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(54) HEAT-NOT-BURN BAKING APPARATUS AND HEATING DEVICE THEREOF

(57) Disclosed are an Aerosol generation device and a heating element thereof. The heating element is configured for being inserted into and heating an aerosol forming substrate. The heating element comprises a first conductive substrate, a second conductive substrate disposed on and electrically connected to the first conductive substrate, and an electric insulating layer disposed between the first conductive substrate and the second conductive substrate. The heating element is formed by two conductive substrates, thus being more stable in electrical connection performance and easier to manufacture.

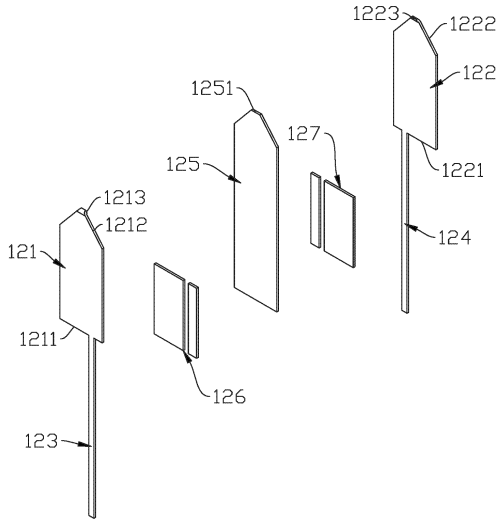

FIG. 5

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Description

FIELD

[0001] The present invention relates to heat not burn devices, in particular to an aerosol generation device and a heating element thereof.

BACKGROUND

[0002] Aerosol generation devices work at low temperatures to heat and atomize components in an aerosol forming substrate. The applied heating way is usually tube peripheral heating or center insertion heating. The former is implemented by a heating tube surrounding the aerosol forming substrate, and the latter is implemented by a heating plate or a heating pole inserted into the aerosol forming substrate. The heating plate is easy to manufacture and convenient to use, thus being widely applied. However, the conducting path for generating heat of plate-based heating is formed by a film screen-printed or coated on the surface of insulating element such as ceramic, and due to the small thickness of the screen-printed or coated film adhered to the surface of the insulating ceramic, partial separation or breakage-induced poor electrical contact of conducting circuits and current instabilities may be caused by deformation of the insulating ceramic during operation of the conducting path.

SUMMARY

[0003] In view of the defects of the prior art, the present invention provides an improved Aerosol generation device and a heating element thereof.

[0004] In order to achieve the above objective, the present invention provides a heating element, configured for being inserted into and heating an aerosol forming substrate, the heating element comprises a first conductive substrate, a second conductive substrate disposed on and electrically connected to the first conductive substrate, and an electric insulating layer disposed between the first conductive substrate and the second conductive substrate.

[0005] In some embodiments, one of the first conductive substrate and the second conductive substrate is made of stainless steel or electrically conductive ceramic.

[0006] In some embodiments, the thicknesses of the first conductive substrate and the second conductive substrate range from 0.2 mm-0.35 mm.

[0007] In some embodiments, the first conductive substrate in the shape of an elongated sheet comprises a first root and a first end opposite to the first root, and the first end is sharpened.

[0008] In some embodiments, the free end of the first end is bent towards the second conductive substrate to form a first conductive part, and the first conductive substrate is electrically connected to the second conductive substrate through the first conductive part.

[0009] In some embodiments, the second conductive substrate is in the shape of an elongated sheet and matches the first conductive substrate in shape and size, the second conductive substrate comprises a second root and a second end opposite to the second root, and the second end is sharpened and forms a pointed end together with the first end.

[0010] In some embodiments, a free end of the second end is bent towards the first end to form a second conductive part, and the second conductive part is electrically connected to the first end.

[0011] In some embodiments, the heating element comprises a first electrode lead electrically connected to the first conductive substrate, and the first electrode lead is integrally made and connected with the first root; and the heating element further comprises a second electrode lead electrically connected to the second conductive substrate, and the second electrode lead is integrally made and connected to the second root.

[0012] In some embodiments, the electric insulating is in the shape of an elongated sheet and has a length that of the first conductive substrate and the second conductive substrate, and the first electrode lead and the second electrode lead are at least partially attached to two opposite surfaces of the electric insulating layer in a lengthwise direction.

[0013] In some embodiments, the front end of the electric insulating layer is sharpened to be V-shaped, so as to match the first end of the first conductive substrate and the second end of the second conductive substrate in shape.

[0014] In some embodiments, the heating element comprises a first insulating assembly and a second insulating assembly attached to two opposite surfaces of the electric insulating layer respectively, the first insulating assembly is disposed on two opposite sides of the first electrode lead, and the second insulating assembly is disposed on two opposite sides of the second electrode lead.

