

(19)



(11)

EP 4 681 563 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
21.01.2026 Bulletin 2026/04

(51) International Patent Classification (IPC):
A24F 40/46^(2020.01) A24F 40/42^(2020.01)

(21) Application number: **24188642.3**

(52) Cooperative Patent Classification (CPC):
A24F 40/46; A24F 40/42; A24F 40/20; A24F 40/40; A24F 40/70

(22) Date of filing: **15.07.2024**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(72) Inventors:
• **WOODMAN, Thomas**
London (GB)
• **POTTER, Mark**
London (GB)
• **LEGG, Mark**
London (GB)

(71) Applicant: **Nicoventures Trading Limited**
London WC2R 3LA (GB)

(74) Representative: **Dehns**
10 Old Bailey
London EC4M 7NG (GB)

(54) **AEROSOL PROVISION SYSTEM**

(57) Aerosol generator (304) of an article (300) for an aerosol provision device (200), the aerosol generator comprising: aerosol generating material; a resistive heating layer (340) comprising a resistive heating element (342) configured to heat at least a portion of the aerosol generating material to generate an aerosol; the aerosol generating material being on the resistive heating layer; a first type of electrical contact (360); and a second type of electrical contact (365); wherein the resistive heating

element is at least a portion of an electrically conductive path between the first type of electrical contact and the second type of electrical contact; wherein the resistive heating element covers a heating area of the resistive heating layer, wherein the resistive heating element is configured such that a heating power per unit area is greater in an outer region of the heating area than in an inner area of the heating area.

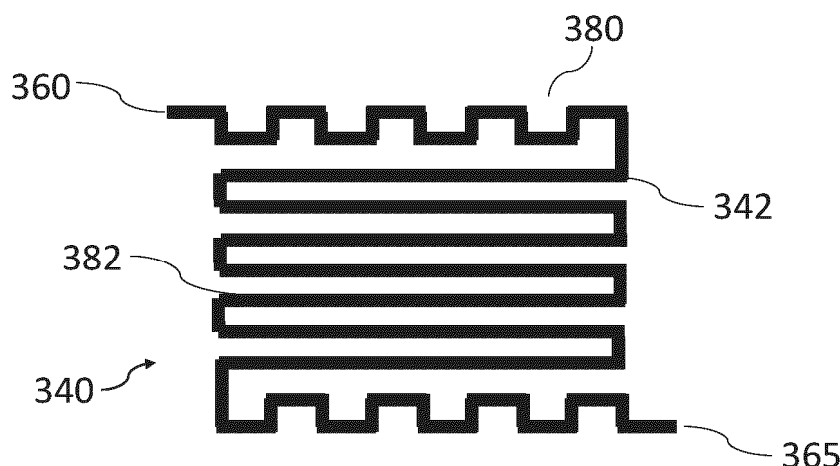


FIG. 26

Description

Technical Field

[0001] The present invention relates to an aerosol provision system and an aerosol forming article.

Background

[0002] Smoking articles such as cigarettes, cigars and the like burn tobacco during use to create tobacco smoke. Attempts have been made to provide alternatives to these articles by creating products that release compounds without combusting. Examples of such products are so-called "heat not burn" products or tobacco heating devices or products, which release compounds by heating, but not burning, material. The material may be, for example, tobacco or other non-tobacco products, which may or may not contain nicotine.

[0003] Aerosol provision systems, which cover the aforementioned devices or products, are known. Common systems use heaters to create an aerosol from a suitable medium which is then inhaled by a user. Often the medium used needs to be replaced or changed to provide a different aerosol for inhalation. It is known to use resistive heating systems as heaters to create an aerosol from a suitable medium.

Summary

[0004] According to an aspect there is provided an aerosol generator of an article for an aerosol provision device, the aerosol generator elongated along a longitudinal direction. The aerosol generator comprises aerosol generating material, a resistive heating layer comprising a resistive heating element configured to heat at least a portion of the aerosol generating material to generate an aerosol, the aerosol generating material being on the resistive heating layer, a first type of electrical contact, and a second type of electrical contact. The resistive heating element is at least a portion of an electrically conductive path between the first type of electrical contact and the second type of electrical contact. The resistive heating element covers a heating area of the resistive heating layer. The resistive heating element is configured such that a heating power per unit area is greater in an outer region of the heating area than in an inner area of the heating area.

[0005] The aerosol generator may comprise an aerosol generating layer comprising the aerosol generating material. The aerosol generating layer may be on the resistive heating layer. The resistive heating layer may extend beyond the aerosol generating material such that the electrical contact is exposed.

[0006] In an embodiment of any of the above, an exterior of the article has a length, a width perpendicular to the length, and a depth perpendicular to each of the length and the width, wherein the length is greater than

or equal to the width, and wherein the width is greater than the depth.

[0007] In an embodiment of any of the above, the aerosol generator comprises a support configured to support the resistive heating layer.

[0008] In an embodiment of any of the above, the support comprises a support layer.

[0009] In an embodiment of any of the above, the support is electrically insulative.

[0010] In an embodiment of any of the above, the support comprises at least one of paper and card.

[0011] In an embodiment of any of the above, the aerosol generating material is in direct contact with the resistive heating layer. In an embodiment of any of the above, the aerosol generating layer is in direct contact with the resistive heating layer.

[0012] In an embodiment of any of the above, the aerosol generating material is in indirect contact with the resistive heating layer. In an embodiment of any of the above, the aerosol generating layer is in indirect contact with the resistive heating layer.

[0013] In an embodiment of any of the above, the resistive heating layer and the support layer define a substrate.

[0014] In an embodiment of any of the above, the aerosol generator comprises a laminate comprising the resistive heating layer and the support layer.

[0015] In an embodiment of any of the above, the laminate comprises the aerosol generating layer.

[0016] In an embodiment of any of the above, the support layer comprises a card layer.

[0017] In an embodiment of any of the above, the first type of electrical contact is configured to electrically connect with a device electrical connector and the second type of electrical contact is configured to electrically connect with the device electrical connector.

[0018] In an embodiment of any of the above, the support defines an exposed contact area of the first type of electrical contact.

[0019] In an embodiment of any of the above, wherein the exposed contact area is a first exposed contact area, and the support defines a second exposed contact area of the second type of electrical contact.

[0020] In an embodiment of any of the above, the aerosol generating layer is a continuous aerosol generating layer.

[0021] In an embodiment of any of the above, the aerosol generating layer is a discontinuous aerosol generating layer.

[0022] In an embodiment of any of the above, the aerosol generating layer comprises a plurality of discrete aerosol generating portions.

[0023] In an embodiment of any of the above, the resistive heating element is one of a plurality of resistive heating elements.

[0024] In an embodiment of any of the above, one of the discrete aerosol generating portions is associated with a corresponding one of the plurality of resistive heating

elements.

[0025] In an embodiment of any of the above, the aerosol generating layer comprises at least one of dots, strips and patches.

[0026] In an embodiment of any of the above, wherein the resistive heating element is a first heating element and the resistive heating layer forms a second resistive heating element, each resistive heating element providing an electrically conductive path for resistive heating of a portion of the aerosol generating material to generate an aerosol at the respective portion of the aerosol generating material. In an embodiment of any of the above, wherein the resistive heating element is a first heating element and the resistive heating layer forms a second resistive heating element, each resistive heating element providing an electrically conductive path for resistive heating of a portion of the aerosol generating material to generate an aerosol at the respective portion of the aerosol generating layer.

[0027] In an embodiment of any of the above, wherein the resistive heating layer forms an array of resistive heating elements comprising at least the first resistive heating element and the second resistive heating element.

[0028] In an embodiment of any of the above, wherein each of the first type of electrical contact and the second type of electrical contact are configured to enable an electric current to be individually provided to each of the resistive heating elements.

[0029] In an embodiment of any of the above, wherein the aerosol generating layer comprises a film or gel layer comprising the aerosol generating material.

[0030] In an embodiment of any of the above, the aerosol generator comprises a plurality of the first type of electrical contact, wherein each of the heating elements comprises a separate first type of electrical contact.

[0031] In an embodiment of any of the above, the aerosol generator comprises a plurality of the second type of electrical contacts, wherein each of the resistive heating elements comprises a separate second type of electrical contact.

[0032] In an embodiment of any of the above, wherein the aerosol generator comprises a single second type of electrical contact.

[0033] In an embodiment of any of the above, wherein the single second type of electrical contact is shared between each of the resistive heating elements.

[0034] In an embodiment of any of the above, wherein the resistive heating element is formed by at least one of: cutting the resistive heating layer; chemically etching the resistive heating layer; forming or pressing the resistive heating layer in the substrate; and printing the resistive heating layer.

[0035] In an embodiment of any of the above, wherein the resistive heating layer is in the form of a foil.

[0036] In an embodiment of any of the above, the resistive heating element is configured such that a re-

sistance per unit area is greater in the outer region than in the inner region to cause the heating power per unit area to be greater.

[0037] In an embodiment of any of the above, the resistive heating element comprises a plurality of turns in the outer region to cause the resistance per unit area to be greater in the outer region.

[0038] In an embodiment of any of the above, the turns are provided by the resistive heating element following a crenelated path in the outer region.

[0039] In an embodiment of any of the above, the turns are adjacent to at least two edges of the heating area.

[0040] In an embodiment of any of the above, the turns are adjacent to all edges of the heating area.

[0041] In an embodiment of any of the above, the resistive heating element extends diagonally relative to edges of the heating area, wherein the turns connect diagonally extending portions of the resistive heating element.

[0042] In an embodiment of any of the above, the resistive heating element is narrower in the outer region than in the inner region to cause the resistance per unit area to be greater in the outer region than in the inner region.

[0043] In an embodiment of any of the above, the outer region covers first and second sides of the heating area.

[0044] In an embodiment of any of the above, the outer region surrounds the inner region.

[0045] In an embodiment of any of the above, a first number of turns per unit area in a first area of the outer region is different to a second number of turns per unit area in a second area of the outer region.

[0046] In an embodiment of any of the above, the plurality of turns comprise curvilinear turns.

[0047] In an embodiment of any of the above, the resistive element comprises a tapered portion.

[0048] According to an aspect, there is provided an aerosol generator of an article for an aerosol provision device comprising: aerosol generating material; a resistive heating layer comprising a resistive heating element configured to heat at least a portion of the aerosol generating material to generate an aerosol; a first type of electrical contact; and a second type of electrical contact; and wherein the resistive heating element is at least a portion of an electrically conductive path between the first type of electrical contact and the second type of electrical contact.

[0049] The aerosol generator may comprise an aerosol generating layer comprising the aerosol generating material. The aerosol generating layer may be on the resistive heating layer.

[0050] According to an aspect, there is provided an aerosol provision device configured to receive an aerosol generator or an article for an aerosol provision device of any of the above.

[0051] According to an aspect, there is provided an aerosol provision system comprising an aerosol generator or an article for an aerosol provision device of any of

the above, and an aerosol provision device of any of the above.

[0052] Any of the devices, articles or systems of any aspect may comprise any of the features specified with respect to other aspects.

Brief Description of the Drawings

[0053] Various embodiments will now be described, by way of example only, with reference to the accompanying schematic drawings, in which:

Figure 1 is a schematic perspective view of an aerosol provision system;

Figure 2 is a schematic perspective view of an article comprising aerosol generating material of the aerosol provision system of Figure 1;

Figure 3 is a schematic perspective view of a first side of an aerosol generator of the article of Figure 2;

Figure 4 is a schematic perspective view of part of a second side of the aerosol generator of Figure 3;

Figure 5 is a schematic block diagram of an aerosol provision system such as the system shown in Figure 1;

Figure 6 is a schematic partially exploded perspective view of the article of Figure 2, with an aerosol generator shown inverted from an assembled orientation and in a spaced relationship with other components;

Figure 7 is a schematic cross-sectional view of another aerosol generator such as the aerosol generator shown in Figure 3;

Figure 8 is a schematic plan view of a heating element of the aerosol generator of Figure 3;

Figure 9 is a schematic plan view of a resistive heating layer of the aerosol generator of Figure 3 with a plurality of heating elements;

Figure 10 is a flow chart showing a method of forming an aerosol generator, such as the aerosol generator of Figure 3;

Figure 11 is an exploded perspective view of an aerosol generator being formed;

Figure 12 is a schematic perspective view of a resistive heating layer of an aerosol generator being formed;

Figure 13 is a flow chart showing a method of forming an aerosol generator, such as the aerosol generator of Figure 3;

Figure 14 is a flow chart showing a method of forming an aerosol generator, such as the aerosol generator of Figure 3;

Figure 15 is a flow chart showing a method of forming an aerosol generator, such as the aerosol generator of Figure 3;

Figure 16 is a schematic perspective view of a resistive heating layer of an aerosol generator being formed;

Figure 17 is a schematic plan view of a heating

element of an aerosol generator;

Figure 18 is a schematic plan view of a heating element of an aerosol generator;

Figure 19 is a schematic perspective view of part of an aerosol generator of the article of Figure 2;

Figure 20 is a schematic perspective view of a device connector of an aerosol provision device of the aerosol provision system of Figure 1;

Figure 21 is a schematic side view of the aerosol generating system of Figure 1;

Figure 22 is a flow chart showing a method of forming an aerosol generator, such as the aerosol generator of Figure 3;

Figures 23 to 25 show an aerosol generator being formed;

Figure 26 is a schematic plan view of a heating element of an aerosol generator;

Figure 27 is a schematic plan view of a heating element of an aerosol generator; and

Figure 28 is a schematic plan view of a heating element of an aerosol generator.

Detailed Description

[0054] As used herein, the term "delivery mechanism" is intended to encompass systems that deliver a substance to a user, and includes: non-combustible aerosol provision systems that release compounds from an aerosolizable material without combusting the aerosolizable material, such as electronic cigarettes, tobacco heating products, and hybrid systems to generate aerosol using a combination of aerosolizable materials; and articles comprising aerosolizable material and configured to be used in one of these non-combustible aerosol provision systems.

[0055] According to the present disclosure, a "non-combustible" aerosol provision system is one where a constituent aerosol-generating material of the aerosol provision system (or component thereof) is not combusted or burned in order to facilitate delivery of at least one substance to a user.

[0056] In some embodiments, the delivery system is a non-combustible aerosol provision system, such as a powered non-combustible aerosol provision system.

[0057] In some embodiments, the non-combustible aerosol provision system is an electronic cigarette, also known as a vaping device or electronic nicotine delivery system (END), although it is noted that the presence of nicotine in the aerosol-generating material is not a requirement.

[0058] In some embodiments, the non-combustible aerosol provision system is an aerosol-generating material heating system, also known as a heat-not-burn system. An example of such a system is a tobacco heating system.

