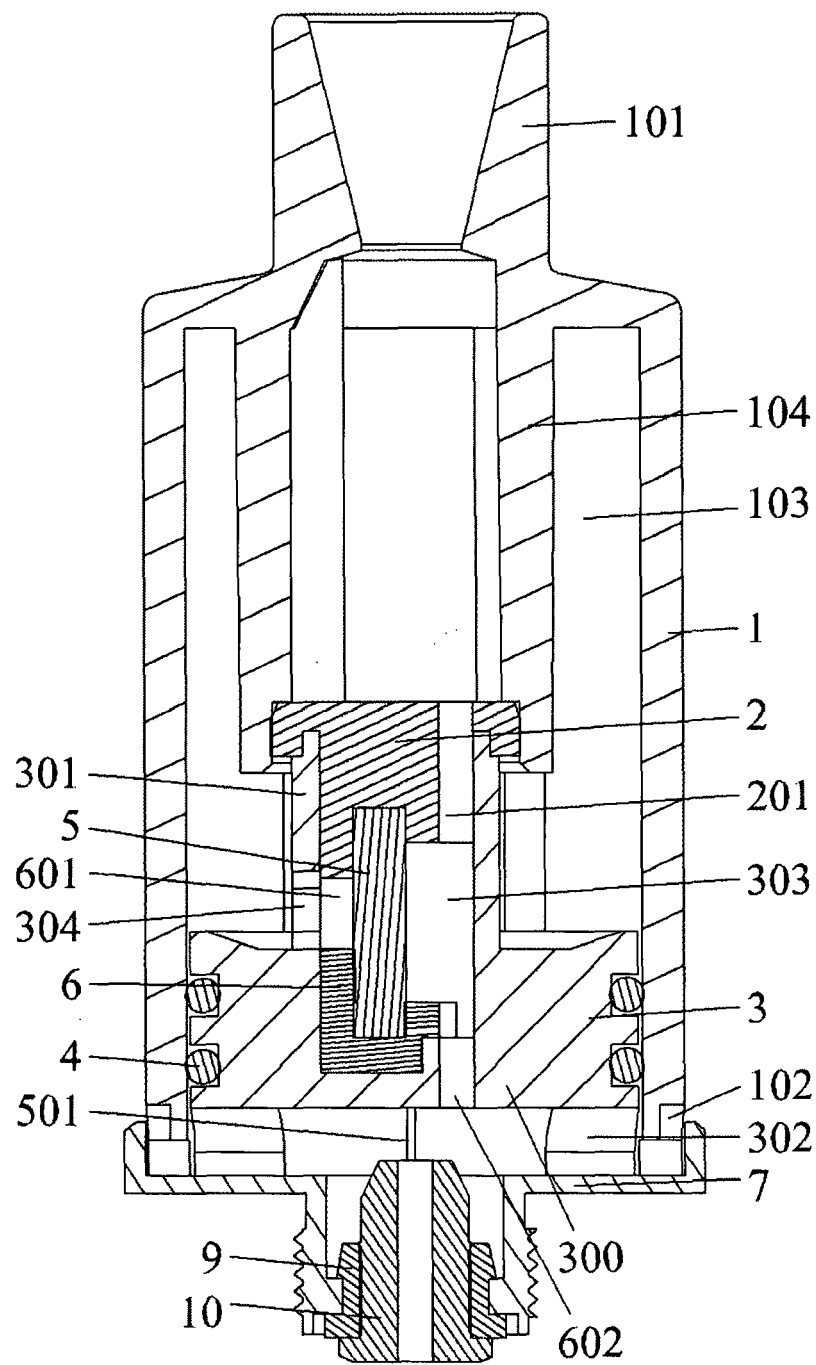


FIG. 3

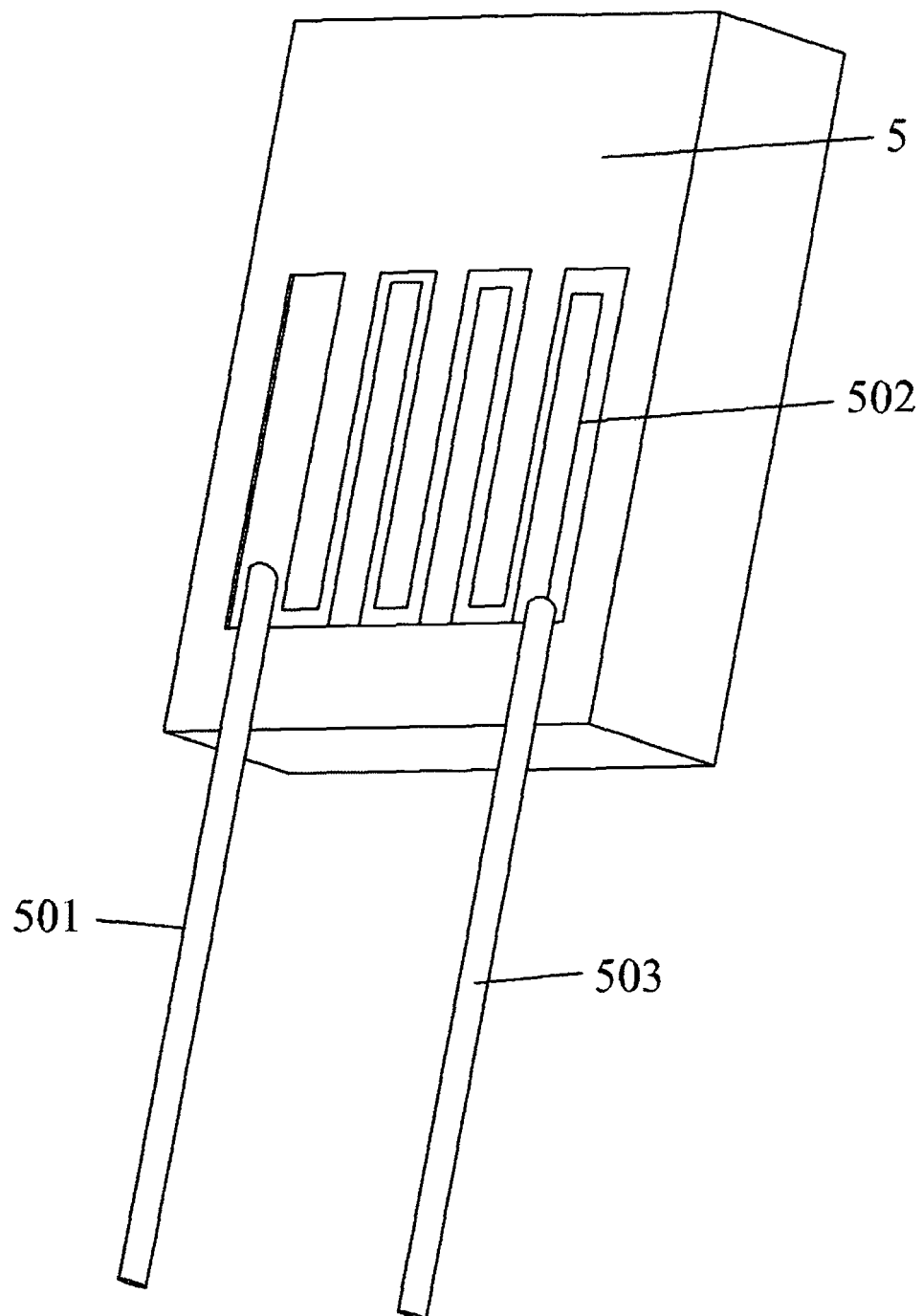


FIG. 4

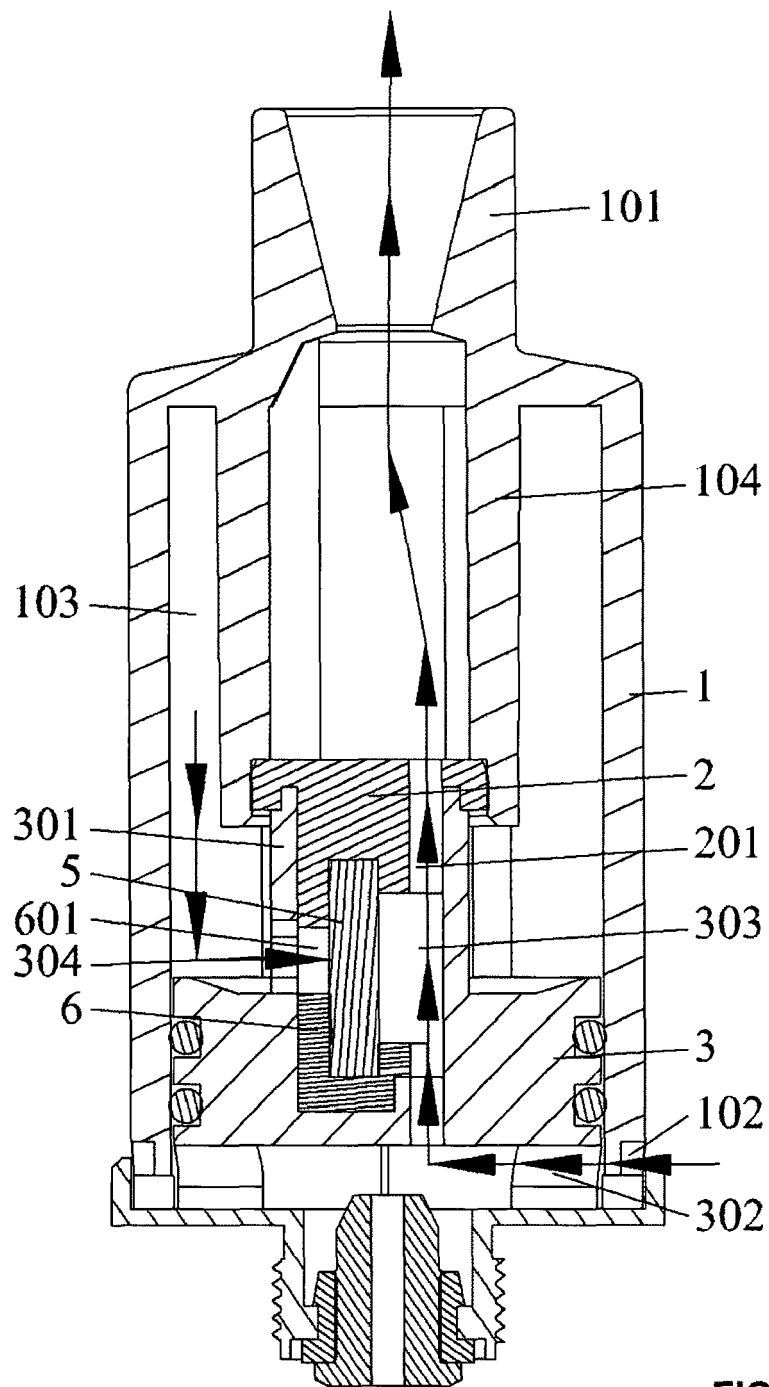


FIG. 5



EUROPEAN SEARCH REPORT

Application Number

EP 21 00 0349

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			

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EPO FORM 1503 03:82 (P04C01)

Place of search Munich	Date of completion of the search 24 May 2022	Examiner Klintebäck, Daniel
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document		

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 21 00 0349

5 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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