[0015] In some embodiments, the heating element comprises an electric conductor extending through the electric insulating layer to electrically connect the first end of the first conductive substrate and the second end of the second conductive substrate.

[0016] The present invention further provides an aerosol generation device comprising any one of the heating elements described above.

[0017] The invention has the following beneficial effects: the heating element is formed by two conductive substrates, thus being more stable in electrical connection performance and easier to manufacture.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. 1 is a perspective view of an aerosol generation device in a state of use according to some embodi-

ments of the invention.

FIG. 2 is a perspective view of the aerosol generation device in FIG. 1 in a state where the aerosol generation device is separated from an aerosol forming substrate.

FIG. 3 is a longitudinal sectional view of the aerosol generation device in FIG. 1.

FIG. 4 is a perspective view of a heating element of the aerosol generation device in FIG. 3.

FIG. 5 is an exploded view of the heating element in FIG. 4.

FIG. 6 is a longitudinal sectional view of the heating element in FIG. 4.

FIG. 7 is a perspective view of the heating element according to some other embodiments of the invention.

FIG. 8 is an exploded view of the heating element in FIG. 7.

DESCRIPTION OF THE EMBODIMENTS

[0019] To more clearly explain the invention, the invention will be further described below in conjunction with the accompanying drawings.

[0020] As shown in FIG. 1 and FIG. 2 which illustrate an Aerosol generation device 1 according to some embodiments of the invention, the Aerosol generation device 1 is configured for heating and baking an aerosol forming substrate 2 detachably inserted therein, such that aerosol extracts in the aerosol forming substrate 2 can be released in a not-burning state. Correspondingly, a hole 10 matching the aerosol forming substrate 2 in size is formed in the top of the Aerosol generation device 1. A cover 15 may be disposed beside the hole 10 and is used for covering the hole 10 when the Aerosol generation device is not used, such that foreign matter is prevented from entering the hole 10, which may otherwise affect the use of the Aerosol generation device 1.

[0021] Referring also to FIG. 3, in some embodiments, the Aerosol generation device 1 may comprise a shell 11, and a heating element 12, a power supply 13 and a mainboard 14 which are disposed in the shell 11. The heating element 12 inserts into the hole 10 from the bottom of the hole 10, so when the aerosol forming substrate 2 is inserted into the hole 10, the heating element 12 can be longitudinally inserted into the aerosol forming substrate 2 from a bottom end of the aerosol forming substrate 2, the heating element 12 is in contact with the aerosol forming substrate 2 to be baked at low temperature. In this way, when the heating element 12 is powered on to generate heat, the heat can be transferred to the aerosol forming substrate 2 to heat the aerosol forming substrate 2 to form aerosol. The power supply 13 is electrically connected to the heating element 12, and the power supply 13 and the heating element 12 are controlled to be connected or disconnected through a switch. The mainboard 14 is configured for supporting relevant main control circuit disposed thereon.

[0022] As shown in FIG. 4 to FIG. 6, in some embodiments, the heating element 12 may comprise a first conductive substrate 121, a second conductive substrate 122 disposed on and electrically connected to the first conductive substrate 121, a first electrode lead 123 electrically connected to the first conductive substrate 121, a second electrode lead 124 electrically connected to the second electrically conductive electrode 122, and an electric insulating layer 125 disposed between the first conductive substrate 121 and the second conductive substrate 122. Preferably, the first conductive substrate 121 and the second conductive substrate 122 are connected in series.

[0023] In some embodiments, the first conductive substrate 121 and the second conductive substrate 122 may be made of resistive materials with good TCR (temperature coefficient of resistance) consistency (such as made of material of one or more of silver, platinum, copper, nickel and palladium). In some embodiments, the first conductive substrate 121 and the second conductive substrate 122 may be made of metal such as stainless steel or an electrically conductive material such as electrically conductive ceramic. In some embodiments, the thickness of the first conductive substrate 121 and the second conductive substrate 122 may range from 0.2-0.35 mm.

[0024] In some embodiments, the first conductive substrate 121 may be in the shape of an elongated sheet, and comprises a first root 1211 and a first end 1212 opposite to the first root 1211. The first end 1212 may be sharpened to be V-shaped. A free end of the first end 1212 may be bent towards the second conductive substrate 122 to form a first conductive part 1213, and the first conductive substrate 121 is electrically connected to the second conductive substrate 122 through the first conductive part 1213. In some embodiments, the first electrode lead 123 is integrally made and connected with the first root 1211.