[0059] In some embodiments, the non-combustible aerosol provision system is a hybrid system to generate aerosol using a combination of aerosol-generating ma-

terials, one or a plurality of which may be heated. Each of the aerosol-generating materials may be, for example, in the form of a solid, liquid or gel and may or may not contain nicotine. In some embodiments, the hybrid system comprises a liquid or gel aerosol-generating material and a solid aerosol-generating material. The solid aerosol-generating material may comprise, for example, tobacco or a non-tobacco product.

[0060] Typically, the non-combustible aerosol provision system may comprise a non-combustible aerosol provision device and a consumable for use with the non-combustible aerosol provision device.

[0061] In some embodiments, the disclosure relates to consumables comprising aerosol-generating material and configured to be used with non-combustible aerosol provision devices. These consumables are sometimes referred to as articles throughout the disclosure.

[0062] In some embodiments, the non-combustible aerosol provision system, such as a non-combustible aerosol provision device thereof, may comprise a power source and a controller. The power source may, for example, be an electric power source.

[0063] In some embodiments, the non-combustible aerosol provision system may comprise an area for receiving the consumable, an aerosol generator, an aerosol generation area, a housing, a mouthpiece, a filter and/or an aerosol-modifying agent.

[0064] In some embodiments, the consumable for use with the non-combustible aerosol provision device may comprise aerosol-generating material, an aerosol-generating material storage area, an aerosol-generating material transfer component, an aerosol generator, an aerosol generation area, a housing, a wrapper, a filter, a mouthpiece, and/or an aerosol-modifying agent.

[0065] As used herein, the term "aerosol-generating material" (which is sometimes referred to herein as an aerosolizable material) is a material that is capable of generating aerosol, for example when heated, irradiated or energized in any other way. Aerosol-generating material may, for example, be in the form of a solid, liquid or semi-solid (such as a gel) which may or may not contain an active substance and/or flavourants.

[0066] In some embodiments, the substance to be delivered comprises an active substance (sometimes referred to herein as an active compound).

[0067] The aerosol-generating material may comprise one or more active substances and/or flavours, one or more aerosol-former materials, and optionally one or more other functional material.

[0068] The aerosol-generating material may comprise a binder, such as a gelling agent, and an aerosol former. Optionally, a substance to be delivered and/or filler may also be present. Optionally, a solvent, such as water, is also present and one or more other components of the aerosol-generating material may or may not be soluble in the solvent. In some embodiments, the aerosol-generating material is substantially free from botanical material. In particular, in some embodiments, the aerosol-gener-

ating material is substantially tobacco free.

[0069] The aerosol-generating material may comprise or be in the form of an aerosol-generating film. The aerosol-generating film may comprise a binder, such as a gelling agent, and an aerosol former. Optionally, a substance to be delivered and/or filler may also be present. The aerosol-generating film may be substantially free from botanical material. In particular, in some embodiments, the aerosol-generating material is substantially tobacco free.

[0070] The aerosol-generating film may have a thickness of about 0.015 mm to about 1 mm. For example, the thickness may be in the range of about 0.05 mm, 0.1 mm or 0.15 mm to about 0.5 mm or 0.3 mm.

[0071] The aerosol-generating film may be continuous. For example, the film may comprise or be a continuous sheet of material.

[0072] The aerosol-generating film may be discontinuous. For example, the aerosol-generating film may comprise one or more discrete portions or regions of aerosol-generating material, such as dots, stripes or lines, which may be supported on a support. In such embodiments, the support may be planar or non-planar.

[0073] The aerosol-generating film may be formed by combining a binder, such as a gelling agent, with a solvent, such as water, an aerosol-former and one or more other components, such as one or more substances to be delivered, to form a slurry and then heating the slurry to volatilise at least some of the solvent to form the aerosol-generating film.

[0074] The slurry may be heated to remove at least about 60 wt%, 70 wt%, 80 wt%, 85 wt% or 90 wt% of the solvent.

[0075] The aerosol-generating material may be an "amorphous solid". In some embodiments, the amorphous solid is a "monolithic solid". The aerosol-generating material may be non-fibrous or fibrous. In some embodiments, the aerosol-generating material may be a dried gel. The aerosol-generating material may be a solid material that may retain some fluid, such as liquid, within it. In some embodiments the retained fluid may be water (such as water absorbed from the surroundings of the aerosol-generating material) or the retained fluid may be solvent (such as when the aerosol-generating material is formed from a slurry). In some embodiments, the solvent may be water.

[0076] The aerosol-former material may comprise one or more constituents capable of forming an aerosol. In some embodiments, the aerosol-former material may comprise one or more of glycerine, glycerol, propylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol, 1,3-butylene glycol, erythritol, meso-Erythritol, ethyl vanillate, ethyl laurate, a diethyl suberate, triethyl citrate, triacetin, a diacetin mixture, benzyl benzoate, benzyl phenyl acetate, tributyrin, lauryl acetate, lauric acid, myristic acid, and propylene carbonate.

[0077] The one or more other functional materials may comprise one or more of pH regulators, colouring agents,

preservatives, binders, fillers, stabilizers, and/or antioxidants.

[0078] The material may be present on or in a support, to form a substrate. The support may, for example, be or comprise paper, card, paperboard, cardboard, reconstituted material, a plastics material, a ceramic material, a composite material, glass, a metal, or a metal alloy.

[0079] An aerosol provision device can receive an article comprising aerosol generating material for heating. An "article" in this context is a component that includes or contains in use the aerosol generating material, which is heated to volatilise the aerosol generating material, and optionally other components in use. A user may insert the article into or onto the aerosol provision device before it is heated to produce an aerosol, which the user subsequently inhales.

[0080] An aerosol generator is an apparatus configured to cause aerosol to be generated from the aerosol-generating material. In some embodiments, the aerosol generator is a heater configured to subject the aerosol-generating material to heat energy, so as to release one or more volatiles from the aerosol-generating material to form an aerosol.

[0081] A consumable is an article comprising or consisting of aerosol-generating material, part or all of which is intended to be consumed during use by a user. A consumable may comprise one or more other components, such as an aerosol-generating material storage area, an aerosol-generating material transfer component, an aerosol generation area, a housing, a wrapper, a mouthpiece, a filter and/or an aerosol-modifying agent. A consumable may also comprise an aerosol generator, such as a heater, that emits heat to cause the aerosol-generating material to generate aerosol in use. The heater may, for example, comprise a material heatable by electrical conduction.

[0082] Non-combustible aerosol provision systems may comprise a modular assembly including both a reusable aerosol provision device and a replaceable aerosol generating article. In some implementations, the non-combustible aerosol provision device may comprise a power source and a controller (or control circuitry). The power source may, for example, comprise an electric power source, such as a battery or rechargeable battery. In some implementations, the non-combustible aerosol provision device may also comprise an aerosol generating component. However, in other implementations the aerosol generating article may comprise partially, or entirely, the aerosol generating component.

[0083] Figure 1 shows a schematic view of an aerosol provision system 100. The aerosol provision system 100 comprises an aerosol provision device 200 and an article 300 comprising aerosol generating material 302 (refer to Figure 3). The article 300 is shown in Figure 2 removed from the aerosol provision device 200. An aerosol generator 304 of the article 300 is shown in Figure 3 with a perspective view of a first side 306, with a perspective view of part of a second side 307 shown in Figure 4.

[0084] The article 300 comprises the aerosol generator 304. The aerosol generator 304 is configured to generate an aerosol from the aerosol generating material 302 upon operation of the aerosol provision system 100, as will be describe in detail below.

[0085] The aerosol provision system 100 may be elongate, extending along a longitudinal axis. The aerosol provision system 100 has a proximal end 102, which will be closest to the user (e.g. the user's mouth) when in use by the user to inhale the aerosol generated by the aerosol provision system 100, and a distal end 104 which will be furthest from the user when in use.

[0086] The proximal end may also be referred to as the "mouth end". The aerosol provision system 100 accordingly defines a proximal direction, which is directed towards the user when in use. Further, the aerosol provision system 100 likewise defines a distal direction, which is directed away from the user when in use. The terms 'proximal' and 'distal' as applied to features of the system 100 will be described by reference to the relative positioning of such features with respect to each other in a proximal-distal direction along a longitudinal axis. The longitudinal axis extends from the mouth end 102 to the distal end 104. A lateral direction is perpendicular to the longitudinal axis. The lateral direction is parallel to a plane of the aerosol generator 304 described below.

[0087] The article 300 is received by the aerosol provision device 200. The configuration of the article 300 and the aerosol provision device 200 may vary. In the present embodiment, the aerosol provision device 200 comprises a device body 202. The device has a housing 204 enclosing components of the device 200. An article receiving portion 206, sometimes referred to as a device chamber, as shown in Figure 5, is configured to receive a portion of the article 300. A proximal end 308 of the article protrudes from the device 200 when the article 300 is received in the device chamber 206. A receptacle 208 defines the chamber 206. The receptacle 208 comprises a receptacle base 210 and a receptacle peripheral wall 212. The configuration of the receptacle 208 may vary in dependence on the configuration of the article 300.

[0088] One or more user-operable control elements 224, such as a button or switch, which can be used to operate the aerosol provision system 100 may be provided on the aerosol provision device 200. For example, a user may activate the system 100 by pressing the control element 224.

[0089] The aerosol provision device 200 comprises an opening 214 at the proximal end, leading into the device chamber 206. The opening 214 is provided in one end, through which the article 300 can be inserted. In embodiments, the article 300 may be fully or partially inserted into the device 200. The configuration of the device 200 may vary, for example the opening may be in a longitudinal side wall of the device 200, and/or may be closed by another feature of the device 200 during use. In the present configuration, the article 300 defines a mouthpiece 310 at the proximal end 308. In other embodiments,

the device 200 defines the mouthpiece. The user places their mouth over the mouthpiece during use.

[0090] The device 200 defines the longitudinal axis along which an article 300 may extend when inserted into the device 200. The opening 214 is aligned on the longitudinal axis. The longitudinal axis may be an axis along which the article 300 is inserted into the device 200. The longitudinal axis may be considered to be a receiving axis of the device 200. The article 300 may similarly have a longitudinal axis along which it is inserted into the device and this axis may be considered to be an insertion axis.

[0091] The aerosol provision device 200 comprises a power source 220. The power source 220 may be a battery, for example a rechargeable battery. The device 200 also comprises a control circuit 222, acting as a controller, comprising a processor and a memory.

[0092] As discussed in detail below, a heating system 110 is configured to heat the aerosol generating material 302 of an article 300. The article 300 in embodiments is a consumable, and is interchangeable with other articles 300. The heating system 110 comprises the aerosol generator 304. The heating system 110 comprises other components of the aerosol provision system 100 including components of the article 300 and the aerosol provision device 200, for example the power source 220 and the control circuit 222.

[0093] The aerosol generator 304 forms part of the article 300. The aerosol generator 304 comprises a heating arrangement 312 configured to heat aerosol generating material 302, for example at least one of a film and a gel to generate an aerosol. The aerosol generating material may be referred to as aerosolisable material.

[0094] The heating arrangement 312 is a resistive heating arrangement. The or each heating element in embodiments is a resistive heating element, as described in detail below. In such arrangements the heating system 110 comprises a resistive heating generator including components to heat the heating arrangement 312 via a resistive heating process. In this case, an electrical current is directly applied to a resistive heating element, and the resulting flow of current in the heating element, acting as a heating component, causes the heating element to be heated by Joule heating. The resistive heating element comprises resistive material configured to generate heat when a suitable electrical current passes through it, and the heating arrangement 312 comprises electrical contacts for supplying electrical current to the resistive material. The provision of a resistive heating arrangement 312 allows for a compact arrangement. Resistive heating provides an efficient configuration.

[0095] In the use of the aerosol provision system 100, air is drawn into an air inlet 314, also referred to as an article inlet, of the article 300, as indicated by arrow 316. The air inlet 314 is in a distal end of the article 300. In embodiments, the air inlet 314 may have a different configuration, for example in the side. The air flow to the air inlet 314 of the article 300 may be defined, for

example by at least one of an air path through the device 200, an air path external to the device 200, and an air path between the device 200 and the article 300. An aerosol generated by the aerosol generator 304 exits the device at an aerosol outlet 318, as indicated by arrow 319. In embodiments the aerosol outlet 318 is in the mouthpiece of the article 300, such that the aerosol is drawn directly from the article 300 into the mouth of a user of the device 10.

[0096] In some example embodiments, the aerosol provision system comprises two main components, namely a control section forming a reusable part and a consumable section forming a replaceable or disposable part which may be referred to as a replaceable or disposable article or cartridge. As described herein, the aerosol provision device 200 forms a control section and the article 300 forms the consumable section. In the use of the aerosol generating system, the control section and the consumable part may be releasably connected at an interface. The consumable part may be removable and replaceable, for example when the consumable part is used, with the control section being re-used with a different consumable part.

[0097] The aerosol provision system 100 as shown is provided by way of example only and is highly schematic. Different aerosol generating devices and other devices may be used in example implementations of the principles described here. For example, in some example embodiments, air is drawn into an air inlet in the control section, passes through the interface, and exits the consumable part.

[0098] As shown schematically in Figure 5, and described in detail below, the article 300 has an article electrical contact configuration 320. The electrical contact configuration 320 in embodiments is formed by the aerosol generator 304. The electrical contact configuration 320 comprises heater electrical contacts 322. The heater electrical contacts 322 may also be known as heater or article contacts. The aerosol provision device 200 comprises an electrical connector 230. The electrical connector 230 comprises connector electrical contacts 232. The connector electrical contacts 232 may also be known as connector or device contacts. The article electrical contact configuration 320 is configured to electrically communicate with the device electrical connector 230.

[0099] The configuration of the article 300 may vary. The article 300 comprises a body 324. The body 324 is hollow. The body 324 defines a flow path 326 (refer to Figure 6) through the article 300. The flow path 326 extends between the air inlet 314 and the aerosol outlet 318. The flow path 326 is defined by an internal space in the article along which air and/or aerosol can flow. The flow path 326 is defined in the body 324. The or each aerosol generator 304 bounds the flow path 326. The aerosol generating material 302 is exposed to the flow path 326. The aerosol generating material 302 is exposed in the internal space. The internal space in embo-

diments comprises two or more chambers.

[0100] The air inlet 314 comprises an opening 315. The opening 315 is formed in the body 324. In embodiments, the opening is formed in another component of the article 300, for example the aerosol generator 304 or another wall feature. The aerosol outlet 318 comprises an outlet opening 317. The outlet opening 317 is formed in the body 324. In embodiments, the outlet opening 317 is formed in another component of the article 300, for example the aerosol generator 304 or another wall feature.

[0101] As shown in Figure 6, the article 300 comprises two aerosol generators 304 forming an aerosol generator arrangement. The number of aerosol generators 304 may differ. Each aerosol generator 304 comprises aerosol generating material 302. The aerosol generating material 302 is exposed to the flow path 326. In embodiments the article 300 comprises a single aerosol generator 304. One of the aerosol generators 304 will be described in detail, with such detail being applicable to one or more further aerosol generators 304 in embodiments.

