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(54) CONSUMABLE CARTRIDGE, AEROSOL-GENERATING DEVICE AND METHOD OF MANUFACTURING THE CONSUMABLE CARTRIDGE

(57) The disclosure relates to a consumable cartridge (100) for use with an electrically heated aerosol-generating device (200), the cartridge comprising at least one heat generating layer (102) extending along a longitudinal axis of the consumable cartridge, the heat generating layer (102) comprises an electrical conductor dimensioned to contact at least two electrical terminals of the electrically heated aerosol-generating device to allow electricity to flow therethrough; a first substrate layer (106) positioned on the heat generating layer (102) and/or surrounded by the heat generating layer (102); an aerosol generating substrate (108) dispersed on the heat generating layer (102), the first substrate layer (106), and/or formed as a separate layer disposed between the heat generating layer (102) and the first substrate layer (106); wherein the heat generating layer (102) comprises a plurality of insulating portions (104) configured the increase the electrical resistance of the heat generating layer (102) and generate heat to produce aerosol from the aerosol generating substrate (108) when electricity is flowing therethrough.

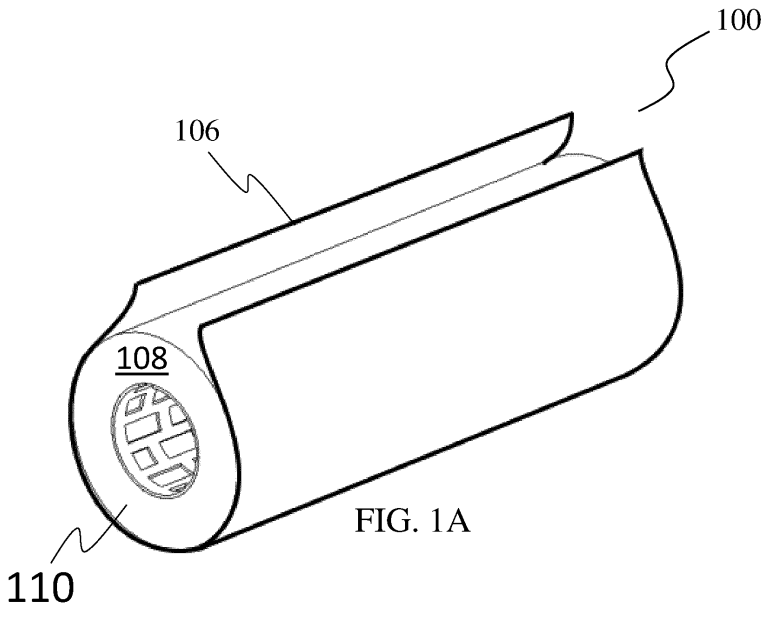

FIG. 1A

Processed by Luminess, 75001 PARIS (FR)

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a consumable cartridge, an aerosol-generating device for use with the consumable cartridge, and a method of manufacturing the consumable cartridge.

BACKGROUND

[0002] The following discussion of the background is intended to facilitate understanding of the present disclosure. However, it should be appreciated that the discussion is not an acknowledgment or admission that any of the material referred to was published, known or a part of the common general knowledge in any jurisdiction as at the priority date of the application.

[0003] Handheld or portable electrically heated aerosol-generating devices which operate by heating an aerosol-generating substrate, also referred to as a consumable cartridge, are known in the art.

[0004] Current electrically heated smoking devices typically incorporates one or more heat generating element(s) or heating assembly for heating the aerosol-generating substrate. However, such heat generating elements are not easily removable and may pose problems in maintenance or replacement. In addition, the positioning of such heat generating elements within the aerosol-generating devices are typically unable to achieve consistent heating of consumable cartridges. Some heat generating elements comprises a piercing surface to pierce the consumable cartridge so as to receive the same. However, the piercing surface may inadvertently cause damage to the consumable cartridge or result in wastage of aerosol generating materials which is displaced during the piercing.

[0005] In addition, if the device is inadvertently switched on without the presence of an aerosol-generating substrate, damage to the device or overheating may occur.

[0006] There therefore exists a need for an improved consumable cartridge and an aerosol-generating device.

SUMMARY

[0007] According with one aspect of the disclosure, there is provided a consumable cartridge as defined in claims 1 to 8. According with another aspect of the disclosure, there is provided an aerosol generating device as defined in claims 9 to 12. According with another aspect of the disclosure, there is provided a method of manufacturing the consumable cartridge as defined in claims 13 to 15.

[0008] It is contemplated that the various aspects may be combined in at least one way, for example in the form of a kit comprising at least one consumable cartridge and an aerosol generating device.

[0009] Other aspects of the disclosure will be apparent to those of ordinary skill in the art upon review of the following description of specific embodiments of the disclosure in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Various embodiments are described, by way of example only, with reference to the accompanying drawings, in which:

FIGS. 1A and 1B show a schematic perspective view and a perspective cross-section view of a consumable cartridge in accordance with an embodiment of the present disclosure.

FIGS. 2A to 2C show three possible configurations of a heat generating layer of the consumable cartridge.

FIGS. 3A and 3B show a schematic perspective view and a perspective cross-section view of a consumable cartridge in accordance with another embodiment of the present disclosure.

FIGS. 4A and 4B show a schematic perspective view of another embodiment of a consumable cartridge comprising crimped portions.

FIG. 5 is a schematic illustration of an electrically heated aerosol-generating device in accordance with an embodiment of the present disclosure.

FIG. 6A is a schematic perspective view of a mouthpiece of the electrically heated aerosol-generating device of FIG. 5; FIG. 6B is a schematic illustration of the electrically heated aerosol-generating device of FIG. 5 with a consumable cartridge inserted.

FIGS. 7A and 7B are schematic illustrations of an apparatus for manufacturing a consumable cartridge in accordance with an embodiment of the present disclosure.

FIG. 8 is a flow chart illustrating a method of manufacturing a consumable cartridge in accordance with an embodiment of the present disclosure.

[0011] Other arrangements are possible, and it is appreciable that the accompanying drawings are not to be understood as superseding the generality of the preceding description of the disclosure.

DETAILED DESCRIPTION

[0012] Embodiments are described with reference to the accompanying drawings. The terminology used herein is for the purpose of describing particular embodiments

only and is not intended to limit the scope of the present disclosure. Other definitions for selected terms used herein may be found within the detailed description of the disclosure and apply throughout the description. Additionally, unless defined otherwise, all technical and scientific terms used herein have the same meanings as commonly understood by one ordinary skilled in the art to which the present disclosure belongs. Where possible, the same reference numerals are used throughout the figures for clarity and consistency.

[0013] Throughout the specification, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

[0014] Throughout the specification, unless the context requires otherwise, the word "include" or variations such as "includes" or "including", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

[0015] Throughout the specification, unless the context requires otherwise, the word "have" or variations such as "has" or "having", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

[0016] Throughout the specification, the articles "a", "an" and "the" as used with regard to a feature or element include a reference to one or more of the features or elements.

[0017] Throughout the specification, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0018] Throughout the specification, unless the context requires otherwise, the term "tobacco" will be understood to include intermediate and/or final products prepared from a part of the tobacco plant, such as leaves, through the process of drying or curing, and further optional processes of aging, fermenting, flavorings etc., and to include any other products derived from any forms of tobacco leaves such as ground and reconstituted tobacco material.

[0019] Throughout the specification, the term "alloy" will be understood to refer to an admixture of metals and elements including, but not limited to, aluminum, copper, iron, magnesium, manganese, nickel, silicon, silver, tin, titanium, vanadium and zinc. The dominant or main component metal may be the metal having the highest percentage, in composition, relative to other elements.

[0020] Throughout the specification, the term "fiber" will be understood to depict a slender and substantially elongated shape.

[0021] Throughout the specification, the term "sheet" and "layer" will be understood to depict a planar surface with a substantially higher length and/or width compared to thickness. In addition, the term 'layer' can refer to single or multiple layers, with or without coating.

[0022] Throughout the specification, the term "wrapped" or "unwrapped" refers to a covering/non-covering of an element.

[0023] Throughout the specification, the term "aerosol generating substrate" refers to a substrate that, when heated, produces an aerosol or vapor suitable for consumption by a user. The aerosol generating substrate may include one or more layers and each layer can include tobacco and/or non-tobacco material.

[0024] Throughout the specification, the term "not-for-burn" refers to a methodology of heating an aerosol generating substrate/product without combustion.