[0025] In some embodiments, the second conductive substrate 122 may be in the shape of an elongated sheet, and may have a size matching that of the first conductive substrate 121. The second conductive substrate 122 may comprise a second root 1221 and a second end 1222 opposite to the second root 1221. The second end 1222 may be sharpened to be V-shaped, which matches the first end 1212, such that the first end 1212 and the second end 1222 can be combined to form a V-shaped pointed end to be easily inserted into the aerosol forming substrate 2. A free end of the second end 1222 may be bent towards the first conductive part 1213 of the first conductive substrate 121 to form a second conductive part 1223,

and the second conductive substrate 122 is electrically connected to the first conductive part 1213 of the first conductive substrate 121 through the second conductive part 1223. In some embodiments, the second electrode lead 123 is integrally made and connected with the second root 1211.

[0026] The first electrode lead 123 and the second electrode lead 124 are electrically connected to a positive electrode and a negative electrode of the power supply 13 respectively, such that a current from the positive electrode of the power supply 13 flows to the first root 1211 of the first conductive substrate 121 through the first electrode lead 123, then flows to the second end 1222 of the second conductive substrate 122 through the first end 1212 of the first conductive substrate 121, and finally flows back to the negative electrode of the power supply 13 through the second root 1221 of the second conductive substrate 122 and the second electrode lead 124. In some embodiments, the first electrode lead 123 and the second electrode lead 124 may be electrically connected to the negative electrode and the positive electrode of the power supply 13 respectively, and in this case, the direction of the current is opposed.

[0027] In some embodiments, the electric insulating layer 125 may be in the shape of an elongated sheet, and the length of the electric insulating layer 125 is preferably greater than that of the first electrically conducting substrate 121 and the second conductive substrate 122, such that the first electrode lead 123 and the second electrode lead 124 can be at least partially attached to two opposite surfaces of the electric insulating layer 125 in a lengthwise direction. In some embodiments, a front end 1251 of the electric insulating layer 125 may be sharpened to be V-shaped, so as to match the end of the first conductive substrate 121 and the end of the second conductive substrate 122 in shape.

[0028] In some embodiments, the heating element 12 may further comprise a first insulating assembly 126 and a second insulating assembly 127 which are attached to two opposite surfaces of the electric insulating layer 125 respectively, the first insulating assembly 126 is disposed on two opposite sides of the first electrode lead 123, and the second insulating assembly 127 is disposed on two opposite sides of the second electrode lead 124.

[0029] FIG. 7 and FIG. 8 illustrate a heating element 12a in some other embodiments of the invention, which can be used as an alternative of the heating element 12 mentioned above. As shown in FIG. 7 and FIG. 8, in some embodiments, the heating element 12a may comprise a first conductive substrate 121a, a second conductive substrate 122a disposed on and electrically connected to the first conductive substrate 121a, a first electrode lead 123a electrically connected to the first conductive substrate 121a, a second electrode lead 124a electrically connected to the second conductive substrate 122a, and an electric insulating layer 125a disposed between the first conductive substrate 121a and the second conductive substrate 122a.

[0030] In some embodiments, the first conductive substrate 121a and the second conductive substrate 122a may be made of a material with high thermal resistance (such as one or more of silver, platinum, copper, nickel and palladium), such that heat can be generated when a current flows through the first conductive substrate 121a and the second conductive substrate 122a. Or, one of the conductive substrate 121a and the second conductive substrate 122a may be made of the material with high thermal resistance, and the other one of the conductive substrate 121a and the second conductive substrate 122a is made of metal such as stainless steel or an electrically conductive material such as electrically conductive ceramic. In some embodiments, the thickness of the first conductive substrate 121a and the second conductive substrate 122a may range from 0.2 mm-0.35 mm.

[0031] In some embodiments, the first conductive substrate 121a may be in the shape of an elongated sheet, and comprises a first root 1211a and a first end 1212a opposite to the first root 1211a. The first end 1212a may be sharpened to be V-shaped. In some embodiments, the first electrode lead 123a is integrally made and connected with the first root 1211a.

[0032] In some embodiments, the second conductive substrate 122a may be in the shape of an elongated sheet, and has a size matching that of the first conductive substrate 121a. The second conductive substrate 122a may comprise a second root 1221a and a second end 1222a opposite to the second root 1221a. The second end 1222a may be sharpened to be V-shaped, which matches the first end 1212a, such that the first end 1212a and the second end 1222a can be combined to form a V-shaped pointed end to be easily inserted into the aerosol forming substrate 2. In some embodiments, the second electrode lead 123a is integrally made and connected with the second root 1211a.

[0033] In some embodiments, the heating element 12a may further comprise an electric conductor 128 which extends through the electric insulating layer 125a and electrically connects the first end 1212a of the first conductive substrate 121a and the second end 1222a of the second conductive substrate 122a, such that the first conductive substrate 121a and the first electrically conductive substrate 121a are electrically connected. In some embodiments, the electric conductor 128a may be columnar. It should be understood that the number of the heating element 12a may be more than one.