[0102] The or each aerosol generator 304 and the body 324 are formed in a stacked configuration. In embodiments, other arrangements such as a tubular arrangement of the article are envisaged. In such tubular arrangements the aerosol generator 304 defines a tubular configuration. Tubular may include circular cross-sectional, an elliptical cross section and other polygonal shapes.

[0103] In embodiments, as shown in the Figures, the article 300 has a flat configuration. That is, wherein an exterior of the article has a length, a width perpendicular to the length, and a depth perpendicular to each of the length and the width, wherein the length is greater than or equal to the width, and wherein the width is greater than the depth. Other configurations are envisaged.

[0104] Figure 6 is a partially exploded perspective view of the article 300, with an aerosol generator 304 shown inverted from an assembled orientation and in a spaced relationship with other components. The article 300 comprises a first one of the aerosol generator 302, the body 324 and a second one of the aerosol generator. The body 324 spaces the first and second aerosol generators 304. The first and second aerosol generators 304 close the internal space defined by the body 324 along which air and/or aerosol can flow. The aerosol generating material 302 of the first and second aerosol generators 304 face each other and is exposed to the internal space. When assembled, the first and second aerosol generators 304 sandwich the body 324. In the embodiment of Figure 6 at least, the first and second aerosol generators 304 and the body have equal plan areas. In embodiments, one or more of the first and second aerosol generators 304 and the body 324 has a greater length and/or width. In embodiments, one of the first and second aerosol generators 304 is replaced by a blank panel. The body 324 comprises a body layer. The body may comprise a plurality of body layers. The body layers may be formed in a

stack and arranged to define features of the article 300, such as the air inlet 314 and aerosol outlet 318.

[0105] A wrap encircles the article 300 and forms part of the article 300. The wrap may comprise a sheet. The wrap acts as a fixed sleeve. The or each aerosol generator 304 protrudes from the wrap at a distal end. Exposed electrical contact regions 323 of the heater contacts 322 are exposed at the distal end. Other configurations are envisaged, for example at least one exposed electrical contact region 323 may additionally or alternatively be defined along a minor longitudinal face or edge of the article 300, and on a major face of the article defined by the aerosol generator 304.

[0106] The aerosol generator 304 is schematically shown in cross section in Figure 7. The aerosol generator 304 is an implementation of the aerosol generator 304 of the aerosol provision system 100 described above.

[0107] The aerosol generator 304 comprises an aerosol generating layer 330. The aerosol generating layer is also known as an aerosolisable layer. The aerosol generating layer 330 comprises the aerosol generating material 302. The aerosol generator 304 comprises a resistive heating layer 340. The resistive heating layer 340, in embodiments, is formed as an electrically conductive layer. The aerosol generating layer 330 is on the resistive heating layer 340. The aerosol generating layer 330 is in direct contact with the resistive heating layer 340. In embodiments, the aerosol generating layer 330 is in indirect contact with the resistive heating layer 340. The resistive heating layer 340 may in embodiments comprise a coating. As described in detail below, the resistive heating layer 340 comprises a plurality of resistive heating elements 342, for example as shown in Figures 8 and 9. The or each resistive heating element 342 forms at least a portion of an electrically conductive path between a pair of the electrical contacts 322. The or each resistive heating element 342 provides the electrically conductive path for resistive heating of at least of portion of the aerosol generating material 302 to generate an aerosol. The aerosol generating material 302 is, in embodiments, in the form of a film or a gel.

[0108] The resistive heating layer 340 is formed as an electrically conductive layer. This layer in embodiments takes the form of at least one of a metal layer, such as an aluminium layer, or a non-metallic material, such as graphene. The resistive heating layer 340 is in the form of a foil, for example an aluminium foil.

[0109] The aerosol generator 304 comprises a support 350. The support 350 in embodiments comprise a paper or card material. The support 350 provides structural support for the aerosol generator 304. The resistive heating layer 340 is on the support 350. The support 350 is configured as a support layer. As shown in Figure 7, in the aerosol generator 304, the resistive heating layer 340 is sandwiched between the support 350 and the aerosol generating layer 330.

[0110] The support 350 is electrically insulative. The resistive heating layer 340 and the support layer 350

define a substrate 352. The substrate 352 supports the aerosol generating layer 330.

[0111] The article 300 may comprise a laminate 354 comprising the resistive heating layer 340 and the support layer 350. In embodiments, the laminate 354 comprises the aerosol generating layer 330. The aerosol generating layer 330 may be formed as a contiguous configuration, or may be formed from discrete portions. The discrete portions may comprise one or more of dots, strips, spirals, or other shapes.

[0112] One or more of the aerosol generating layer 330, resistive heating layer 340 and the support layer 350 may comprise a further layer. For example the support layer 350 may comprise a backing layer or an intermediate layer. The support layer 350 in embodiments is omitted.

[0113] Figure 8 shows one of the resistive heating elements 342. The resistive heating layer 340 comprises a plurality of resistive heating elements 342. In embodiments, the resistive heating layer 340 comprises a single resistive heating element 342.

[0114] The plurality of heating elements 342 may be formed in an array 344 as shown in Figure 9. Other configurations are envisaged.

[0115] The resistive heating element 342 comprises a resistive heating path. The resistive heating path is formed by an electrically conducting path. The resistive heating path is non-straight. The resistive heating path is convoluted. The configuration of the resistive heating path may vary. The electrical resistance of the heating element 342 may be dependent on the nature of the resistive heating path in the conductive layer, for example the length, width, thickness and arrangement of the path.

[0116] The resistive heating element 342 extends between a first type of electrical contact 360 and a second type of electrical contact 365. The first type of electrical contact 360 is configured to provide a positive contact and the second type of electrical contact 365 is configured to provide a negative contact. Electrical current flows between the first type of electrical contact 360 and the second type of electrical contact 365 through the path. The contact arrangement may be reversed. The first and second types of electrical contacts 360, 365 are heater electrical contacts 322. The first and second types of electrical contacts 360, 365 form at least part of the article electrical contact configuration 320.

[0117] The meandering or serpentine nature of the path of the resistive heating element 342 is such that the electrical resistance of the path is increased when compared with a straight path between the first and second type of electrical contacts.

[0118] The resistive heating layer 340 may comprise a first type of electrical track 361 extending from the resistive heating element 342. The first type of electrical track 361 comprises the first type of electrical contact 360. The electrical contact 360 of the first type is configured to electrically connect with the device electrical connector 230. The first type of electrical contact 360

comprises a first type of exposed contact region 362. The first type of exposed contact region 362 is exposed on the article for direct connection with the device electrical connector 230.

[0119] The resistive heating layer 340 may comprise a second type of electrical track 366 extending from the resistive heating element 342. The second type of electrical track 366 comprises the second type of electrical contact 365. The electrical contact 365 of the second type is configured to electrically connect with the device electrical connector 230. The second type of electrical contact 365 comprises a second type of exposed contact region 367. The second type of exposed contact region 367 is exposed on the article 300 for direct connection with the device electrical connector 230.

[0120] As discussed in detail below, the conducting path of the resistive heating element 342 in embodiments is created by defining at least one electrically insulative barrier 346 in the resistive heating layer 340. In embodiments, the electrically insulative barrier 346 is formed by cutting electrically insulative barrier restrictions (i.e. electrically insulating portions), such as gaps, channels or slots into a sheet formed of electrically conductive material to form the resistive heating layer 340. In embodiments, the electrically conductive element 342 is preformed to define the or each resistive heating element 342 and then applied to the support 350. In embodiments, the resistive heating layer 340 is applied to the support 350, and the or each resistive heating element 342 then defined in the resistive heating layer 340. The or each resistive heating element 342 defining the resistive heating layer 340 may be a printed heater.

[0121] The at least one electrically insulative barrier 346 defines the first and second types of electrical track 361, 366.

[0122] In some embodiments, the tracks of the or each resistive heating element 342 have a width in the region of 0.5mm to 1mm (two example prototypes have widths of 0.93mm and 0.72mm respectively) and gaps between the tracks of less than about 0.25mm (the same two example prototypes have gaps of 0.2mm and 0.05mm respectively). The or each resistive heating element 342 may have overall dimensions of the order of 10mm x 10mm. Other dimensions are possible in other example embodiments. By forming the or each resistive heating element 342 of these dimensions from an aluminium foil of having a thickness of 0.006mm and an electrical resistivity of between 2 and 6 μOhmcm , the resistance of the path has been calculated to be of the order of 1 Ohm. In one example embodiment, the resistance was measured at between 0.83 and 1.31 Ohms.

[0123] As shown in Figure 9, the resistive heating layer 340 may be formed into a plurality of resistive heating elements, indicated generally by the reference numerals 342a, 342b, 342c, 342d and 342e. Each of the resistive heating elements 342a-342e extends from a respective one of the first type of electrical contact, indicated generally by the reference numerals 360a, 360b, 360c, 360d

and 360e to a single second type of electrical contact 365. The number of electrical contacts may vary. As such, each resistive heating element 342a-342e extends between a discrete first type of electrical contact and a common second type of electrical contact.

[0124] Each of the resistive heating element 342a-342e provides an electrically conductive path for resistive heating of a portion of the aerosol generating material 302 to generate an aerosol at the respective portion of the aerosol generator 304.

[0125] The separate first type 360a-360e of electrical contacts enable an electric current to be individually provided to each of the plurality of resistive heating elements 342a-342e. The heating of different zones of the aerosol generating layer 330 can be controlled. For example, an aerosol generator may be provided with five aerosol generating zones. The resistive heating layer 340 allows each of those zones to be activated separately. Accordingly, for example, five puffs of aerosol may be generated from a single consumable incorporating a single aerosol generator 304, and ten puffs of aerosol may be generated from a single consumable incorporating two aerosol generators 304.

[0126] In the example resistive heating layer 340, the plurality of first type of electrical contacts 360a-360e, for example a positive electrical connection, are provided and a single second type of electrical contact 365, for example a negative electrical connection is provided. This is not essential to all implementations. For example, multiple contacts of the second type could be provided. In embodiments each resistive heating element 342a-342e comprises a corresponding one of the first type of electrical contact 360 and a corresponding one of the second type of electrical contact 365.

[0127] In the shown embodiment of Figure 9 of the resistive heating layer 340, the first type of electrical contacts 360a-360e are arranged on a first edge 363 of the resistive heating layer 340 and the second type of electrical contact 365 is arranged on a second edge 368 of the resistive heating layer 340. This may allow for convenient connection of electrical power, but, of course, many other configurations are possible, some of which are discussed further below.

[0128] Figure 10 is a flow chart showing part of a method of forming an aerosol generator 304 or an algorithm, indicated generally by the reference numeral 400, in accordance with an example embodiment.

[0129] The method or algorithm 400 starts at operation 402, where a resistive heating layer is formed into one or more heating elements (e.g. a plurality of heating elements), wherein each resistive heating element extends from an electrical contact of a first type to an electrical contact of a second type. In use, the or each heating element may be used to provide an electrically conductive path for resistive heating of a portion of an aerosol generating material to generate an aerosol. The formation of the or each resistive heating element may occur prior to or post application of the resistive heating layer on

a support, where a support is present. The resistive heating layer may be adhered to the support, or mounted or formed on the support in a different configuration.

[0130] At operation 404, the formed the resistive heating layer is placed in contact with the aerosol generating layer, wherein said aerosol generating layer incorporates aerosol generating material. Algorithm 400 may be used to produce the aerosol generator 304 described above.

[0131] Figure 11 shows the aerosol generator 304 being formed in accordance with an embodiment. The aerosol generating material 302 is formed on the resistive heating layer 340 by depositing aerosol generating material, for example by spraying, painting, dispensing or in some other way. The aerosol generating layer 330 is disposed on resistive heating layer 340 as indicated by the arrow 406, in an example implementation of the operation 64.

[0132] Figure 12 shows the resistive heating layer 340 being formed in accordance with an example embodiment. The resistive heating layer 340 is in the process of being cut using a laser cutter 408. The cutting of the resistive heating layer 340 can be used to form the paths of the heating elements described herein. The use of the laser cutter 408 (or some other cutting process) is not the only method by which the resistive heating layer 340 described herein may be generated. Some example methods are described below.

[0133] Figure 13 is a flow chart showing part of a method of forming an aerosol generator 304 or an algorithm, indicated generally by the reference numeral 410. The method or algorithm 410 starts at operation 412, where the resistive heating layer is provided. At operation 414, one or more of the resistive heating elements are formed in the resistive heating layer by chemically etching the resistive heating layer. The operations 412 and 414 are an example implementation of the operation 402 of the method 400 described above. The aerosol generating material is then disposed on the resistive heating layer, thereby implementing the operation 404 described above.

[0134] Figure 14 is a flow chart showing part of a method of forming an aerosol generator 304 or an algorithm, indicated generally by the reference numeral 418. The method or algorithm 418 starts at operation 420, where one or more heating elements are formed, at least in part, by printing a resistive heating layer. The operation 420 is therefore an example implementation of the operation 62 of the algorithm 402 described above. The aerosol generating material is then disposed on the resistive heating layer, thereby implementing the operation 404 described above.

[0135] The cutting, etching and printing methods described above are provided by way of example; other additional or alternative methods are also possible. For example, a so-called "hot foiling" approach could be used in which a heating element is made out of a resistive heating layer, and then assembled/bonded onto a support. Yet other techniques could be used, such as die

cutting. Moreover, two or more technologies could be combined (e.g. electrical conductivity could be added to connection traces by adding more conductive material, such as additional foil, printed material, etc.). The skilled person will be aware of many further technologies, or combinations of technologies, that could be used in implementations of the principles described herein.

[0136] Figure 15 is a flow chart showing method of operation or an algorithm, indicated generally by the reference numeral 424, in accordance with an example embodiment. The method or algorithm 424 may, for example, be implemented using any of the aerosol generators described herein. The method or algorithm 424 is initiated when an instruction to activate heating is received in an instance of operation 426. In response to the instruction to activate heating, a determination is made (in operation 428) regarding whether a heating element is available. As discussed above, a plurality of heating elements may be provided. The operation 428 may involve determination which of the heating elements have been used and/or the corresponding available aerosol generating material used up.

[0137] If a heating element is available, the algorithm moves to operation 430, where an available heating element is used. As discussed above, heating elements may be individually controllable, for example by providing electrical power to individual heating elements. Once the operation 430 is complete, the algorithm terminates at operation 432. If, at operation 428, a determination is made that no heating elements are available, for example because all heating elements have been used, then the algorithm terminates at operation 432. This may mean that a consumable part being used to implement the algorithm 424 needs to be replaced.

[0138] Figure 16 shows the resistive heating layer 340 being formed in accordance with an embodiment. The resistive heating layer 340 is being cut using the laser cutter 408, although other methods could be used, such as chemical etching or printing, as discussed above. The cutting of the electrically conductive layer 340 forms the heating elements as described herein.