[0025] Throughout the specification, the term "acetate tow" includes colored acetate tow.

[0026] According to an aspect of the disclosure there is a consumable cartridge 100 for use with an electrically heated aerosol-generating device, the cartridge comprising at least one heat generating layer 102 extending along a longitudinal axis of the consumable cartridge, the heat generating layer 102 comprises an electrical conductor dimensioned to contact at least two electrical terminals of the electrically heated aerosol-generating device to allow electricity to flow therethrough; a first substrate layer 106 positioned on the heat generating layer 102 and/or surrounded by the heat generating layer 102; an aerosol generating substrate 108 dispersed on the heat generating layer 102, the first substrate layer 106, and/or formed as a separate layer disposed between the heat generating layer 102 and the first substrate layer 106; wherein the heat generating layer 102 comprises a plurality of insulating portions 104 configured the increase the electrical resistance of the heat generating layer 102 and generate heat to produce aerosol from the aerosol generating substrate 108 when electricity is flowing therethrough.

[0027] FIG. 1Aand FIG. 1B illustrate a consumable cartridge 100 in the form of a three-layered elongate tube comprising the heat generating layer 102 configured as a central core layer.

[0028] The heat generating layer 102 may comprise an electrical conductor. Non-limiting examples of the electrical conductor may include nickel, nichrome, Iron Chrome Aluminum (FeCrAl) alloy, stainless steel, titanium, aluminium, copper, combination(s) of the aforementioned. Other suitable electrically conductive material for use with human consumable products may be contemplated.

[0029] The first substrate layer 106 may be configured as a single layer or multi-layer. The single or multi-layer may be formed from or of at least one of the following materials: paper, metal (such as aluminium, copper, aluminium foil), metallic alloy, reconstituted tobacco, coated paper, cellulose fibre including natural and synthetic fibre.

[0030] In the embodiment shown in FIG. 1A and 1B, there is a second substrate layer 110 arranged as an intermediate layer 110 disposed between the first substrate layer 106 and the heat generating layer 102. The

intermediate layer 110 may be formed from or of at least one of the following materials: acetate tow, cellulose fiber including synthetic and naturel fibre, cotton, fabric, yarn, mesh, metal fibre, reconstitute tobacco sheet, cut rag, powder/granule, and/or paper.

[0031] The aerosol generating substrate 108 may be integrated as part of the intermediate layer 110 (for example as tobacco-related materials as mentioned) and/or may be sprayed or coated onto at least one of the first substrate 106, the second substrate 110, and/or the heat generating layer 102. Non-limiting examples of the aerosol generating substrate 108 includes nicotine, propylene glycol (PG) and vegetable glycerin (VG). It is contemplated that the aerosol generating substrate 108 may be applied to the substrates/layers via known means such as coating, spraying, embedding, dipping.

[0032] The plurality of insulating portions 104 may comprise a plurality of perforations or holes formed on the heat generating layer 102. Such insulating portions 104 are incorporated to increase the overall electrical resistivity of the electrical conductor so as to facilitate the generation of heat when an electrical current is passed therethrough. The plurality of perforations may optionally comprise at least one of the following shapes: round, elliptical, square, polygonal, or combinations of one of the aforementioned.

[0033] In some embodiments and as shown in FIGS. 2A to 2C, the heat generating layer 102 can be formed by a flat sheet rolled into a cylindrical shape, with open or overlapping ends, or it can be a tube with perforated holes.

[0034] Referring to FIG. 3A and FIG. 3B, which show another embodiment of the consumable cartridge 100 comprising three-layers, that is, a heat generating layer 102, an intermediate layer (second substrate layer) 110, and an outer layer (first substrate layer) 106. In this embodiment, at least one surface, such as the inner surface and the edges of the perforated holes 104 of the heat generating layer 102, may be applied with aerosol generating substrate 108 such as nicotine, PG, VG or other aerosol generating substance by means of spraying, coating, dipping or any other means as known to a skilled person.

[0035] The intermediate layer 110 may be arranged to wrap or surround the heat generating layer 102. The intermediate layer 110 may comprise one or more layers of paper. The surfaces of the paper may be applied with aerosol generating substrate 108 such as nicotine, PG, VG or other aerosol generating substance by means of spraying, coating, dipping or any other means as known to a skilled person.

[0036] The outer layer 106 may be applied over the intermediate layer 110. The outer layer may be at least one layer, the at least one layer includes material such as metal, reconstituted tobacco sheet, paper (including coated paper, cellulose fiber (including natural and synthetic). The metal may include aluminium, copper, and/or other metallic alloy in foil/sheet form.

[0037] In some embodiments, at least one of the first substrate 106 and the second substrate 110 may be crimpled as shown in FIG. 4. The crimpling may be performed along a longitudinal axis of the consumable cartridge 100 as shown, or may be along a transverse axis (not shown).

[0038] In some embodiments, the consumable cartridge 100 may comprise multiple layers of heat generating layer 102. In some embodiments, the heat generating layer 102 may arranged in one of the following configurations: (i) on the first substrate 106 and/or the second substrate 110, (ii) wrapped or surrounded by the first substrate 106 and/or the second substrate 110, or (iii) sandwiched between the first substrate 106 and the second substrate 110.

[0039] According to another aspect of the disclosure there is an electrically heated aerosol-generating device 200 for use with a consumable aerosol-generating cartridge 100. The heat aerosol-generating device 200 does not incorporate heat generating elements such as resistive wires or elongate piercing members.

[0040] Referring to FIG. 5, the electrically heated aerosol-generating device 200 comprises a housing 202 having a cavity 204 for receiving the consumable cartridge 100, the cavity 204 comprises a base 206 supporting a first electrical contact 208 for contacting an end of the heat generating portion 102 of the cartridge 100; a mouthpiece 210 comprising a passageway for aerosol to flow therethrough and a second electrical contact 212 for contacting an opposite end of the heat generating portion 102 of the cartridge 100; wherein the second electrical contact 212 is positioned diametrically opposite the first electrical contact 206 when in use.

[0041] The housing 202 may have an elongate structure and defines the cavity 204, the cavity 204 shaped and dimensioned to receive the consumable cartridge 100 as described. The base 206 may be arranged as a separator disposed between the cavity 204 and a compartment 216 housing one or more batteries and control electronics. The base 206 may be an electrical insulator. The second electrical contact 212 is separated from the first electrical contact 208 via the cavity 204.

[0042] The mouthpiece 210 may include a passageway or outlet for generated aerosol to flow therethrough. The mouthpiece portion 210 is removably attached to the housing 202 and may be connected or attached to the housing 202 via screw fitting, hinged connection, snap fitting or other connectors as known to a skilled person.

[0043] Unlike conventional devices, the device 200 does not include an elongate piercing member for receiving/piercing the aerosol generating substrate or comprises electric heater(s) within the device 200. Electrical current therefore does not flow through the device 200 without the presence of the consumable cartridge 100.

[0044] As illustrated in FIG. 5 and FIG. 6A, the second electrical contact 212 may be connected to one or more electrical contacts 220 disposed around a circumference of the mouthpiece 210. The electrical contact(s) 220 can in turn be connected to an electrically conductive casing

214 disposed around the perimeter of the housing 202, the conductive casing 214 which will then be connected to a terminal, example, a negative terminal of the battery. The electrically conductive casing 214 may be formed of or from metallic materials. The first electrical contact 208 is electrically isolated from the electrically conductive casing 214 such that no electrical current will flow between the first electrical contact 208 and the second electrical contact 212 when the consumable cartridge 100 is not present within the device (open circuit).

[0045] As shown in FIG. 6A, the mouthpiece 210 includes a plurality of air seals shaped and dimensioned as flanges along the periphery of a contact area between the mouthpiece 210 and the housing 202.

[0046] FIG. 6B shows the device 200 in operation when a consumable cartridge 100 is inserted within the cavity 204. The first and second electrical contacts 208, 212 are shaped and dimensioned to urge against an internal surface of the heat generating layer 102 so as to hold the consumable cartridge 100 in position as well as to conduct electricity therethrough. When a consumable cartridge 100 is inserted within the cavity 204 and a switch (not shown) is turned on, electricity can flow through the heat generating layer 102 and the electrical resistance of the heat generating layer 102 and the electricity flowing through the heat generating layer 102 produces heat to vaporize the aerosol generating substrate 108.