[0034] The first electrode lead 123a and the second electrode lead 124a are electrically connected to a positive electrode and a negative electrode of the power supply 13 respectively, such that a current from the positive electrode of the power supply 13 flows to the first root 1211a of the first conductive substrate 121a through the first electrode lead 123a, then flows to the second end 1222a of the second conductive substrate 122a through the first end 1212a of the first conductive substrate 121a and the electric conductor 128a, and finally flows back

to the negative electrode of the power supply 13 through the second root 1221a of the second conductive substrate 122a and the second electrode lead 124a. In some embodiments, the first electrode lead 123a and the second electrode lead 124a may be electrically connected to the negative electrode and the positive electrode of the power supply 13 respectively, and in this case, the direction of the current is opposed.

[0035] In some embodiments, the electric insulating layer 125a may be in the shape of an elongated sheet, and the length of the electric insulating layer 125a is preferably greater than that of the first electrically conducting substrate 121a and the second conductive substrate 122a, such that the first electrode lead 123a and the second electrode lead 124a can be at least partially attached to two opposite surfaces of the electric insulating layer 125a in a lengthwise direction. In some embodiments, a front end 1251a of the electric insulating layer 125a may be sharpened to be V-shaped, so as to match the end of the first conductive substrate 121a and the end of the second conductive substrate 122a in shape. In some embodiments, the front end 1251a of the electric insulating layer 125a may be formed with a mounting hole 1250a perforating therethrough, and the electric conductor 128a may be inserted in the mounting hole 1250a.

[0036] In some embodiments, the heating element 12a may further comprise a first insulating assembly 126a and a second insulating assembly 127a which are attached to two opposite surfaces of the electric insulating layer 125a respectively, the first insulating assembly 126a is disposed on two opposite sides of the first electrode lead 123a, and the second insulating assembly 127a is disposed on two opposite sides of the second electrode lead 124a.

[0037] It can be understood that the above embodiments are merely preferred ones of the invention and are specifically described in detail, but they should not be construed as limitations of the patent scope of the invention.

Claims

1. A heating element, configured for being inserted into and heating an aerosol forming substrate, **characterized in that** the heating element comprises a first conductive substrate, a second conductive substrate disposed on and electrically connected to the first conductive substrate, and an electric insulating layer disposed between the first conductive substrate and the second conductive substrate.

2. The heating element according to Claim 1, **characterized in that** at least one of the first conductive substrate and the second conductive substrate is made of stainless steel or electrically conductive ceramic.

3. The heating element according to Claim 1, **characterized in that** the thicknesses of the first conductive substrate and the second conductive substrate range from 0.2 mm-0.35 mm.

4. The heating element according to any one of Claims 1-3, **characterized in that** the first conductive substrate in the shape of an elongated sheet comprises a first root and a first end opposite to the first root, and the first end is sharpened.

5. The heating element according to Claim 4, **characterized in that** the free end of the first end is bent towards the second conductive substrate to form a first conductive part, and the first conductive substrate is electrically connected to the second conductive substrate through the first conductive part.

6. The heating element according to Claim 4, **characterized in that** the second conductive substrate is in the shape of an elongated sheet and matches the first conductive substrate in shape and size, the second conductive substrate comprises a second root and a second end opposite to the second root, and the second end is sharpened and forms a pointed end together with the first end.

7. The heating element according to Claim 6, **characterized in that** a free end of the second end is bent towards the first end to form a second conductive part, and the second conductive part is electrically connected to the first end.

8. The heating element according to Claim 7, **characterized in that** the heating element comprises a first electrode lead electrically connected to the first conductive substrate, and the first electrode lead is integrally made and connected with the first root; and the heating element further comprises a second electrode lead electrically connected to the second conductive substrate, and the second electrode lead is integrally made and connected to the second root.

9. The heating element according to Claim 8, **characterized in that** the electric insulating is in the shape of an elongated sheet and has a length that of the first conductive substrate and the second conductive substrate, and the first electrode lead and the second electrode lead are at least partially attached to two opposite surfaces of the electric insulating layer in a lengthwise direction.

10. The heating element according to Claim 9, **characterized in that** the front end of the electric insulating layer is sharpened to be V-shaped, so as to match the first end of the first conductive substrate and the second end of the second conductive substrate in shape.

11. The heating element according to Claim 10, **characterized in that** the heating element comprises a first insulating assembly and a second insulating assembly attached to two opposite surfaces of the electric insulating layer respectively, the first insulating assembly is disposed on two opposite sides of the first electrode lead, and the second insulating assembly is disposed on two opposite sides of the second electrode lead.