[0139] In the embodiment of Figure 16, the paths cut are linear paths, extending along the length of the electrically conductive layer 120.

[0140] Figure 17 shows another embodiment of the resistive heating layer 340. The resistive heating layer 340 may be formed using the laser cutter 408 described above, or some similar device or another method. The resistive heating layer 340 comprises a plurality of resistive heating elements 342, each resistive heating element 342 being a linear heating element comprising a conducting path extending along a length of the resistive heating layer 340. Each resistive heating element 342 extends from one of the first type of electrical contact 360, for example a positive electrical connection to one of the second type of electrical contact 365, for example a negative electrical contact. In such an embodiment, both types of electrical contact are provided at the same end of

the resistive heating layer 340 and are provided next to each other. In such an arrangement that there is free from a common second type of electrical contact as is some other embodiments; instead, each heating element has separate first and second types of electrical contacts.

[0141] Figure 18 shows another embodiment of the resistive heating layer 340. The resistive heating layer 340 may be formed using the laser cutter 408 described above, or some similar device or another method. The resistive heating layer 340 comprises a plurality of heating elements 342, each heater element 342 being a linear heating element comprising a conducting path extending along a length of the resistive heating layer 340. Each resistive heating element 342 extends from one of the first type of electrical contact 360, for example a positive electrical connection to the second type of electrical contact 365, for example a negative electrical contact. In such an embodiment, the different types of electrical connection are provided at the opposite ends of the resistive heating layer 340 and a common second type of electrical contact is provided. Although a linear path is provided, an increase in the electrical resistance may be provided by means of providing a crenelated path, acting as a convoluted path. Note that the paths of any other embodiments described herein could also be crenelated.

[0142] Figure 19 shows the distal end of the article 300. As shown, the body 324 comprises a plurality of body layers 325. The body layers 325 are arranged in a stack of body layers 325. The body layers 325 form a laminate. The body layers 325 in embodiments are card layers. Other suitable materials may be used. The body layers 325 are configured to define features of the article 300. At least one body layer in embodiments comprises a gap defining the air inlet 315. The gap defines the opening 314.

[0143] The aerosol generator 304 comprises the resistive heating layer 340. The resistive heating layer 340 comprises the resistive heating elements 342, the first type of electrical contacts 360, for example providing positive electrical connections to each of a plurality of heating elements 342 and a single second type of electrical contact 365, for example providing a common negative electrical connection to the plurality of heating elements 342. The first and second types of electrical contacts 360, 365, namely the heater contacts 322, together form at least part of the article electrical contact configuration 320 of the aerosol generator 304.

[0144] The resistive heating elements 342 are on an inner side of the resistive heating layer 340. The inner side defines the first side 306 of the aerosol generator 304 as shown in Figure 3. The heater contacts 322 are on the second side 307 of the resistive heating layer 340. The second side 307 defines an outer side of the aerosol generator 304. The heater contacts 322 are exposed so that they are able to be brought into contact with the device electrical connector 230. The heater contacts 322 are on an opposing side of the resistive heating layer 340 to the resistive heating elements 342. Other configura-

tions are envisaged.

[0145] The support layer 350 is between an inner portion of the resistive heating layer 340 and an outer portion of the resistive heating layer 340.

[0146] A fold 370 is formed in the resistive heating layer 340. The fold 370 defines the heater contacts 322. The fold 370 as shown in Figures 2 to 4 and 19 extends perpendicular to the longitudinal axis of the aerosol generator 304. The fold 370 defines a flap 372. The heater contacts 322 are on the flap 372. The flap defines a contact panel. The remaining part of the blank defines a main panel.

[0147] In embodiments with the support layer 350, the support layer 350 in embodiments is folded. The substrate 352 is folded at the fold 370. In embodiments, the support layer 350 ends at the fold. In embodiments, the fold 370 extends parallel to the longitudinal axis of the aerosol generator 304.

[0148] The folded portion of resistive heating layer 340 is affixed in the folded position. This folded portion in embodiments is adhered, for example by bonding. Other fixing means are anticipated.

[0149] The fold 370 defines the first type of exposed contact region 362. The fold 370 defines the second type of exposed contact region 367. The electrical tracks 361, 366 electrically communicate across the fold 370. The heater contacts 322 of the first type of electrical track 361 and the second type of electrical track 366 are defined on the second side of the resistive heating layer 340. Portions of the first type of electrical track 361 and the second type of electrical track 366 extend on the first side of the resistive heating layer 340. In embodiments the resistive heating elements extend from the fold 370. Other configurations are anticipated.

[0150] The aerosol generator 304 comprises a plurality of connector electrical contacts 232 of the electrical connector 230. The configuration of the device connector 230 is dependent on the configuration of the heater contacts 322 of the aerosol generator 304. In embodiments, such as the aerosol generator as shown in Figure 19, the aerosol generator 300 comprises a plurality of heater contacts 322 including a plurality of the first type of heater contact 360 and one of the second type of heater contact 365. The article 300 comprises another set of heater contacts 322 on the opposing side of the article 300 corresponding to the second aerosol generator 304.

[0151] Figure 20 shows a device connector 230 of the aerosol provision device 200 used in some embodiments. The connector 230 has separate connector electrical contacts 232 for connection with the heater contacts 322.

[0152] Figure 21 schematically shows the aerosol provision system 100. The system 100 comprises the article 300 and aerosol provision device 200, both shown in block diagram. The device 200 comprises first and second connectors 230a and 230b.

[0153] The connectors 230a and 230b enable the aerosol provision device 200 to provide regulated or

controlled electrical voltages and/or currents to the various first and second type of heater contacts 360, 365 of the aerosol generator 304 when the article 300 is inserted into the aerosol provision device 200. The aerosol provision device 200 may comprise a connector arrangement configured to provide electrical power to the connectors 230a, 230b. The aerosol provision device 200 may, for example, operate the method as described above.

[0154] Figure 22 is a flow chart showing a method of forming an aerosol generator 304 or an algorithm, indicated generally by the reference numeral 440, in accordance with an example embodiment.

[0155] The method or algorithm 440 starts at operation 442, where a resistive heating layer is formed into at least one resistive heating element, the or each heating element providing an electrically conductive path for resistive heating of at least a portion of an aerosolizable material to generate an aerosol. Example heating elements that may be formed in the operation 442 are described elsewhere in this document.

[0156] At operation 442, an aerosol generating material is applied and/or formed on the resistive heating layer.

[0157] The operations 442 and 444 of the method or algorithm 440 are similar to (and may be identical to) the operations 402 and 404 of the method or algorithm 400 described above.

[0158] In operation 446 at least one first type of electrical contact is provided on the resistive heating layer. The method of formation may be any of the methods described above. In operation 448 at least one second type of electrical contact is provided on the resistive heating layer. The method of formation may be any of the methods described above.

[0159] In embodiments, the first and second types of electrical contact are formed along or proximal a single edge of the resistive heating layer. In embodiments, the first and second types of electrical contact are formed along or proximal to different edges of the resistive heating layer.

[0160] In embodiments, the first types of electrical contact (e.g. positive connection(s)) are provided along a first edge of the resistive heating layer. In embodiments, the second types of electrical contact (e.g. negative electrical connection(s)) are provided along a second edge of the resistive heating layer. The operations 446 and 448 could be performed in a different order, or at the same time. Moreover, the operations 446 and 448 could be performed together with the operation 442.

[0161] At operation 450, the resistive heating layer is folded. In embodiments, the support layer is folded together with the resistive heating layer. In embodiments, the resistive heating layer is folded such that electrical contacts of the first and second type are provided adjacent to one another, as discussed in detail below.

[0162] Figures 23 to 25 show an embodiment of the aerosol generator 304 being formed in accordance with the algorithm 440.

[0163] Figure 23 shows another embodiment of the

aerosol generator 304 being formed. The resistive heating layer 340 is being cut using a laser cutter 408. The pre-folded configuration defines a blank for forming the aerosol generator 304. The blank in embodiments defines fold lines along which folds are made during formation of the aerosol generator. The aerosol generator 304 blank comprises the resistive heating layer 340 and the support layer 350. The resistive heating layer 340 and the support layer 350 define panels defined by the fold lines.

[0164] As shown in Figure 23, the resistive heating layer 340 is formed into a plurality of heating elements 192, although the number may differ and may be one. A plurality of the first type of the electrical contact 360 (e.g. positive electrical contact) are provided along the first edge of the electrically conductive layer (one contact for each heating element is shown). A single second type of electrical contact 365 is provided along the second edge of the resistive heating layer 340. In embodiments the contacts are spaced from the edges. As discussed above, each heating element of the plurality extends from an electrical contact of the first type to an electrical contact of the second type.

[0165] The cutting of the resistive heating layer 340 by the laser cutter 408 forms the paths of the or each heating element 342. As discussed above, laser formation or some other cutting process is not the only method by which the resistive heating layer 340 described above may be generated. Some example alternative methods include chemical etching and printing.

[0166] As indicated in Figure 24, the aerosol generating layer 200 is provided on the resistive heating layer 340. The blank is then folded, as indicated by the arrows in Figure 24. In this embodiment, the folds are formed parallel to a longitudinal direction of the aerosol generator 304. Two folds are formed. A first panel 375 is defined comprising the heating elements 342. A second panel 376 is formed comprising the plurality of the first type of the electrical contact 360. A third panel 377 is formed comprising the second type of electrical contact 365. The aerosol generating layer 330 is on the first panel 375. Figure 25 shows the folded aerosol generator 304.

[0167] Figure 26 shows another embodiment of the resistive heating element 342 of the resistive heating layer 340 of the aerosol generator 304 of the article 300. The aerosol generator 304 comprises many of the features of the aerosol generator 304 shown in Figure 3 and repeated description of those features is omitted, with differences being described here. In other examples, the aerosol generator 304 may comprise any of the features of the aerosol generators 304 described above with respect to other figures. As before, the aerosol generator 304 comprises the resistive heating layer 340 and the aerosol generating layer 330. It will be understood that the resistive heating layer 340 may comprise a plurality of resistive heating elements 342 as illustrated in Figure 26 and described here.

[0168] In this embodiment, the resistive heating element 342 covers a heating area of the resistive heating

layer 340, wherein resistive heating element 342 is configured such that a heating power per unit area is greater in an outer region of the heating area than in an inner area of the heating area. The outer region is closer to an edge of the heating area than the inner region. The inner region is closer to a centre of the heating area than the outer region. The resistive heating element 342 is configured such that a resistance per unit area is greater in the outer region than in the inner region to cause the heating power per unit area to be greater.

[0169] The resistance per unit area may be varied in a number of ways. In this embodiment, the resistive heating element 342 comprises a plurality of turns in the outer region to cause the resistance per unit area to be greater in the outer region. A turn may be defined as a section of the resistive heating element through which the resistive heating element changes direction. For example, a turn in the resistive heating element may result in a portion resistive heating element before the turn being substantially parallel to a portion of the resistive heating element after the turn. The portion of the resistive heating element before a turn may be angled relative to a portion of the resistive heating element after the turn. In some embodiments, the plurality of turns may comprise at least one U-turn. As will be understood, by forming a plurality of turns in the outer region within a unit area, thereby increasing the length of the resistive heating element 342 within the unit area, the resistance per unit area will be greater compared to a unit area without a plurality of turns. Therefore, causing the heating power per unit area to be greater. The plurality of turns may comprise curvilinear and/or linear turns. That is, the turns may be curved, rather than straight as shown.

[0170] In this embodiment, the turns may be provided by the resistive heating element following a crenelated path 380 in the outer region. In the present example, the turns are through 90 degrees with substantially straight portions between the turns. In the present example, the crenelated path has a series of regular crenels. By regular, it is meant that each crenel in the series of crenels has the same height and same width. However, it is to be understood that the height and/or width of each crenel in the series of crenels may differ. By varying the height and/or width of each crenel and/or varying the spacing between each crenel, the resistance per unit area may be varied. Put another way, the number of crenels per unit area may be increased or decreased. The resistance per unit area in an outer region comprising the crenelated path may be greater than the resistance per unit area in an inner region comprising non-crenelated paths, for example, linear portions 382.

[0171] The turns, for example the crenelated paths 380, may be adjacent to at least two edges (e.g. along lateral edges) of the heating area. The turns may be adjacent to all edges of the heating areas. In this embodiment, the crenelated paths 380 are adjacent to two edges of the heating area. The two edges may be opposite each other, as shown in Figure 26. Alternatively, the two edges

may be at an angle to each other. For example, the top edge and the right edge. The turns may be configured so as to be adjacent to three or more edges of the heating area. For example, the turns may be adjacent the top and bottom edges as shown, as well as the right and/or left edges.

[0172] In this embodiment, the width of the resistive heating element 342 is shown as constant. However, it is to be understood that resistive heating element 342 may be narrower in the outer region to cause the resistance per unit to be greater in the outer region. This is discussed further below.

[0173] Additionally or alternatively, the spacing between adjacent portions of the resistive heating element 342 may be increased or decreased so as to decrease or increase the heating power per unit area. For example, the number of turns per unit area may be increased or decreased so as to decrease or increase the spacing between adjacent portions of the resistive heating element 342. The number of turns per unit area in a first area of the outer region may be different to the number of turns per unit area in a second area of the outer region. For example, the number of turns per unit area may be greater in a first area of the outer region than in a second area of the outer region so as to further vary the resistance per unit area. This may allow fine tuning of power per unit area in the outer region.

[0174] It is to be understood that by configuring the resistive heating element such that the heating power per unit area is greater in an outer region of the heating area than in an inner area of the heating area, the uniformity of heating is improved across the heater. This ensures that all the aerosol generating layer 330 covering the heater is heated, thereby minimising the required area of heater and reducing an amount of unused aerosol generating material. In conventional heaters, heating areas in the center, or inner region, of these heaters are surrounded by further heating areas. However, the heating areas at the edges, or outer region, of these heaters are not surrounded by further heating areas. Therefore, heating is greater in the inner region than the outer region, leading to a lack of uniform heating. By increasing the power per unit area in the outer region, the heating provided is more uniform.

[0175] The increased heating power per unit area can be achieved by increasing the resistance per unit area in particular regions. The increased resistance per unit area can be achieved by implementing turns in the resistive heating element and/or narrowing the resistive heating element.

[0176] Additionally, by forming regions of higher and lower resistance in the outer and inner regions, respectively, a differential in heating power per unit area is created, thereby compensating for the cooling effect of incoming air passing over the heating area and help maintain a constant temperature at the surface of the aerosol generating layer 330.

[0177] Figure 27 shows another embodiment of the

resistive heating element 342 of the resistive heating layer 340 of the aerosol generator 304 of the article 300. The aerosol generator 304 comprises many of the features of the aerosol generator 304 shown in Figure 3 and repeated description of those features is omitted, with differences being described here. In other examples, the aerosol generator 304 may comprise any of the features of the aerosol generators 304 described above with respect to other figures. As before, the aerosol generator 304 comprises the resistive heating layer 340 and the aerosol generating layer 330. It will be understood that the resistive heating layer 340 may comprise a plurality of resistive heating elements 342 as illustrated in Figure 27 and described here.