[0047] FIG. 7A shows an embodiment of an apparatus 300 for manufacturing a consumable cartridge 100. The machine may be used to implement a method 400 as shown in FIG. 8 for manufacturing a consumable cartridge 100 comprising a heat generating layer and at least one of a first substrate layer and a second substrate layer, the method comprising the steps of: a. providing a heat generating layer 102 and a plurality of insulating portions 104 on the heat generating layer 102 configured to increase the electrical resistance of the heat generating layer 102 (step 402); b. providing a second substrate layer 110 disposed between the first substrate layer 106 and the heat generating layer 102 (step 404); and/or providing a first substrate layer 106 wrapping the heat generating layer 102 or wrapping the second substrate layer 110 (step 406).

[0048] The apparatus 300 may comprise a transport jet 302 for facilitating the movement, dispensation, and formation of the consumable cartridge 100, a first bobbin 304 for feeding raw material associated with the heat generating layer 102, a second bobbin 306 for feeding the first substrate layer 106. In the embodiment shown in FIG. 7A, the second substrate 110 may be layered onto the heat generating layer 102 before the first substrate layer 106 is layered. The apparatus may further comprise a sprayer 308 for coating aerosol generating material onto the intermediate layer 110 to enhance the aerosol generating effect before the first substrate layer 106 is layered. A cutter 310 may be positioned downstream the after the first substrate layer 106 is layered to cut the consumable cartridge into desired shape.

[0049] FIG. 7B shows another embodiment of the apparatus 300, wherein the intermediate layer 110 is dispensed from a third bobbin 312 and crimped by means of a crimping mechanism 314. The crimping mechanism 314 may be arranged as a transverse crimping tool or a longitudinal crimping tool.

[0050] In some embodiments (not shown), the apparatus may comprise a liquid bath comprising aerosol generating materials arranged to receive the second substrate layer 110, the heat generating layer 102, and/or the first substrate layer 106.

[0051] In the described embodiments, it is contemplated that at least a layer of the aerosol generating consumable cartridge may comprise two surfaces, with an outer surface coated with paper and an inner surface coated with metal (including copper, aluminium, silver, nickel, or tin), or metallic alloy foil laminate, reconstituted tobacco sheet, paper (including coated paper), before being formed onto a desired shape, such as tubular shape.

[0052] It is to be appreciated by the person skilled in the art that variations and combinations of features described above, not being alternatives or substitutes, may be combined to form yet further embodiments falling within the intended scope of the invention.

Reference numerals

[0053]

100: consumable cartridge
102: heat generating layer
104: insulating portions
106: first substrate layer
108: aerosol generating substrate
110: second substrate layer
200: electrically heated aerosol-generating device
202: a housing
204: a cavity
206: base
208: a first electrical contact
210: a mouthpiece
212: second electrical contact
216: compartment for electrical power source and control electronics
218: air seal
220: metal contacts
300: apparatus for manufacturing consumable cartridge
302: transport jet
304: first bobbin
306: second bobbin
308: sprayer
310: cutter
312: third bobbin
314: crimping mechanism
400: Method for manufacturing a consumable cartridge
402-406: method steps

Claims

1. A consumable cartridge (100) for use with an electrically heated aerosol-generating device (200), the cartridge comprising

   at least one heat generating layer (102) extending along a longitudinal axis of the consumable cartridge, the heat generating layer (102) comprises an electrical conductor dimensioned to contact at least two electrical terminals of the electrically heated aerosol-generating device to allow electricity to flow therethrough;
   a first substrate layer (106) positioned on the heat generating layer (102) and/or surrounded by the heat generating layer (102);
   an aerosol generating substrate (108) dispersed on the heat generating layer (102), the first substrate layer (106), and/or formed as a separate layer disposed between the heat generating layer (102) and the first substrate layer (106);
   wherein the heat generating layer (102) comprises a plurality of insulating portions (104) configured the increase the electrical resistance of the heat generating layer (102) and generate heat to produce aerosol from the aerosol generating substrate (108) when electricity is flowing therethrough.

2. The consumable cartridge (100) of claim 1, wherein the plurality of insulating portions (104) comprises a plurality of perforations formed on the heat generating layer (102), and optionally the plurality of perforations comprises at least one of the following shapes: round, elliptical, square, polygonal, or combinations of one of the aforementioned.

3. The consumable cartridge (100) of claim 1 or 2, wherein the heat generating layer (102) is formed from or of at least one of the following materials: nickel, nichrome, Iron Chrome Aluminum (FeCrAl) alloy, stainless steel, titanium, aluminium, copper.

4. The consumable cartridge (100) of any one of claims 1 to 3, further comprises a second substrate layer (110) disposed between the first substrate layer (106) and the heat generating layer (102) such that the first substrate layer (106) is wrapped around second substrate layer (110) and the second substrate layer (110) is wrapped around the heat generating layer (102), wherein the second substrate layer (110) comprises at least one of an acetate tow, a cellulose fiber (including synthetic and naturel fibre), cotton, fabric, yarn, mesh, metal fibre, and/or reconstituted tobacco sheet, cut rag, powder/granule, and/or paper.

5. The consumable cartridge (100) of any one of the preceding claims, wherein the first substrate layer (106) comprises a single layer with paper, or multilayer, including material such as metal (including nickel, aluminium, copper, aluminium foil, alloy), conductor, reconstituted tobacco, coated paper, cellulose fibre (including natural and synthetic paper).

6. The consumable cartridge (100) of claim 1, wherein the heat generating layer (102) comprises nicotine, propylene glycol PG, vegetable glycerine VG or other aerosol generating materials.

7. The consumable cartridge (100) of claim 1, wherein a second substrate layer (110) comprises nicotine, PG, VG or applied to the second substrate layer (110), and the first substrate layer (106) comprises paper, metal or metallic alloy in sheet or foil form, reconstituted tobacco sheet, coated paper, cellulose fiber, such as natural and synthetic fiber;
   wherein preferably the second substrate layer (110) is arranged in a crimped form or wherein the first substrate layer (106) and second substrate layer (110) are crimpled together, and wherein the first substrate layer (106) and second substrate layer (110) are crimpled together along a transverse axis or a longitudinal axis.

8. The consumable cartridge (100) of claim 1, wherein the heat generating layer (102) is arranged in one of the following configurations:

   (i) on the first substrate (106) and/or the second substrate (110),
   (ii) wrapped by the first substrate (106) and/or the second substrate (110), or
   (iii) sandwiched between the first substrate (106) and the second substrate (110).

9. An electrically heated aerosol-generating device (200) for use with a consumable aerosol-generating cartridge (100) of any one of claims 1 to 8, the device comprising

   a housing (202) having a cavity (204) for receiving the cartridge (100), the cavity having a base (206) having a first electrical contact (208) for contacting an end of the heat generating portion (102) of the cartridge (100);
   a mouthpiece (210) comprising a passageway for aerosol to flow therethrough and a second electrical contact (212) for contacting an opposite end of the heat generating portion (102) of the cartridge (100);
   wherein the second electrical contact (212) is positioned diametrically opposite the first electrical contact (208).

10. The device (200) of claim 9, wherein the second elec-

trical contact (212) is separated from the first electrical contact (208) via the cavity (204).

11. The device (200) of claim 9 or 10, wherein the mouthpiece (210) comprises an air seal (218).

12. The device (200) of any one of claims 9 to 11, wherein the housing comprises a perimeter (214) formed from or of electrically conductive material, the first electrical contact (208) is electrically insulated from the perimeter (214), and the second electrical contact (212) is electrically connected to the perimeter (214), or wherein the second electrical contact (212) is electrically insulated from the perimeter (214), and the first electrical contact (208) is electrically connected to the perimeter (214).

13. A method (300) for manufacturing a consumable cartridge (100) comprising a layer, a first substrate layer, and/or a second substrate layer, the method comprising the steps of:

a. providing a heat generating layer (102) and a plurality of insulating portions (104) configured the increase the electrical resistance of the heat generating layer (102);
b. optionally providing a second substrate layer (110) disposed between the first substrate layer (106) and the heat generating layer (102); and
c. providing a first substrate layer (106) wrapping the heat generating layer (102) or the second substrate layer (110).