12. The heating element according to Claim 6, **characterized in that** the heating element comprises an electric conductor extending through the electric insulating layer to electrically connect the first end of the first conductive substrate and the second end of the second conductive substrate.

13. An aerosol generation device, comprising the heating element according to any one of Claims 1-12.

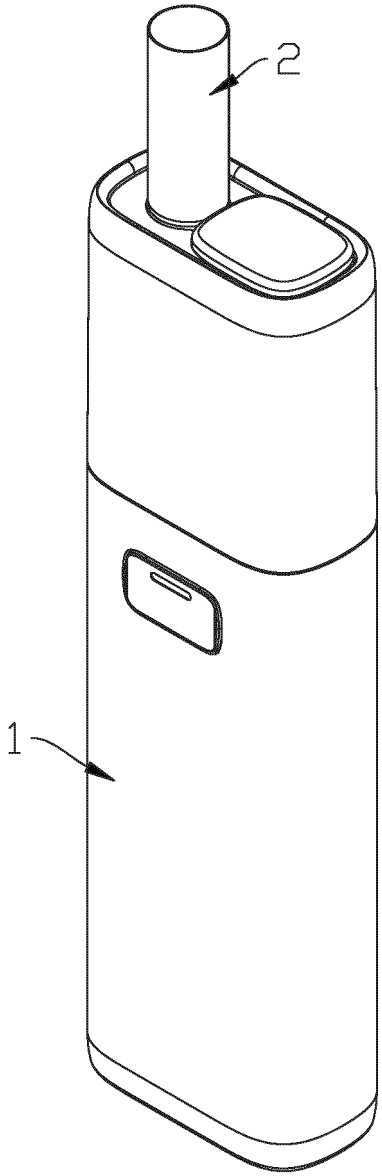

FIG. 1

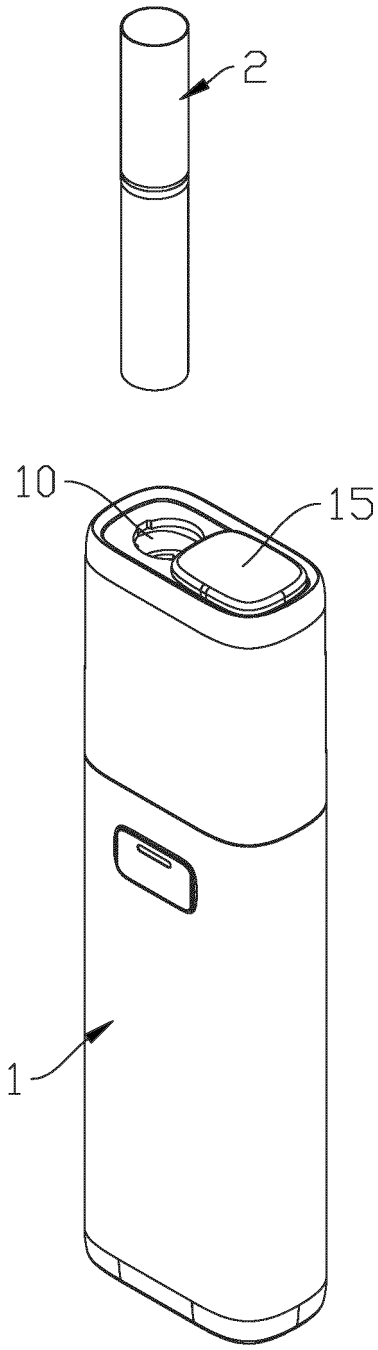

FIG. 2

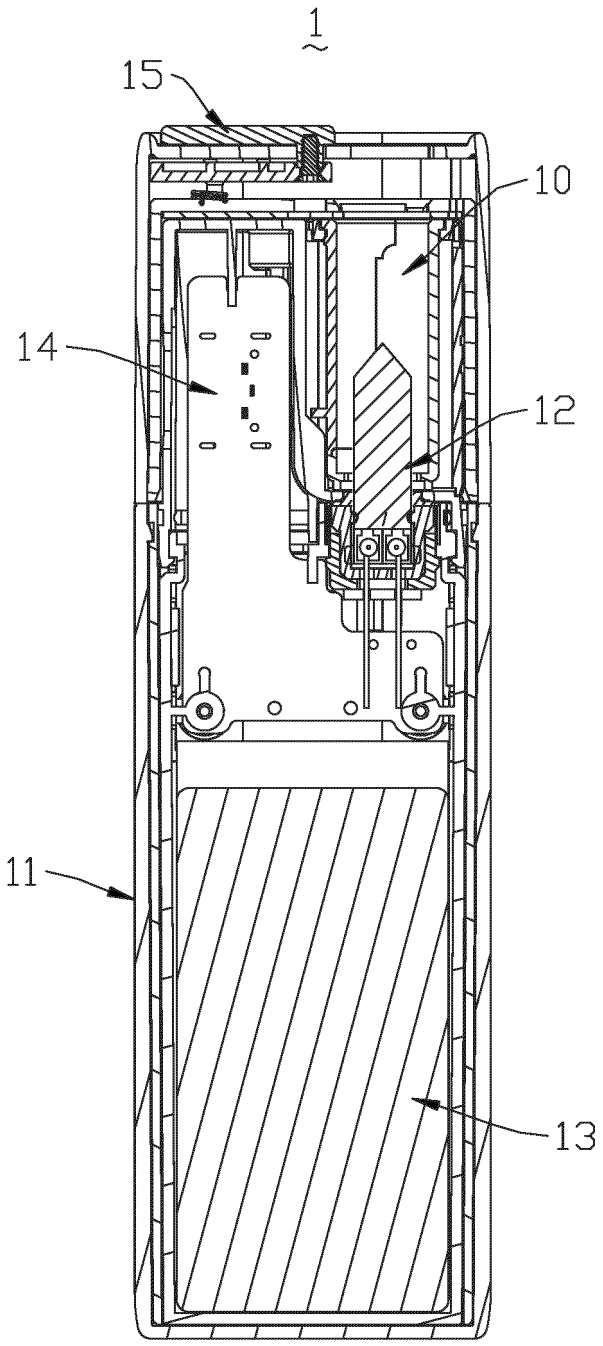

FIG. 3

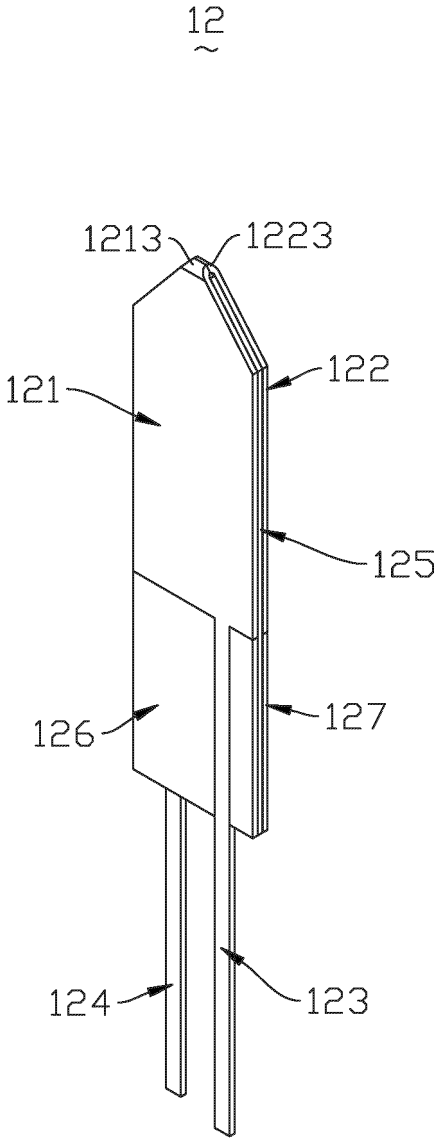

FIG. 4

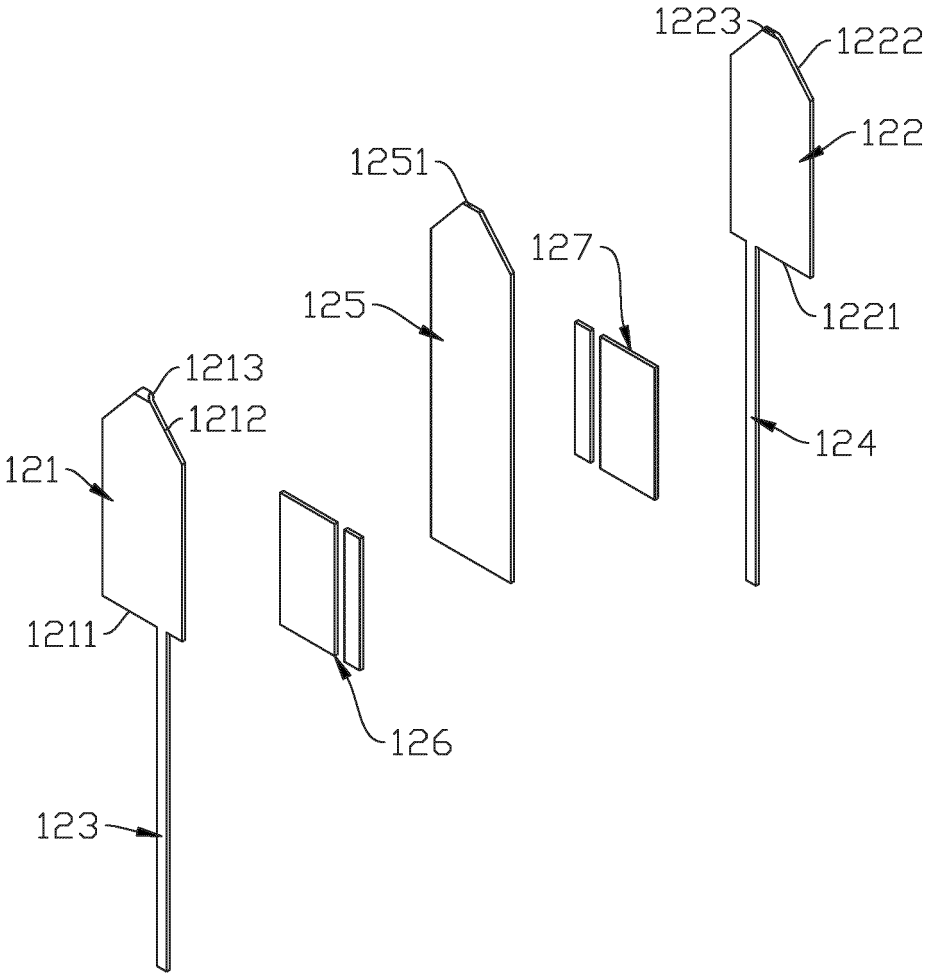

FIG. 5

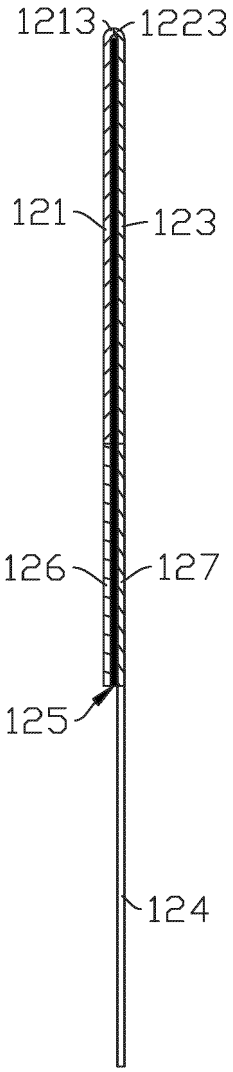

FIG. 6