[0178] In this embodiment, the resistive heating element 342 covers a heating area of the resistive heating layer 340, wherein resistive heating element 342 is configured such that a heating power per unit area is greater in an outer region of the heating area than in an inner area of the heating area. The resistive heating element 342 is configured such that a resistance per unit area is greater in the outer region than in the inner region to cause the heating power per unit area to be greater.

[0179] In this embodiment, the resistive heating element 342 is narrower in the outer region to cause the resistance per unit area to be greater in the outer region. That is, the resistive heating element 342 is narrower in the outer region than the inner region. In this embodiment, the resistive heating element comprises a first width 384 in the outer region and a second width 386 in the inner region. In this embodiment, the first width 384 is narrower than the second width 386. It is to be understood that the resistive heating element may have more than two widths, for example, three, four, or more different widths. In the present embodiment, the change in the first and second widths 384, 386 between the resistive heating element 342 in the outer region and the inner region is discontinuous and there is a step change in width between the outer region and the inner region. It is to be understood that the change in widths may be continuous or smooth. For example, the resistive heating element 342 may taper towards the outer region. This may allow fine tuning of power per unit area between the inner and outer regions.

[0180] In this embodiment, the resistive heating element 342 comprises a plurality of turns in the outer region to cause the resistance per unit area to be greater in the outer region. In this embodiment, the turns are adjacent two edges of the heating area. However, it is to be understood that the turns may be adjacent to at least two edges of the heating area.

[0181] Figure 28 shows another embodiment of the resistive heating element 342 of the resistive heating layer 340 of the aerosol generator 304 of the article 300. The aerosol generator 304 comprises many of the features of the aerosol generator 304 shown in Figure 3 and repeated description of those features is omitted, with differences being described here. In other examples,

the aerosol generator 304 may comprise any of the features of the aerosol generators 304 described above with respect to other figures. As before, the aerosol generator 304 comprises the resistive heating layer 340 and the aerosol generating layer 330. It will be understood that the resistive heating layer 340 may comprise a plurality of resistive heating elements 342 as illustrated in Figure 26 and described here.

[0182] In this embodiment, the resistive heating element 342 covers a heating area of the resistive heating layer 340, wherein resistive heating element 342 is configured such that a heating power per unit area is greater in an outer region of the heating area than in an inner area of the heating area. The resistive heating element 342 is configured such that a resistance per unit area is greater in the outer region than in the inner region to cause the heating power per unit area to be greater. In this embodiment, the resistive heating element 342 comprises a plurality of turns in the outer region to cause the resistance per unit area to be greater in the outer region. In this embodiment, the resistive heating element 342 extends diagonally relative the edges of the heating area. In this embodiment, the turns 390 connect diagonally extending portions 388 of the resistive heating element. In this embodiment, the turns 390 are adjacent to all edges of the heating area.

[0183] It is to be understood that the angle at which the resistive heating element 342 extends diagonally relative to the edges of the heating area may be more or less than shown in Figure 28. For example, although the diagonally extending portions 388 are shown to extend at an angle of about 45 degrees relative to the edges of the heating area, this angle may be more or less than 45 degrees. It is thought that an angle of 45 degrees provides best uniformity.

[0184] In this embodiment, the width of the resistive heating element is shown as constant. However, it is to be understood that the resistive heating element 342 may be narrower in the outer region to cause the resistance per unit to be greater in the outer region. For example, the turns 390 of the resistive heating element 342 that connect the diagonally extending portions 388 of the resistive heating element 342 may be narrower than the diagonally extending portions 388 of the resistive heating element. Additionally or alternatively, the width of one or more of the diagonally extending portions 388 of the resistive heating element 342 may vary between the inner and outer region. For example, one or more of the diagonally extending portions 388 of the resistive heating element 342 may be narrower in the outer region than the inner region. For example, one or more of the diagonally extending portions 388 may taper towards the outer region.

[0185] Additionally or alternatively, the spacing between adjacent diagonally extending portions 388 of the resistive heating element 342 may be increased or decreased so as to decrease or increase the heating power per unit area. For example, the number of turns

390 per unit area may be increased or decreased so as to decrease or increase the spacing between diagonally extending portions 388 of the resistive heating element 342.

[0186] Additionally or alternatively, portions of the resistive heating element 342 may follow a crenelated path. For example, portions of the resistive heating element 342 may follow a crenelated path in the outer region. It is to be understood that by providing turns in the outer region of the heating area improves the uniformity of heating and ensure that all the aerosol generating layer 330 covering the heater is heated, thereby minimising the required area of heater. Additionally, by forming regions of higher and lower resistance in the outer and inner regions, respectively, a differential in heating power per unit area is created, thereby compensating for the cooling effect of incoming air passing over the heating area and help maintain a constant temperature at the surface of the aerosol generating layer 330.

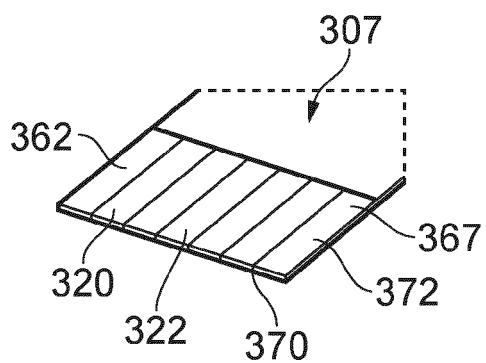
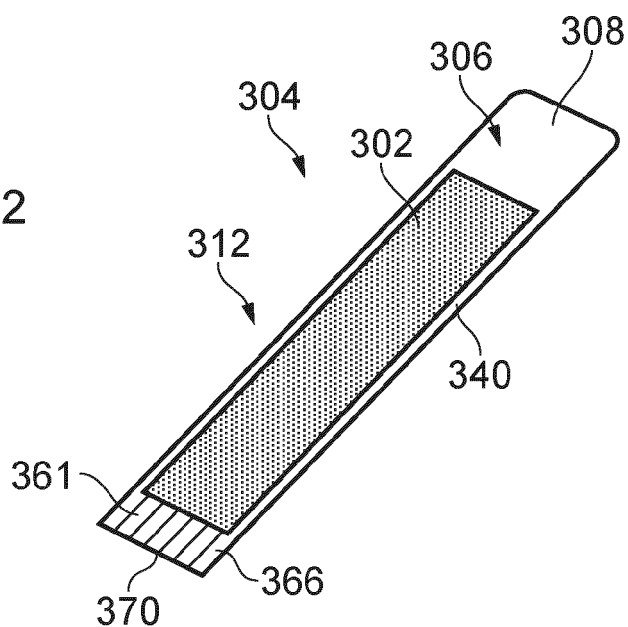
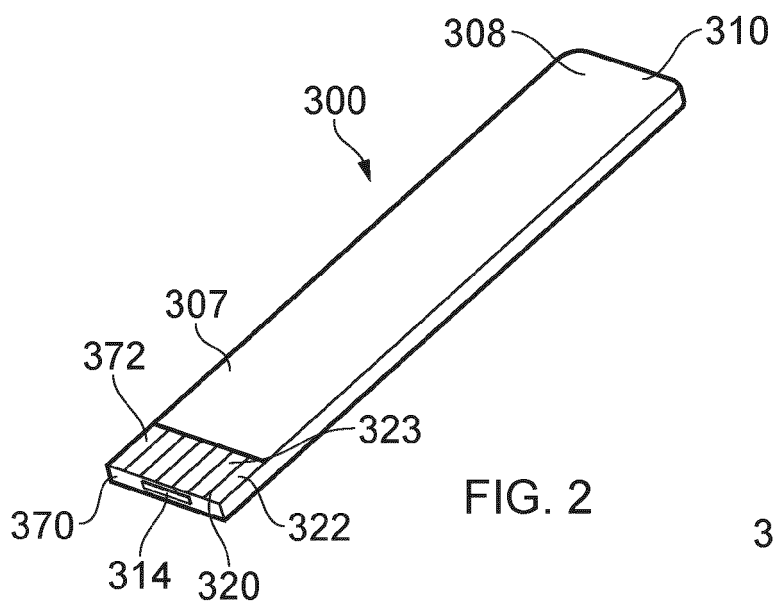
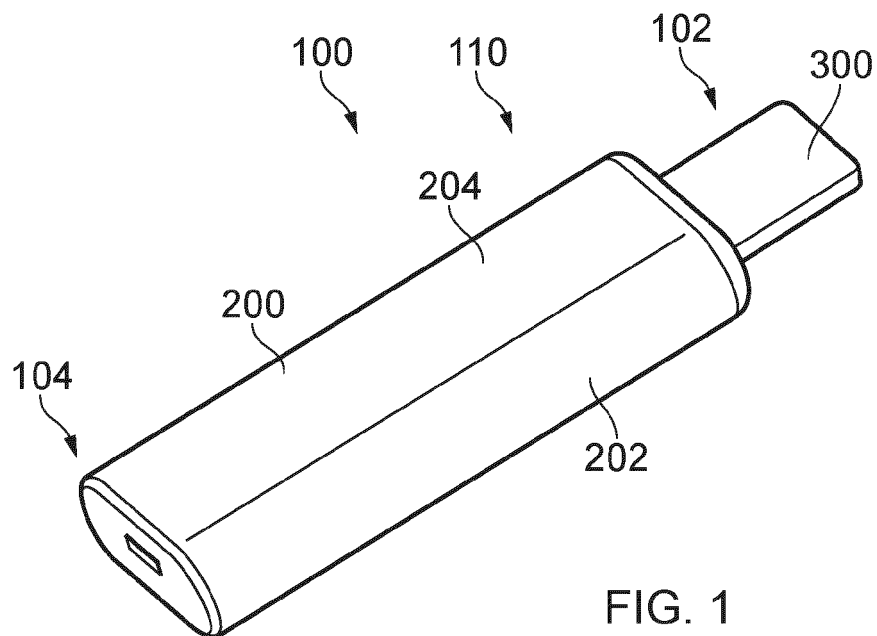
[0187] The various embodiments described herein are presented only to assist in understanding and teaching the claimed features. These embodiments are provided as a representative sample of embodiments only, and are not exhaustive and/or exclusive. It is to be understood that advantages, embodiments, examples, functions, features, structures, and/or other aspects described herein are not to be considered limitations on the scope of the invention as defined by the claims or limitations on equivalents to the claims, and that other embodiments may be utilised and modifications may be made without departing from the scope of the claimed invention. Various embodiments of the invention may suitably comprise, consist of, or consist essentially of, appropriate combinations of the disclosed elements, components, features, parts, steps, means, etc., other than those specifically described herein. In addition, this disclosure may include other inventions not presently claimed, but which may be claimed in future.

Claims

1. An aerosol generator of an article for an aerosol provision device, the aerosol generator elongated along a longitudinal direction, the aerosol generator comprising:

aerosol generating material;
 a resistive heating layer comprising a resistive heating element configured to heat at least a portion of the aerosol generating material to generate an aerosol;
 the aerosol generating material being on the resistive heating layer;
 a first type of electrical contact; and
 a second type of electrical contact;
 wherein the resistive heating element is at least a portion of an electrically conductive path be-

- tween the first type of electrical contact and the second type of electrical contact;
wherein the resistive heating element covers a heating area of the resistive heating layer, wherein the resistive heating element is configured such that a heating power per unit area is greater in an outer region of the heating area than in an inner area of the heating area.
2. The aerosol generator of claim 1, comprising an aerosol generating layer comprising the aerosol generating material, wherein the resistive heating layer comprising the resistive heating element is configured to heat the aerosol generating material of the aerosol generating layer to generate an aerosol. 5
 3. The aerosol generator of claim 2, wherein the aerosol generating layer is on the resistive heating layer. 10
 4. The aerosol generator of any of claims 1 to 3, wherein the resistive heating element is configured such that a resistance per unit area is greater in the outer region than in the inner region to cause the heating power per unit area to be greater. 15
 5. The aerosol generator of claim 4, wherein the resistive heating element comprises a plurality of turns in the outer region to cause the resistance per unit area to be greater in the outer region. 20
 6. The aerosol generator of claim 5, wherein the turns are provided by the resistive heating element following a crenelated path in the outer region. 25
 7. The aerosol generator of claim 5 or 6, wherein the turns are adjacent to at least two edges of the heating area. 30
 8. The aerosol generator of claim 7, wherein the turns are adjacent to all edges of the heating area. 35
 9. The aerosol generator of any of claims 4 to 8, wherein the resistive heating element extends diagonally relative to edges of the heating area, wherein the turns connect diagonally extending portions of the resistive heating element. 40
 10. The aerosol generator of any of claims 4 to 9, wherein the resistive heating element is narrower in the outer region to cause the resistance per unit area to be greater in the outer region. 45
 11. The aerosol generator of claim 10, wherein the resistive element comprises a tapered portion. 50
 12. The aerosol generator of any of claims 1 to 11, wherein the outer region covers first and second sides of the heating area. 55
 13. The aerosol generator of claim 12, wherein the outer region surrounds the inner region.
 14. The aerosol generator of any of claims 5 to 13, wherein a first number of turns per unit area in a first area of the outer region is different to a second number of turns per unit area in a second area of the outer region.
 15. The aerosol generator of any of claims 5 to 14 wherein the plurality of turns comprises curvilinear turns.