14. The method (300) of claim 13, wherein the heat generating layer (102) is formed from or of at least one of the following materials: nickel, nichrome, Iron Chrome Aluminum (FeCrAl) alloy, stainless steel, titanium, aluminium, copper, alloy of the aforementioned materials; and/or
the method (300) further comprising the step of crimping the first and/or second substrate layer, wherein the crimping comprises at least one of a longitudinal crimp and/or a transverse crimp.

15. The method (300) of any one of claims 13 or 14, further comprising the step of spraying or coating nicotine, PG, VG or others aero-generating substance onto the first substrate layer, the second substrate layer and/or the heat generating layer (102); and/or
the method (300) further comprising a step of dipping or partially submersing the first substrate layer and/or the second substrate layer in a liquid bath comprising aerosol generating materials.

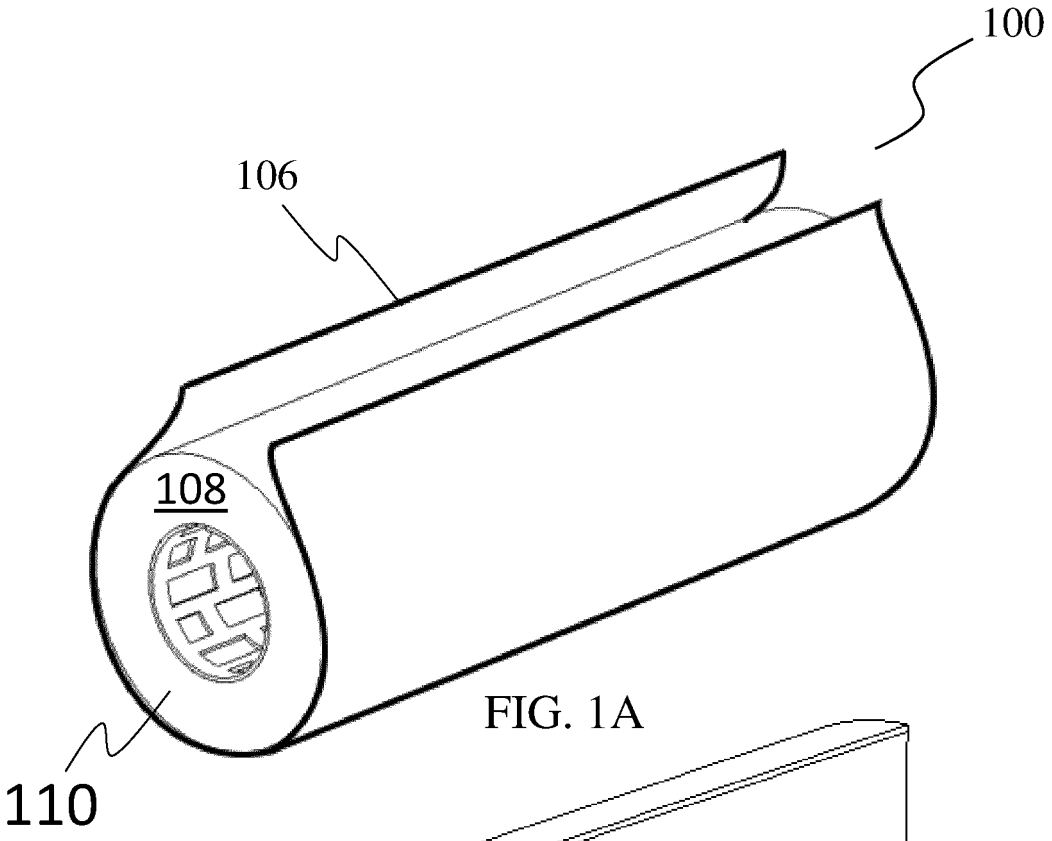

FIG. 1A

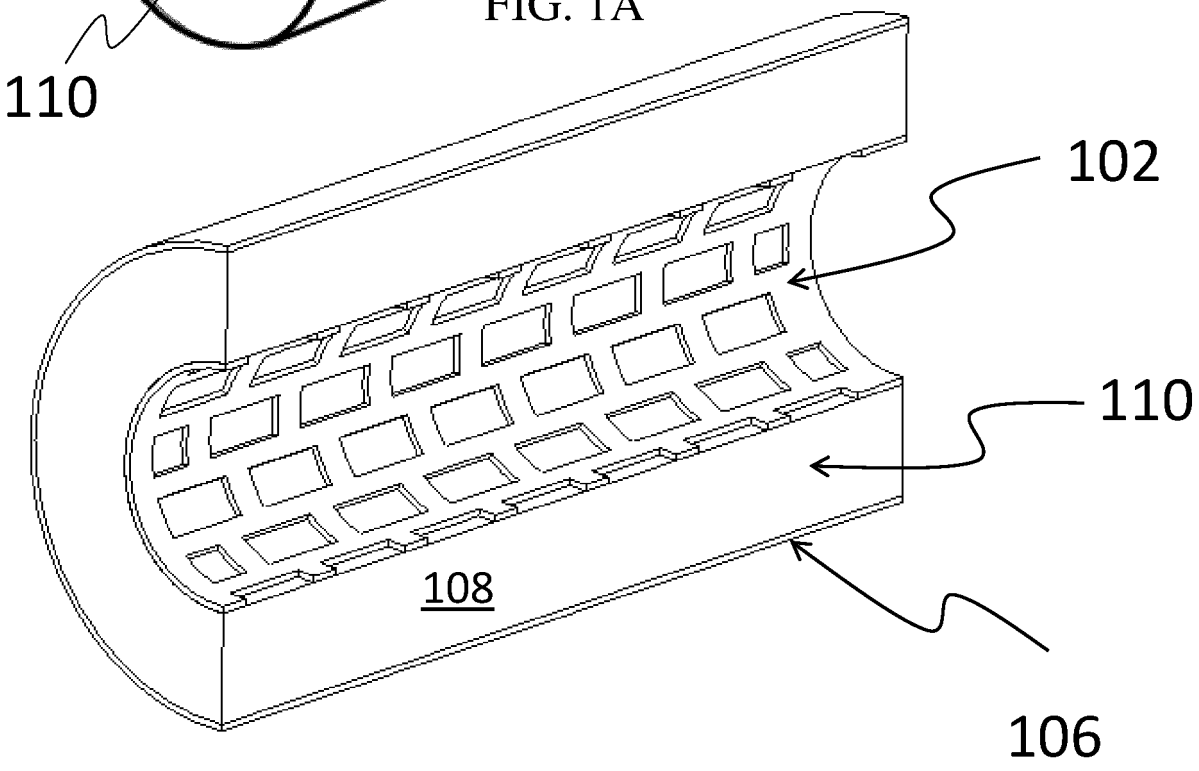

FIG. 1B

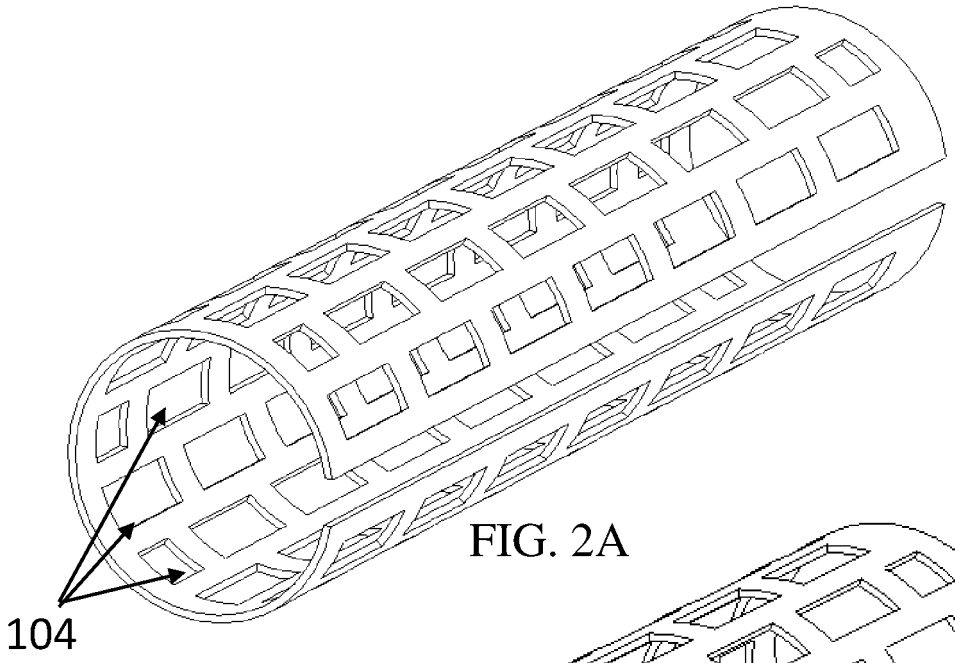

FIG. 2A

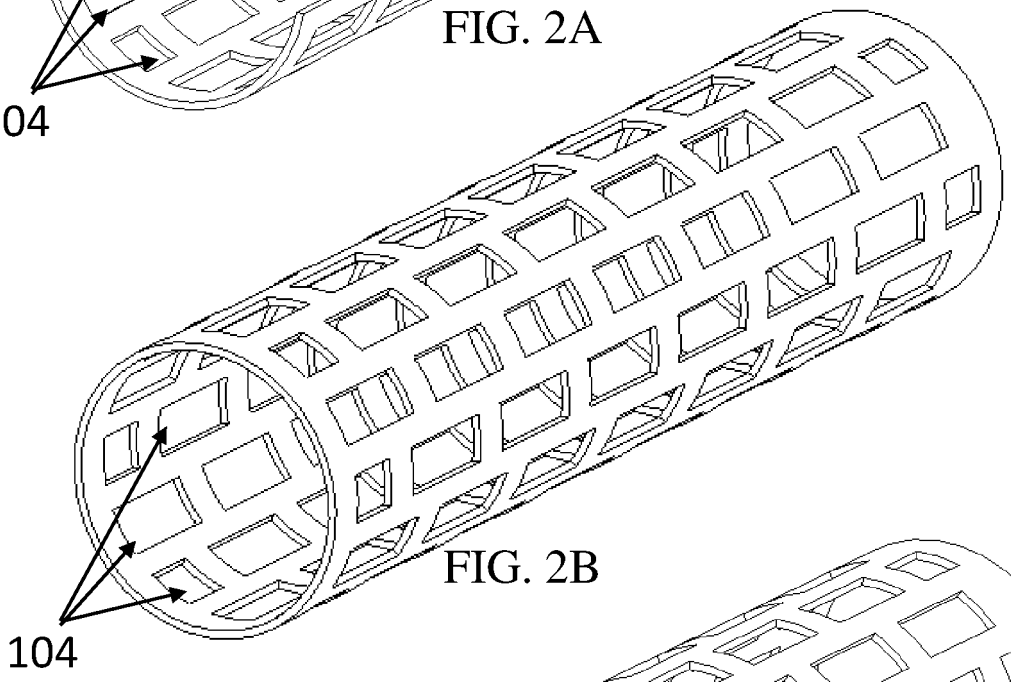

FIG. 2B

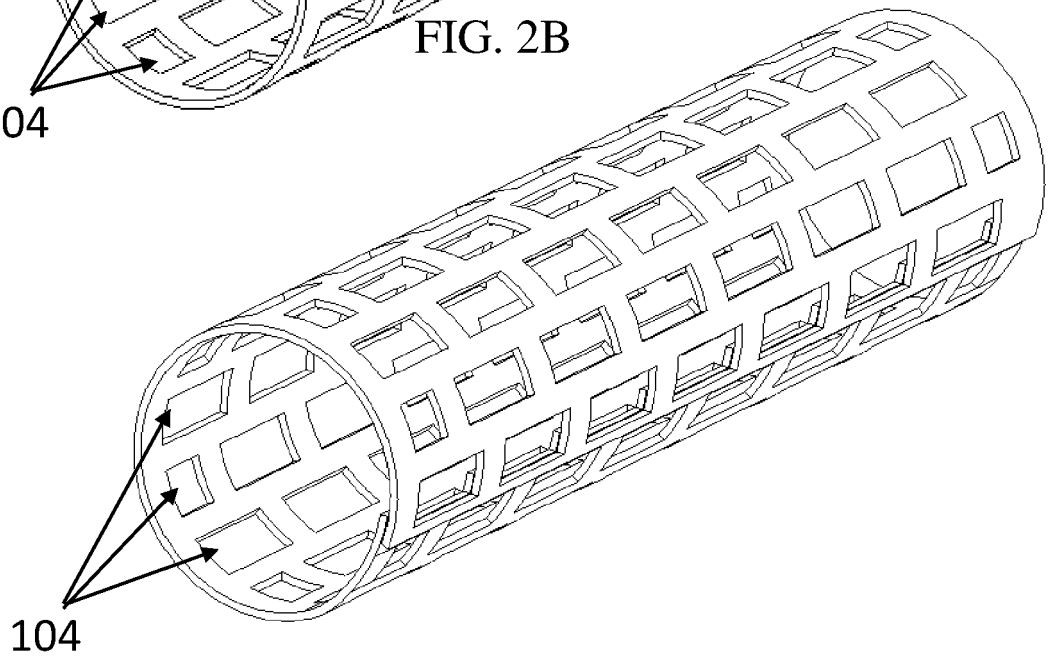

FIG. 2C

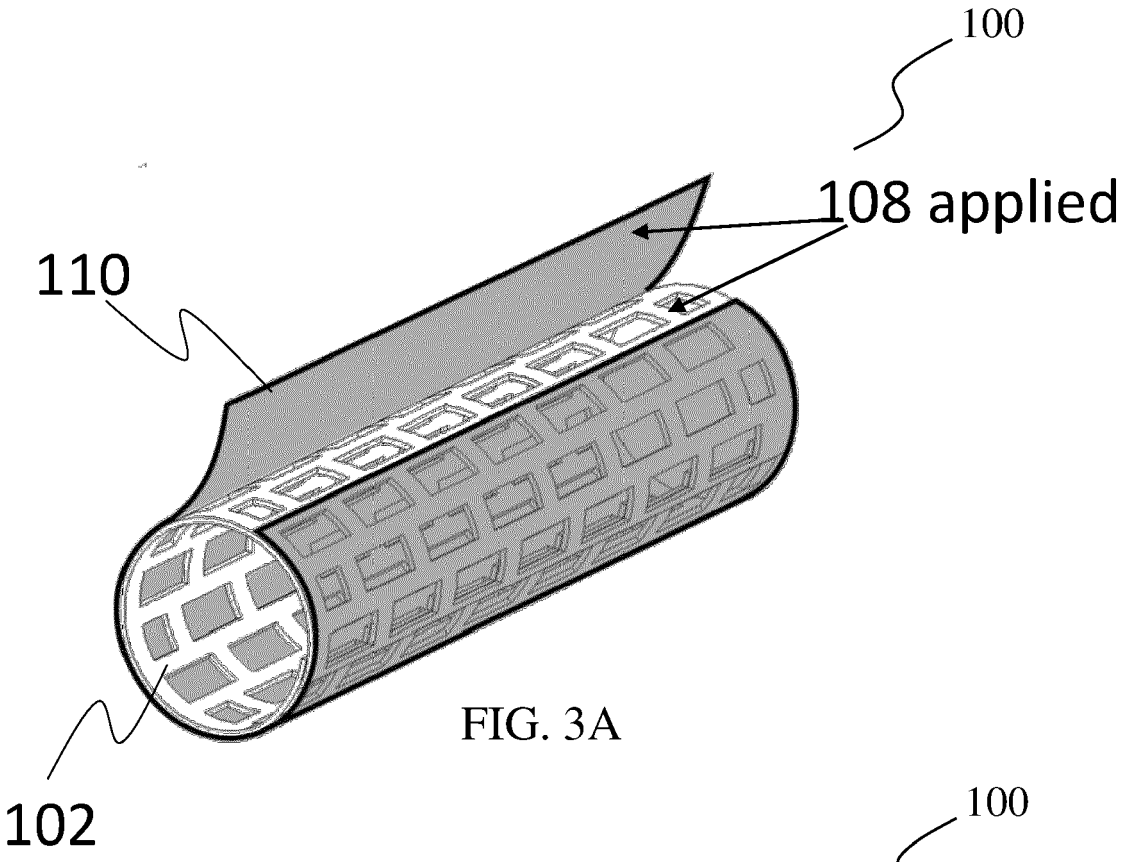

FIG. 3A