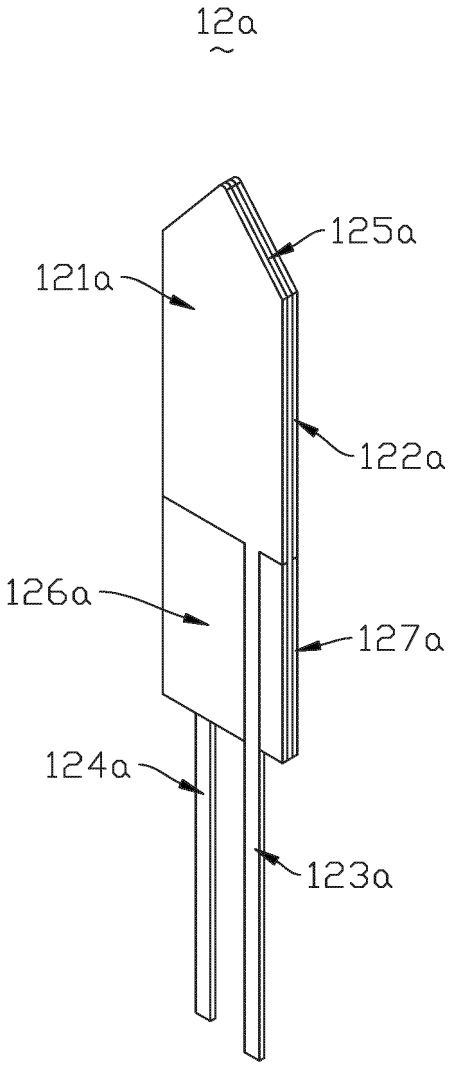

FIG. 7

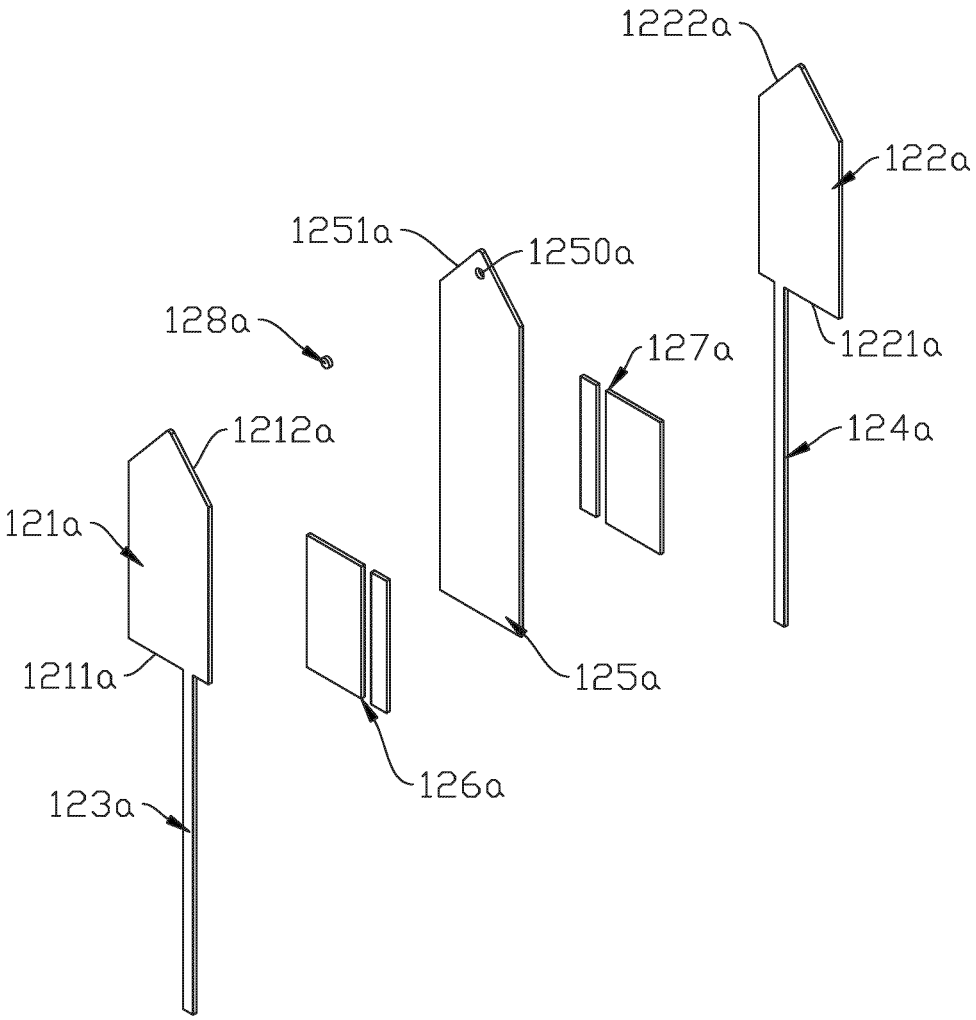
1222a
122a
1251a
1250a
128a
127a
1221a
1212a
124a
121a
1211a
125a
126a
123a

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/109319

A. CLASSIFICATION OF SUBJECT MATTER

A24F 40/46(2020.01)i; A24F 47/00(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)

A24F40;A24F47

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

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

DWPI; CNABS; SIPOABS; CNTXT; Patentics: 深圳麦时, 电子烟, 绝缘层, 电热, 电加热, 发热, 加热, 导电, 电线, 引线, 引脚, 第二, 插, 层, smok+, heat+, insula+, insert+, infix, interpos+, layer?, wire?, lead+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 112137172 A (SHENZHEN MAISHI TECHNOLOGY CO., LTD.) 29 December 2020 (2020-12-29) claims 1-13	1-13