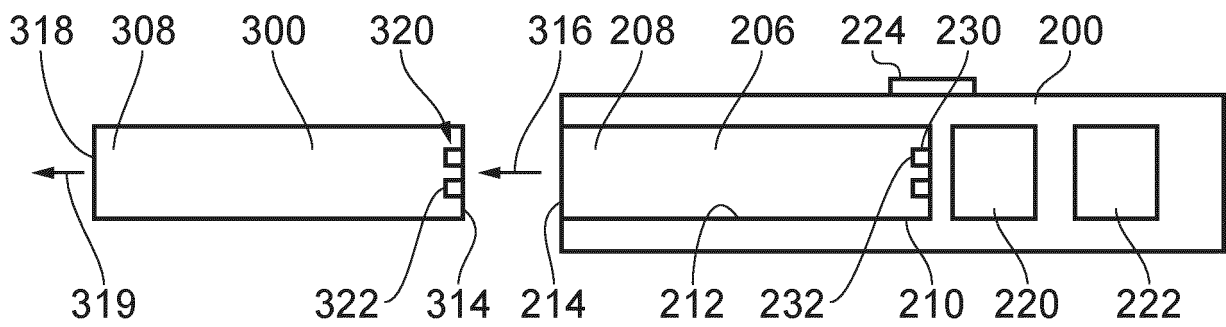


FIG. 5

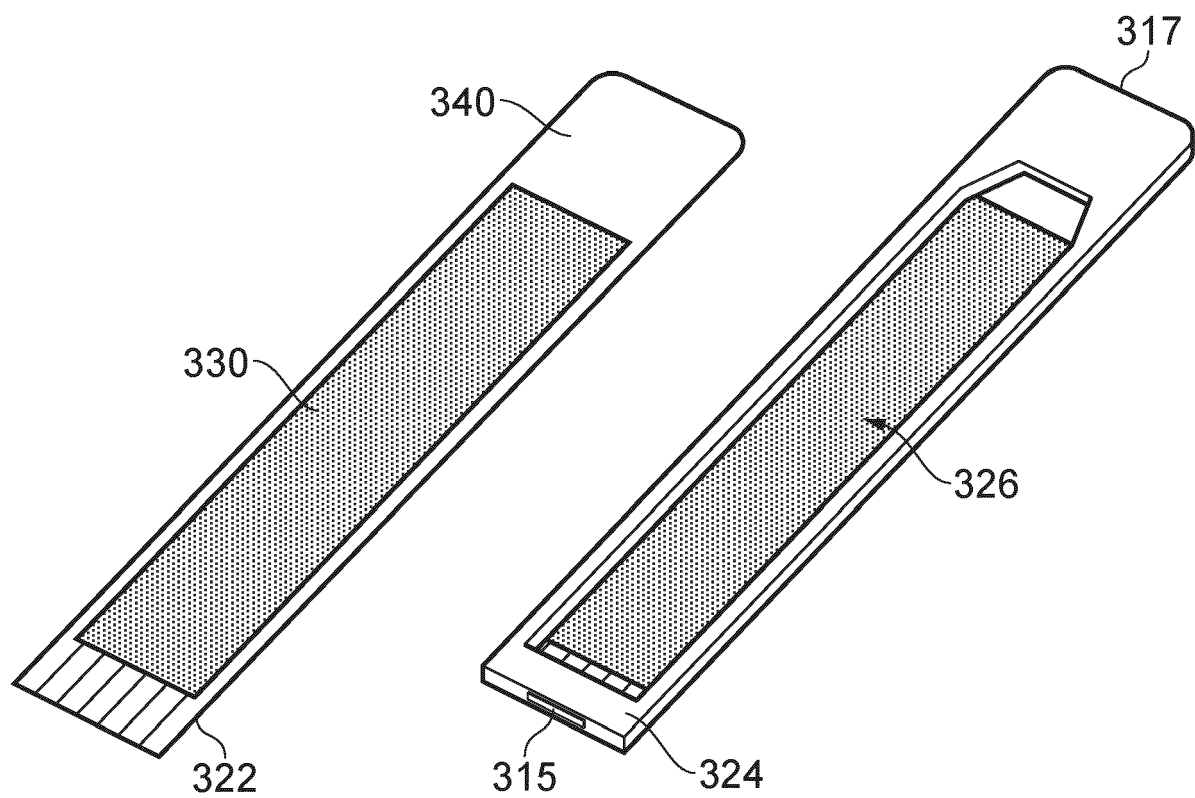
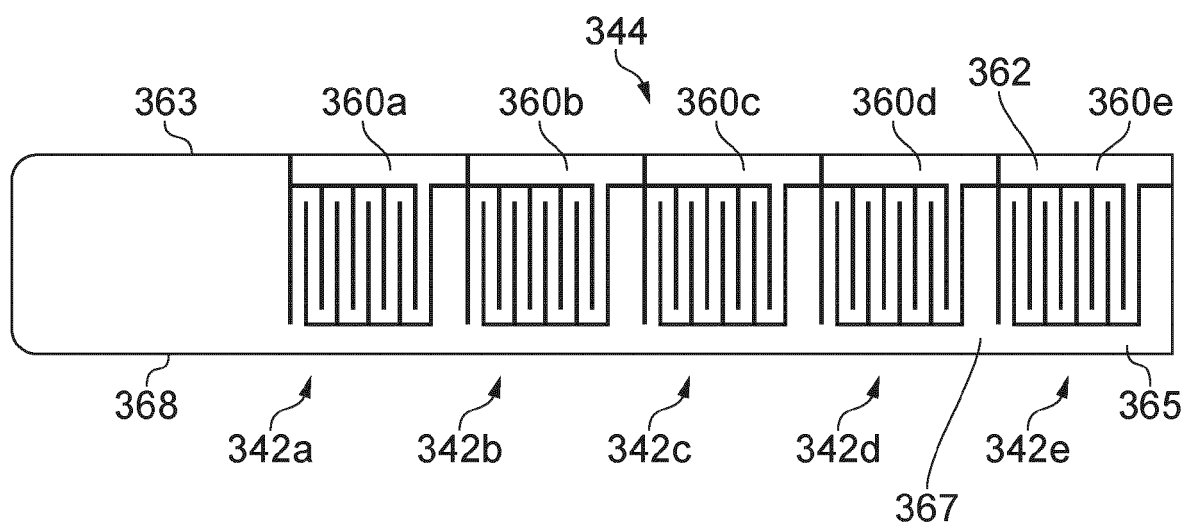
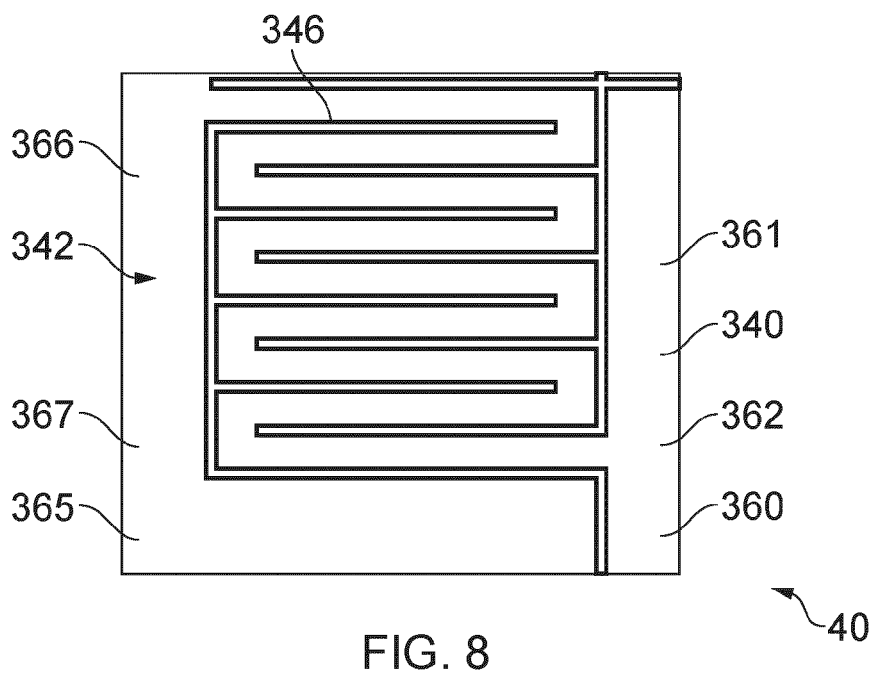
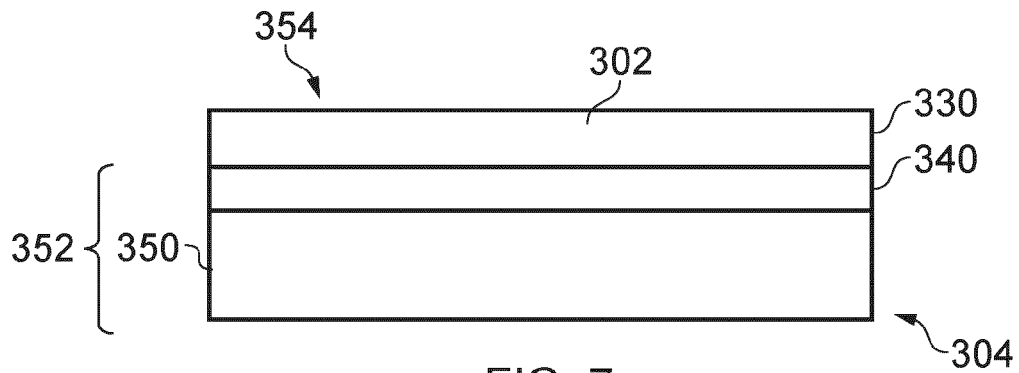