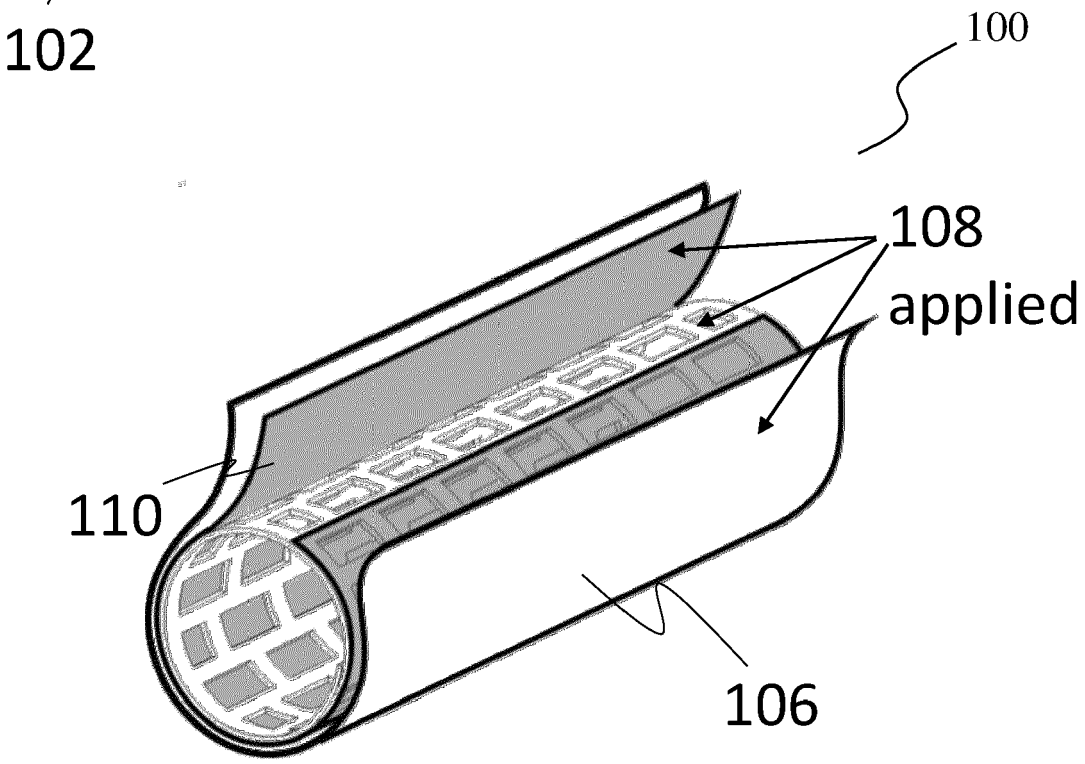

FIG. 3B

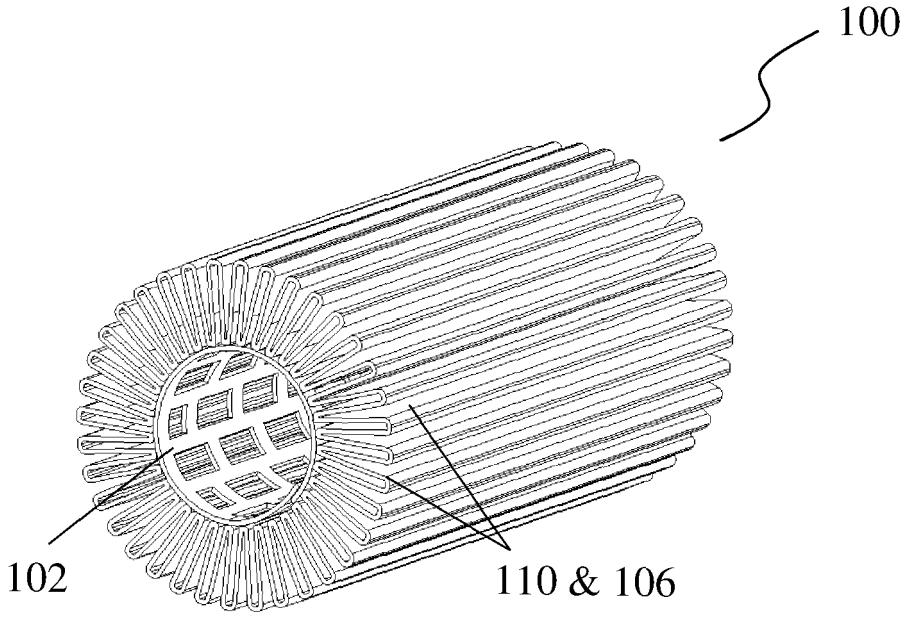

FIG. 4A

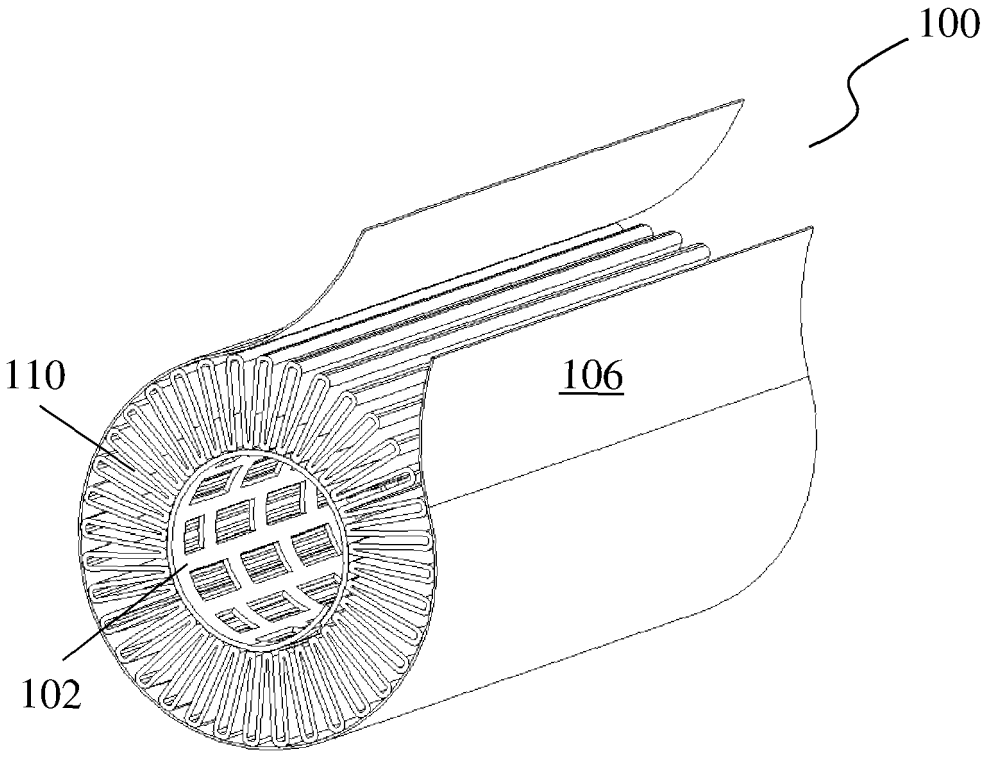

FIG. 4B

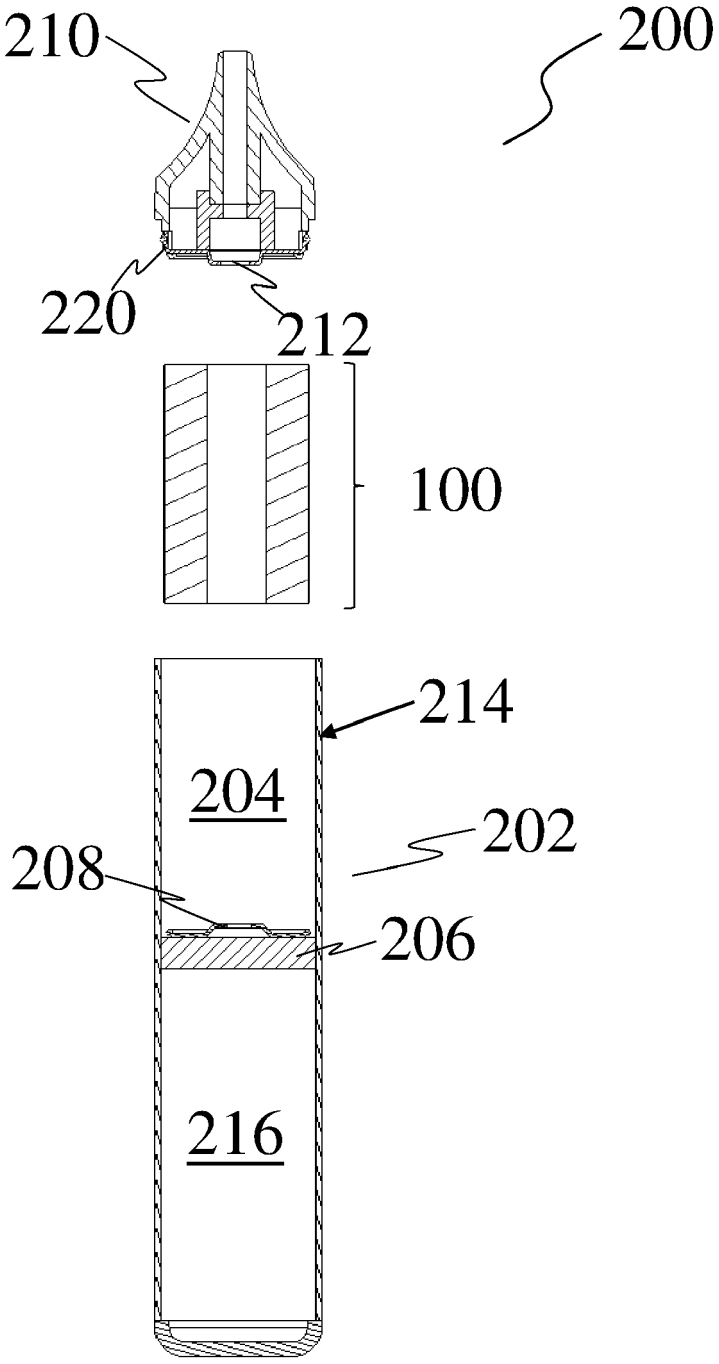

FIG. 5

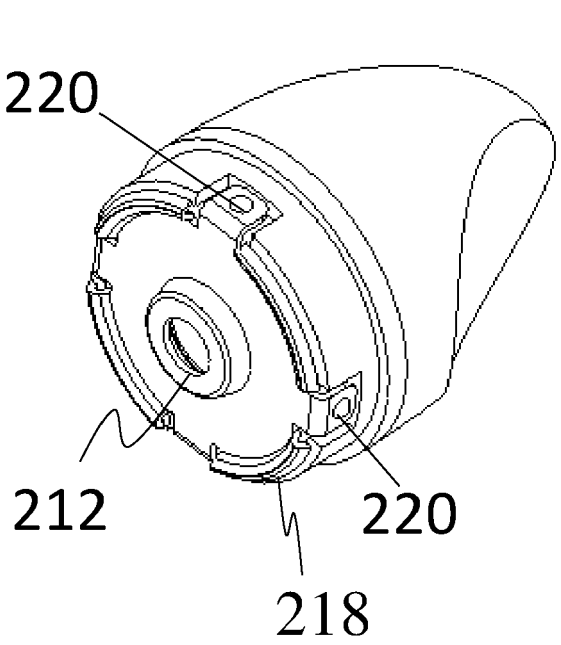

FIG. 6A

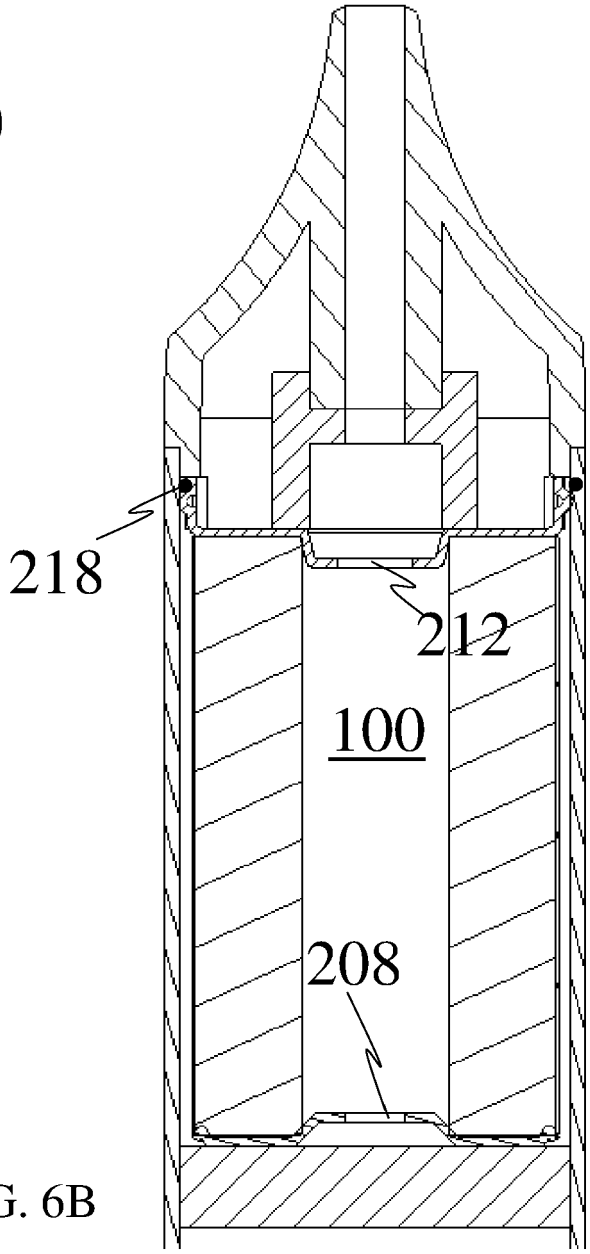

FIG. 6B

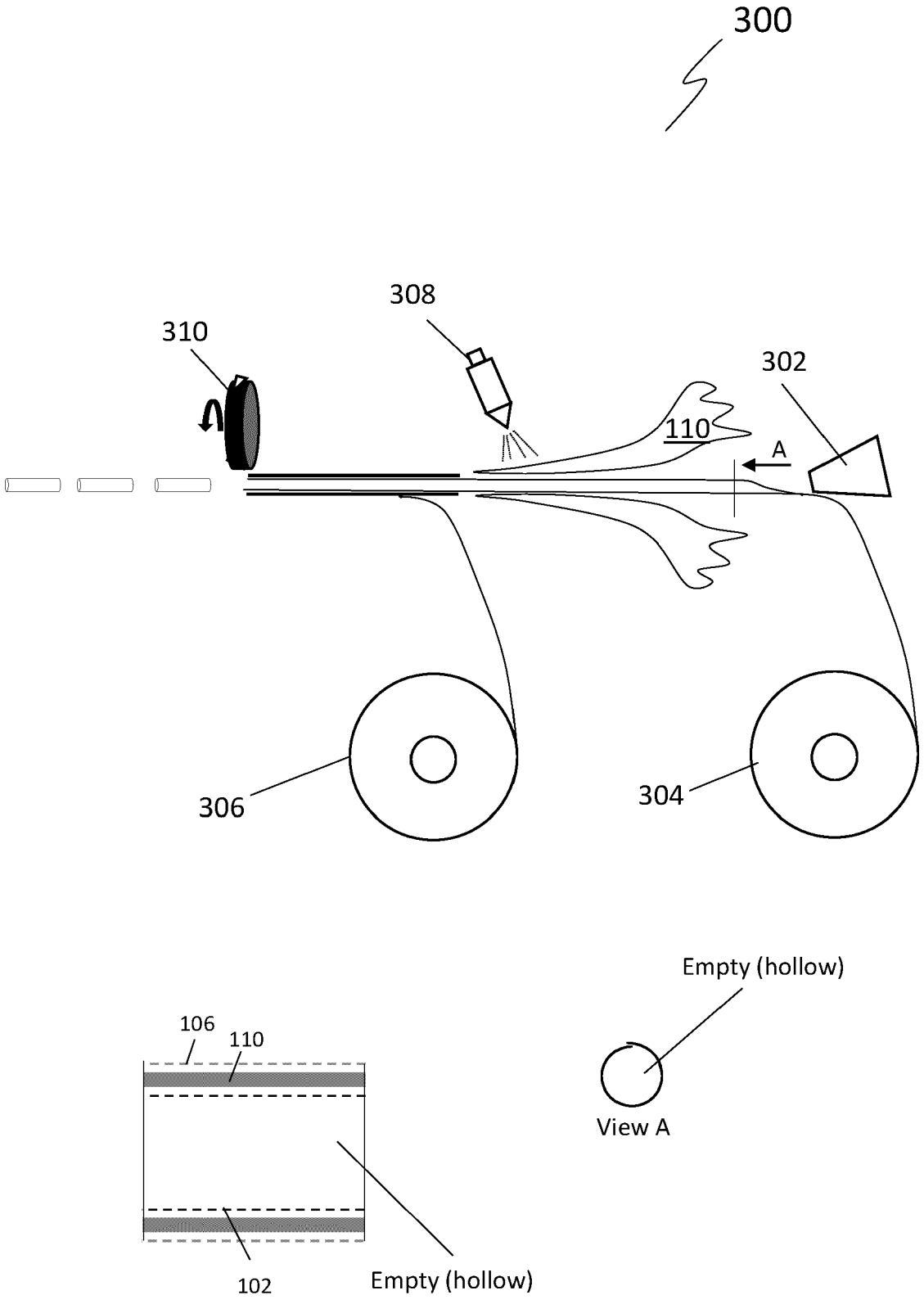
300
308
310
302
110
A
306
304
Empty (hollow)
106
110
View A
102
Empty (hollow)