Y	CN 111296896 A (SHENZHEN YOUME NETWORK TECHNOLOGY CO., LTD.) 19 June 2020 (2020-06-19) description, paragraphs 28-39, and figures 7-8	1-13
Y	CN 107668772 A (CHINA HEALTH AND WELLNESS GROUP LIMITED) 09 February 2018 (2018-02-09) description paragraphs 58-66 and figures 2, 4	1-13
A	CN 110101123 A (SHENZHEN TAOTAO TECHNOLOGY CO., LTD.) 09 August 2019 (2019-08-09) entire document	1-13
A	CN 209807157 U (CHINA TOBACCO HUNAN INDUSTRIAL CO., LTD.) 20 December 2019 (2019-12-20) entire document	1-13

☑ 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
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 September 2021	**27 October 2021**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** **China**	
Facsimile No. **(86-10)62019451**	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/109319

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 111449291 A (SHENZHEN MAISHI TECHNOLOGY CO., LTD.) 28 July 2020 (2020-07-28) entire document	1-13
A	KR 20180113841 A (AMOGREENTECH CO., LTD.) 17 October 2018 (2018-10-17) entire document	1-13
A	EP 3409467 A1 (HERAEUS SENSOR TECHNOLOGY GMBH) 05 December 2018 (2018-12-05) entire document	1-13

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/109319

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		EP 3409467 B1	03 July 2019

Form PCT/ISA/210 (patent family annex) (January 2015)