FIG. 6



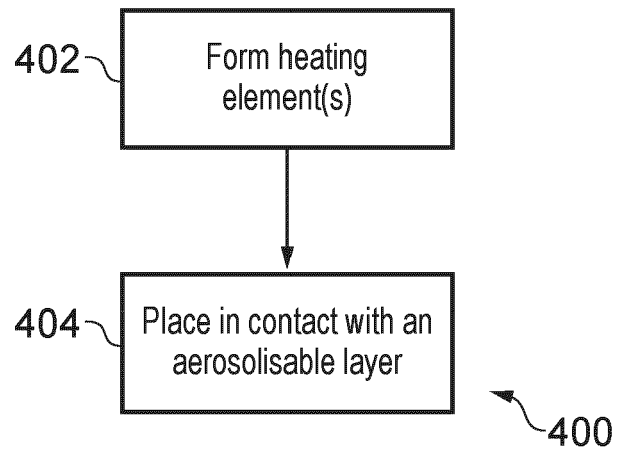


FIG. 10

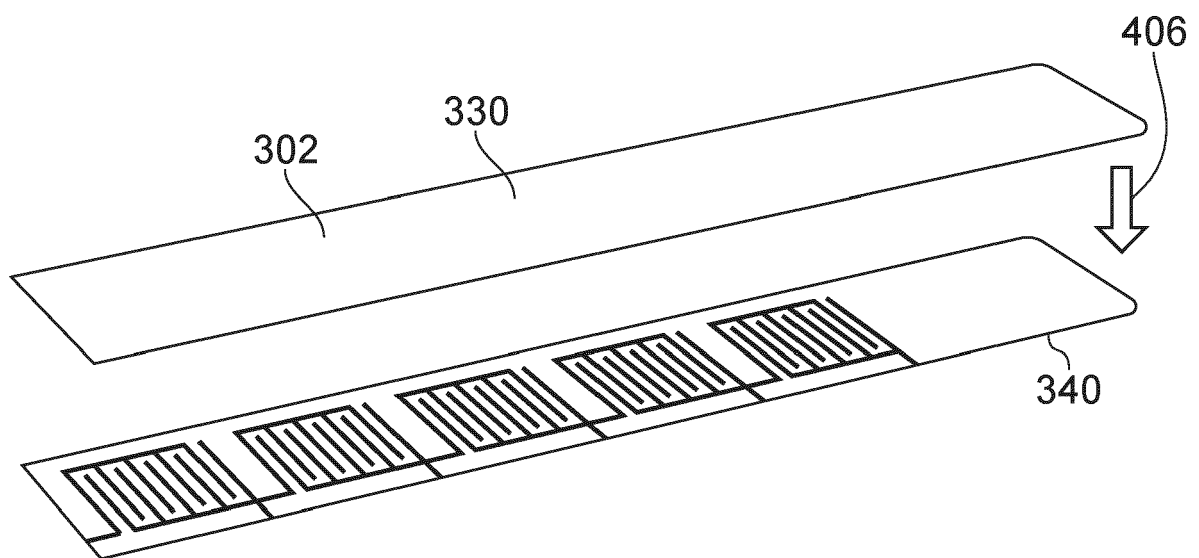


FIG. 11

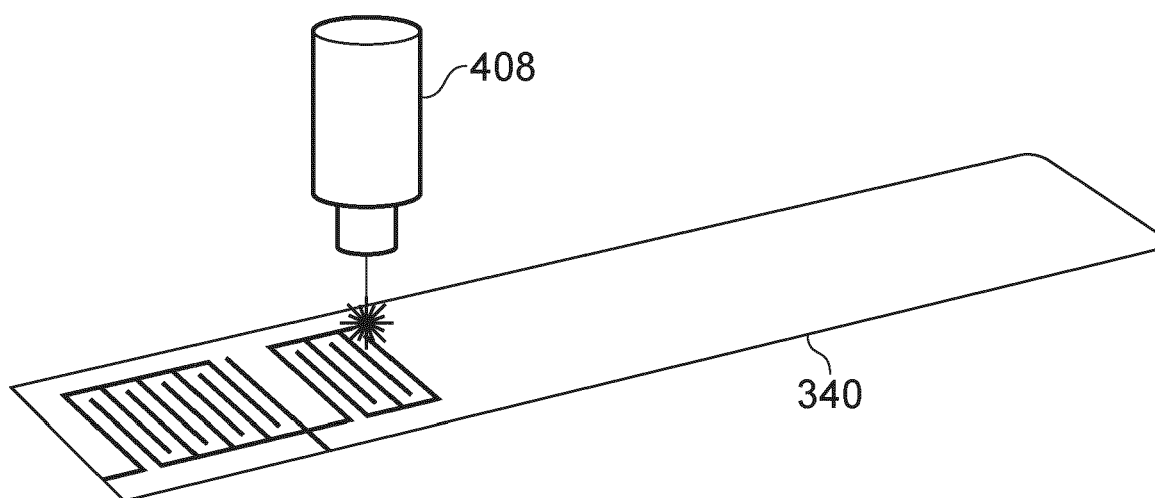


FIG. 12

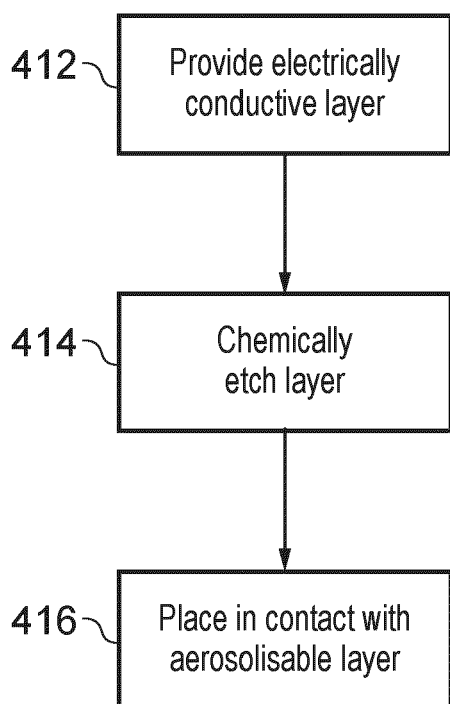


FIG. 13

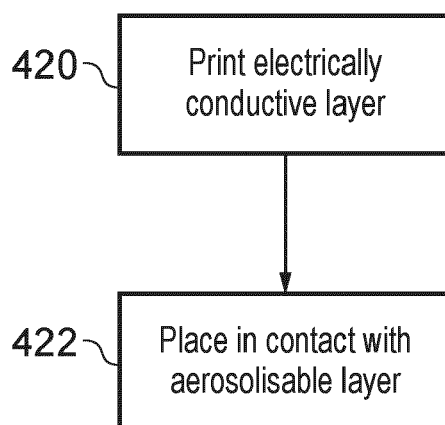


FIG. 14

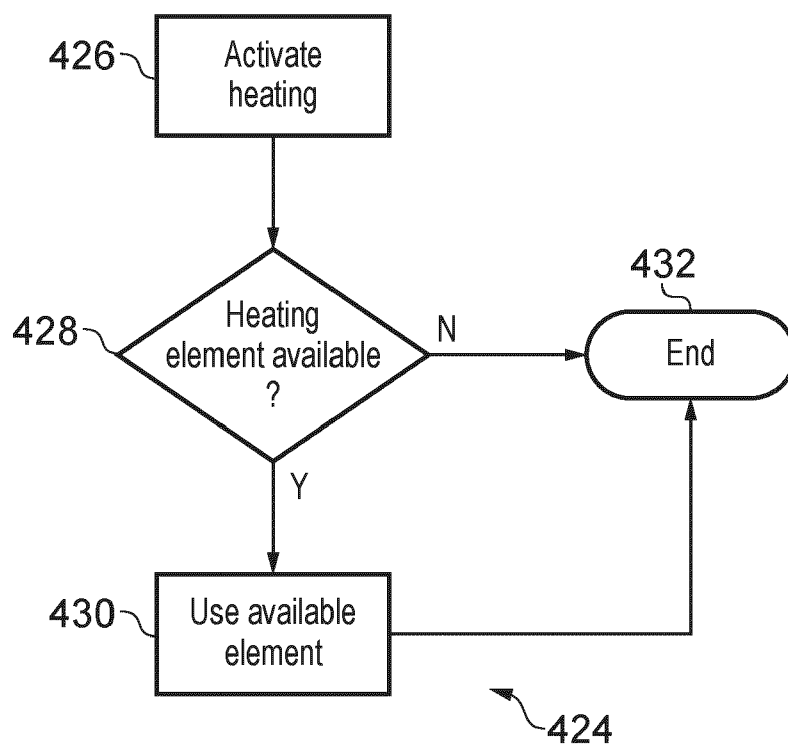


FIG. 15

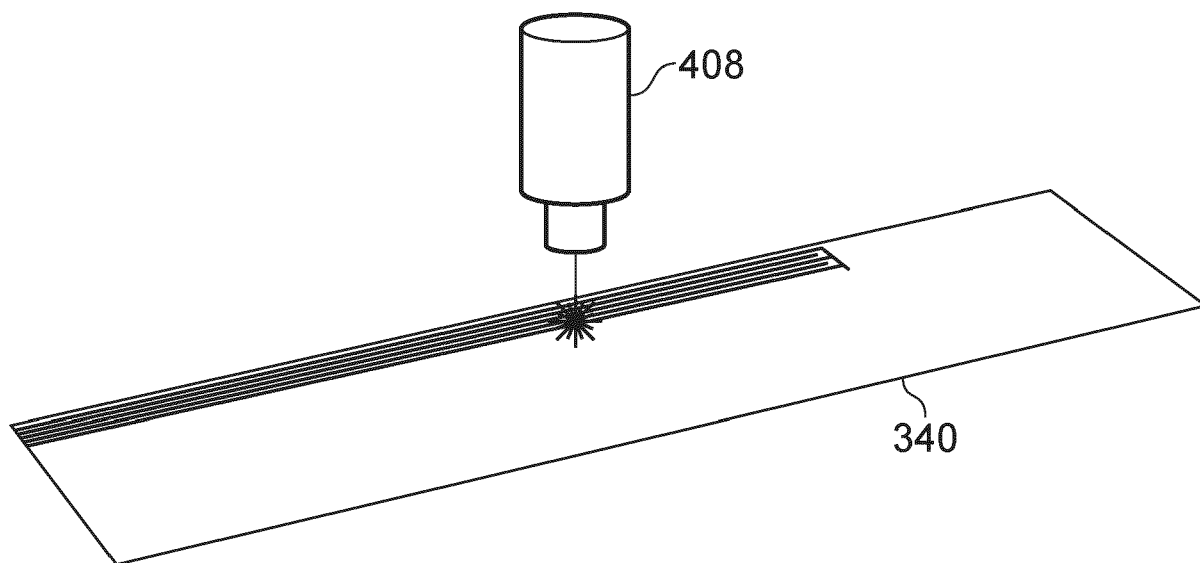
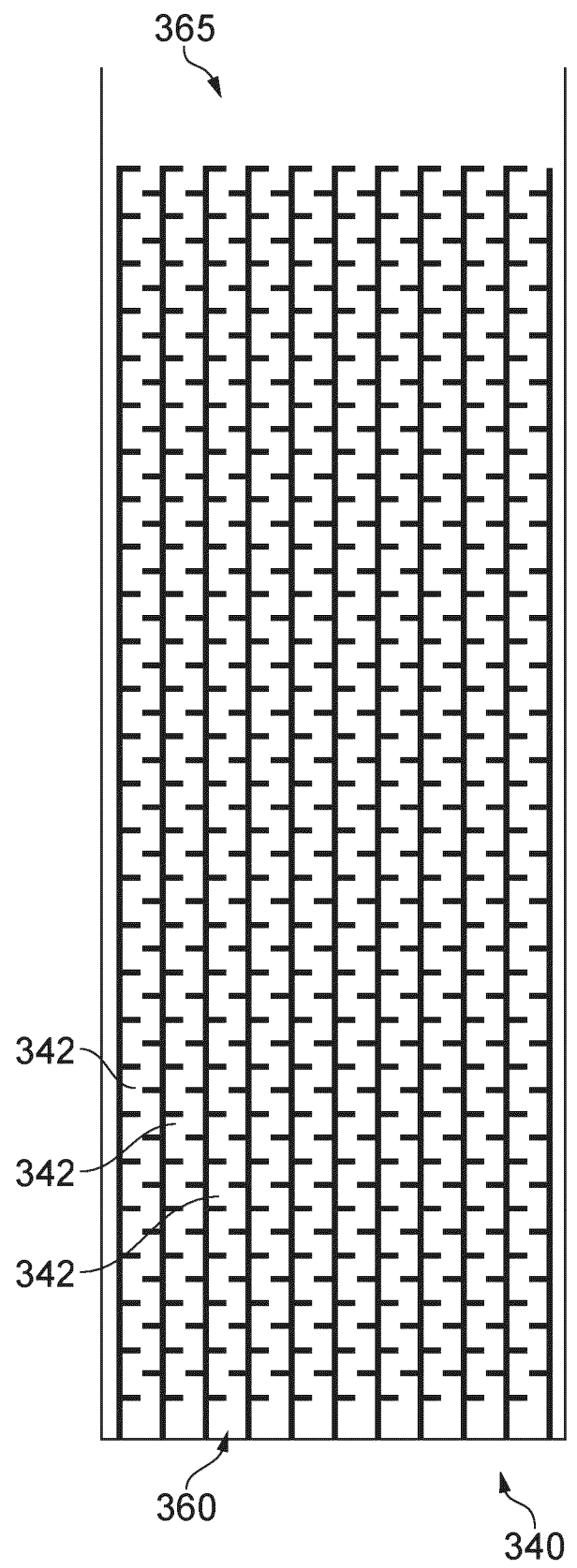
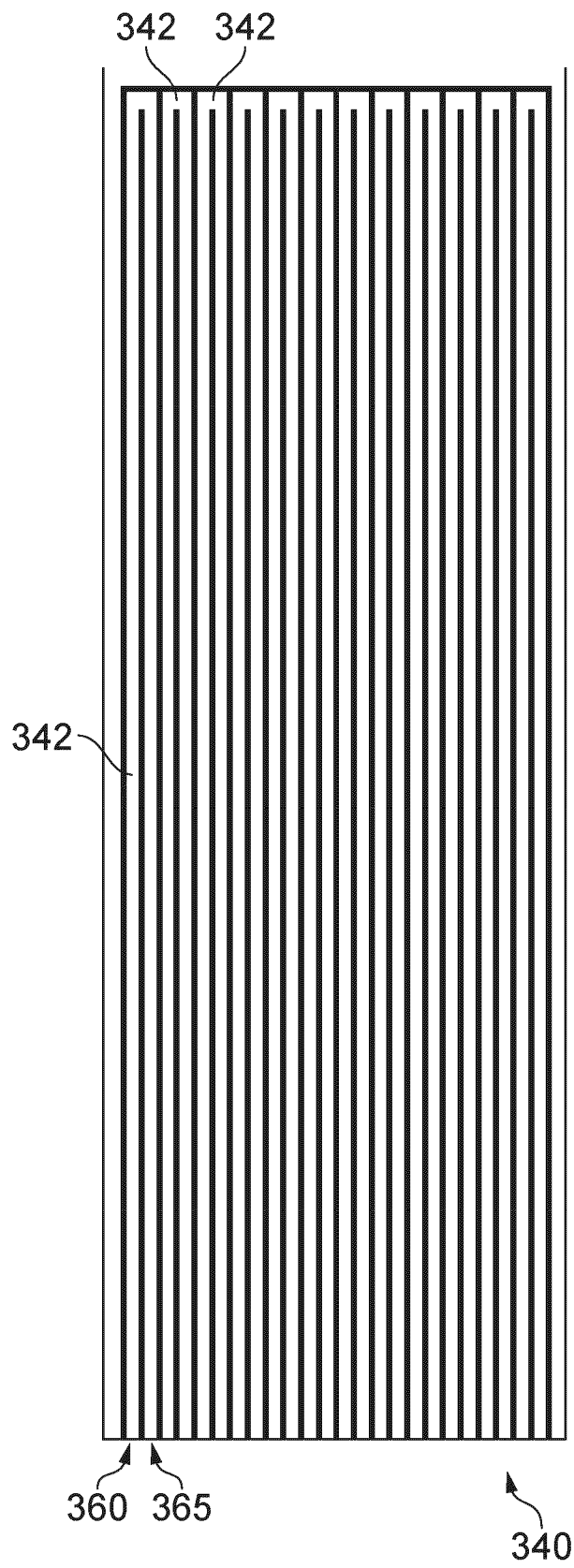