FIG. 7A

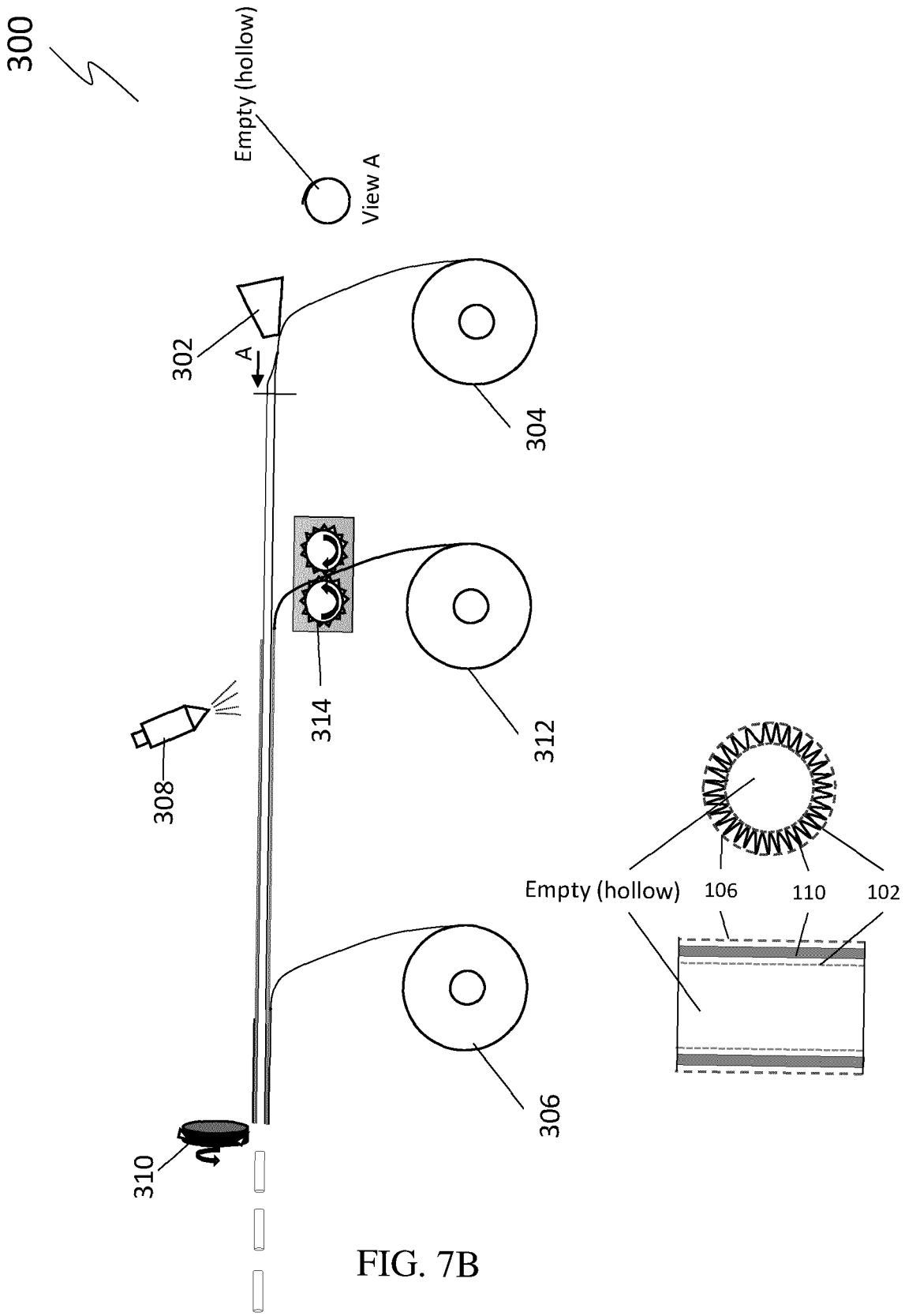
300
Empty (hollow)
View A
302
A
304
314
312
308
310
306
Empty (hollow)
106
110
102

FIG. 7B

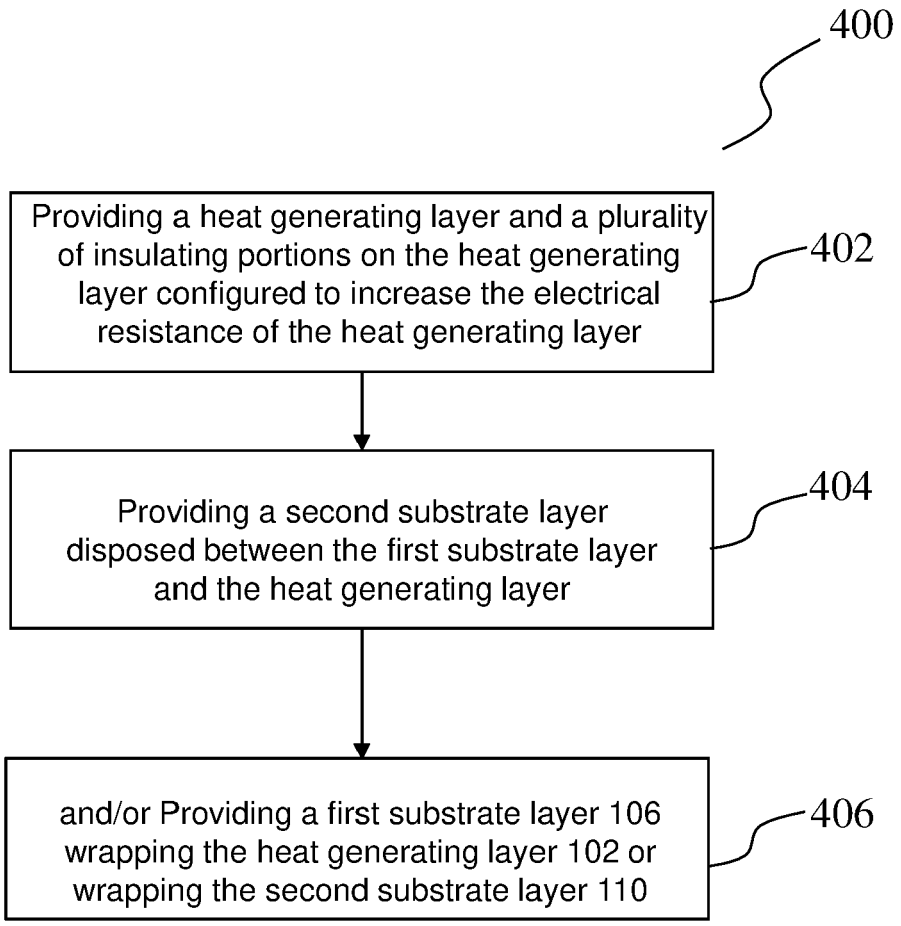
400
Providing a heat generating layer and a plurality of insulating portions on the heat generating layer configured to increase the electrical resistance of the heat generating layer
402
Providing a second substrate layer disposed between the first substrate layer and the heat generating layer
404
and/or Providing a first substrate layer 106 wrapping the heat generating layer 102 or wrapping the second substrate layer 110
406

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 22 18 5923

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 December 2022	Klintebäck, Daniel

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