FIG. 16



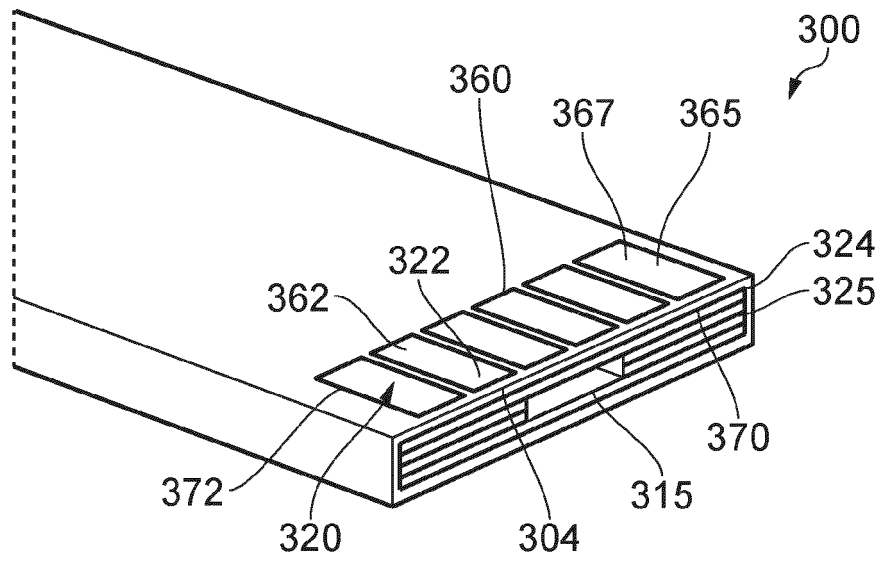


FIG. 19

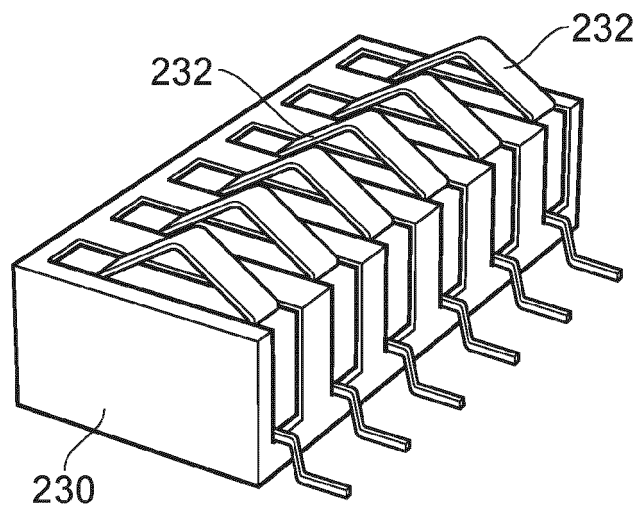


FIG. 20

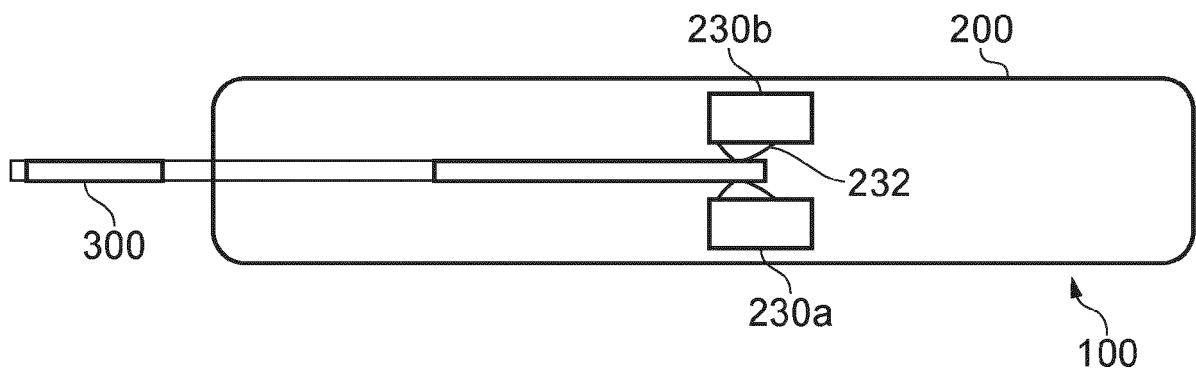


FIG. 21

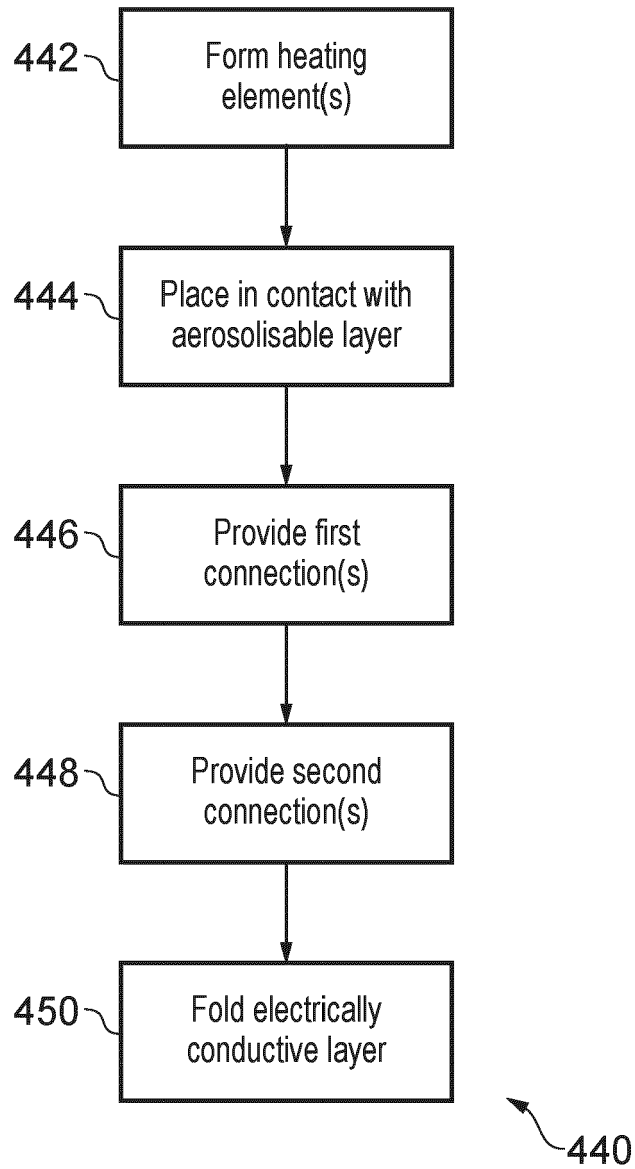


FIG. 22

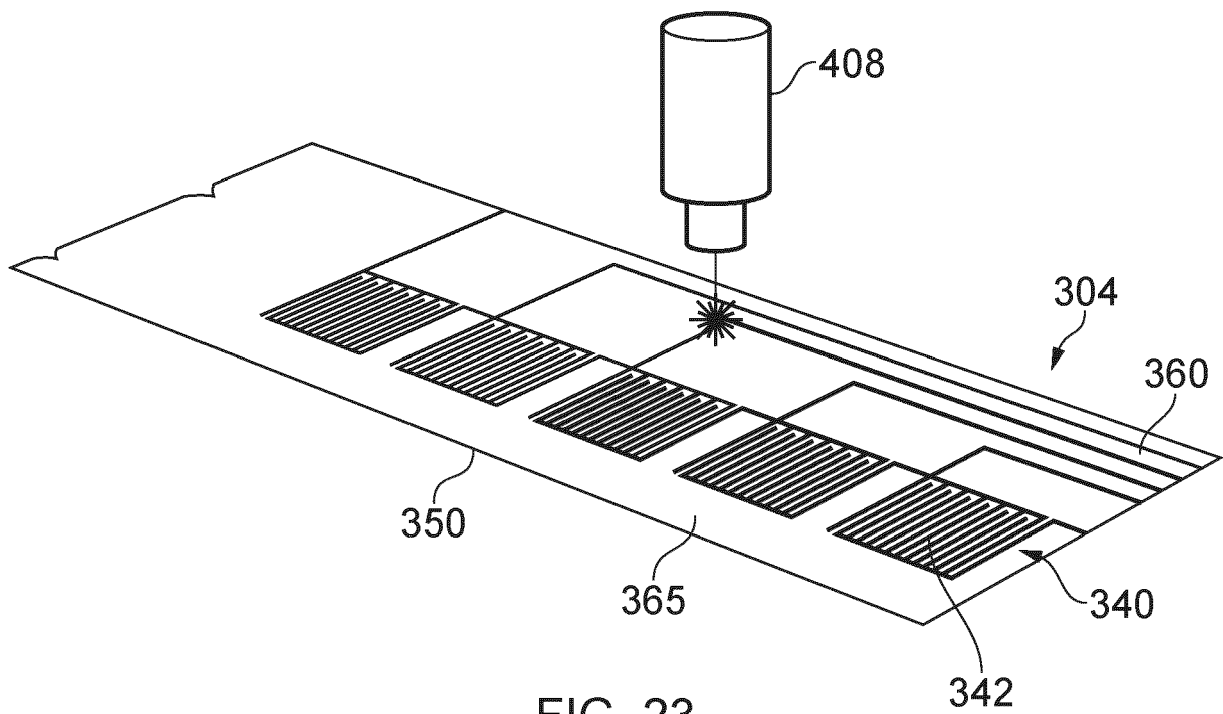


FIG. 23

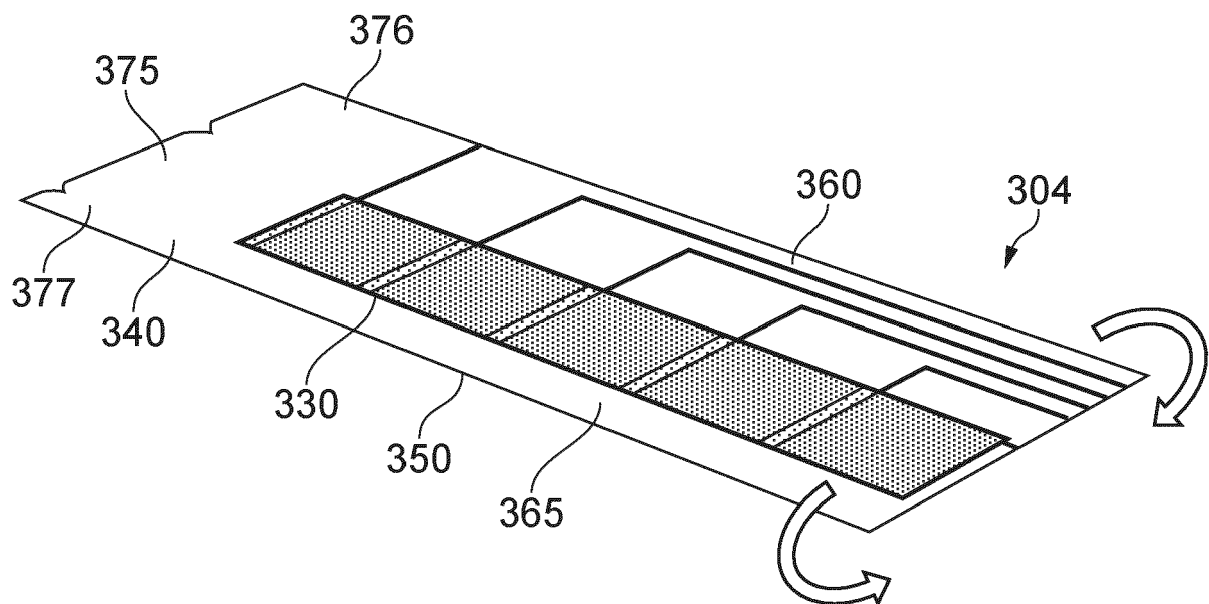


FIG. 24

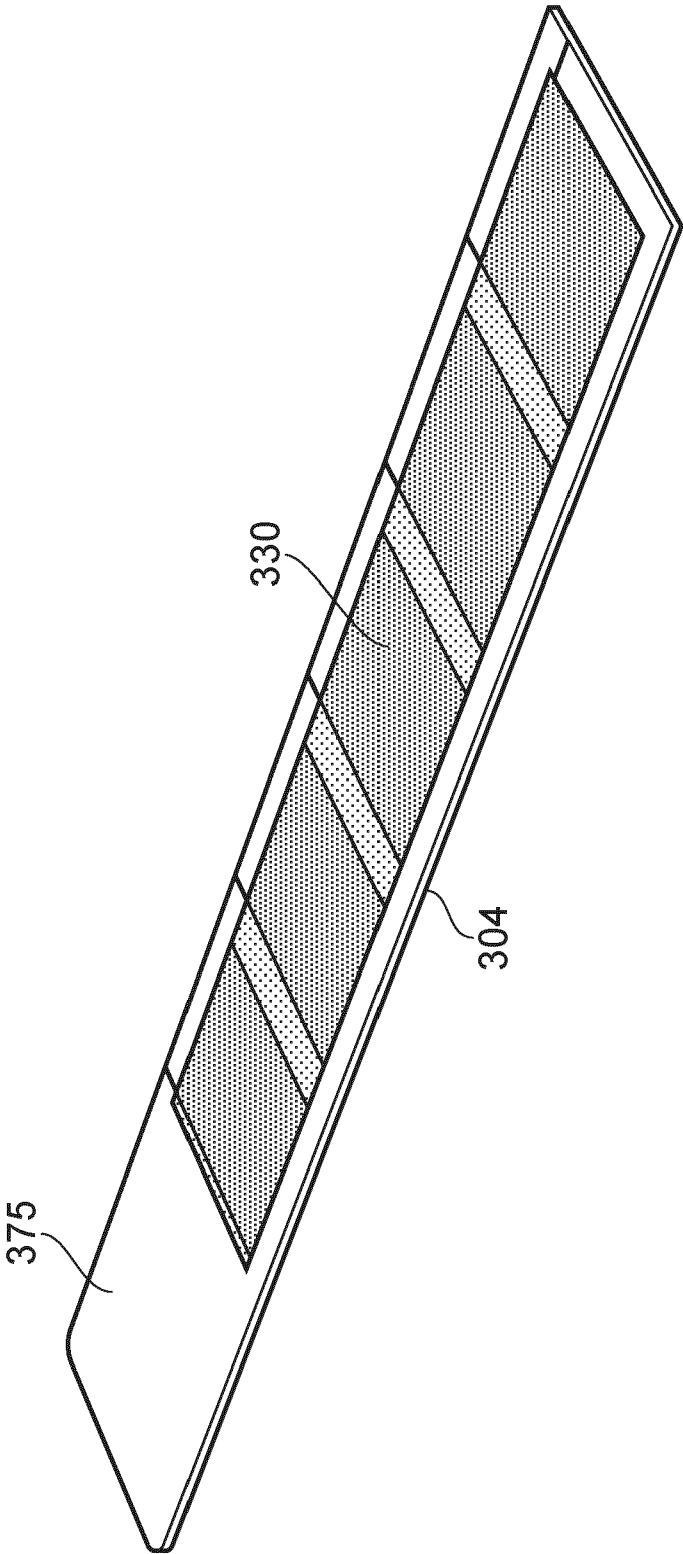


FIG. 25

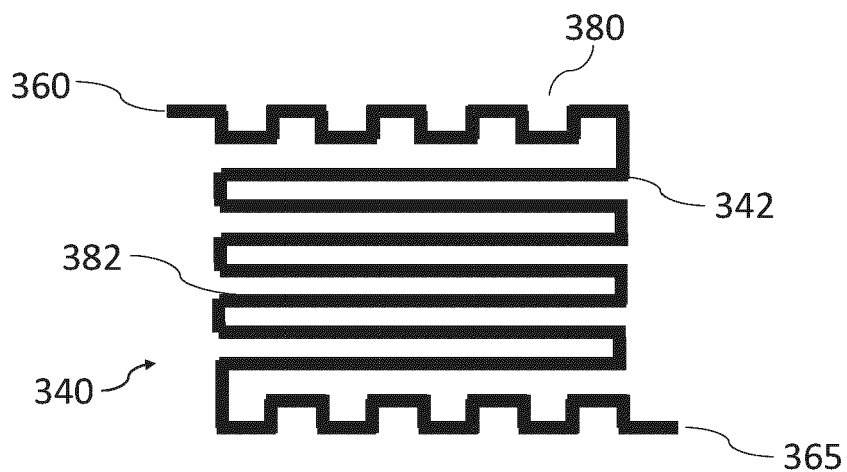


FIG. 26

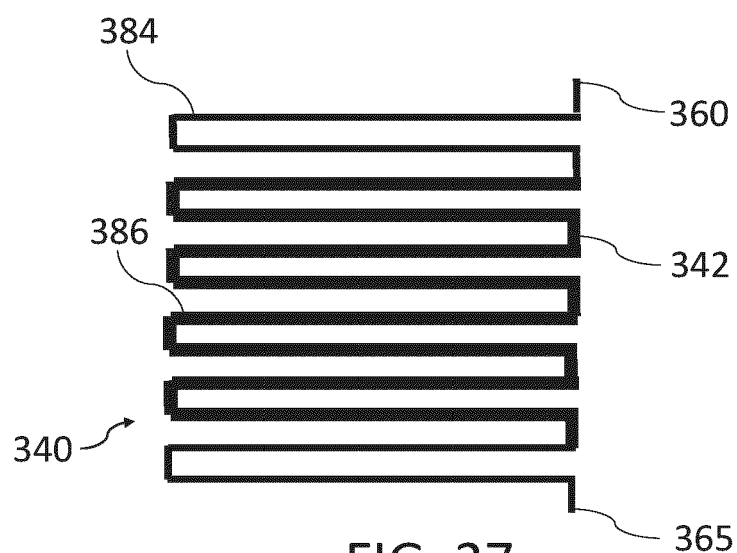


FIG. 27

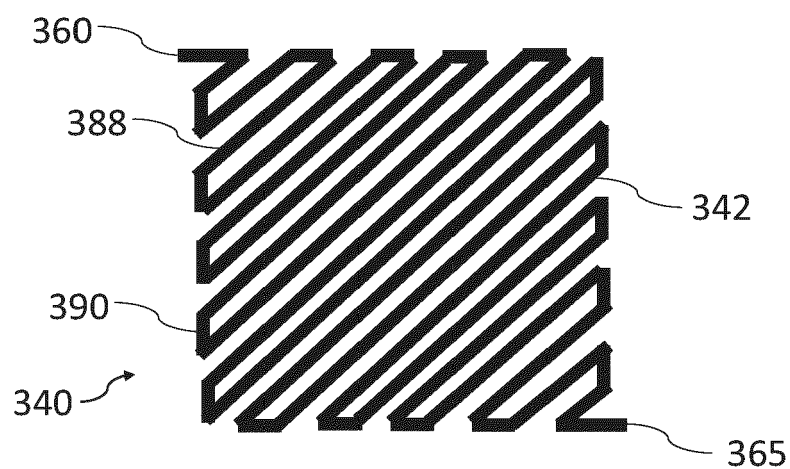


FIG. 28



EUROPEAN SEARCH REPORT

Application Number

EP 24 18 8642

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 3 456 150 B1 (NICOVENTURES TRADING LTD [GB]) 5 May 2021 (2021-05-05)	1-8, 10-15	INV. A24F40/46
A	* abstract; figures 4, 5; table 1 * * paragraph [0018] - paragraph [0020] * * paragraph [0031] - paragraph [0037] * * paragraph [0040] *	9	A24F40/42
A	WO 2022/154527 A1 (KT & G CORP [KR]) 21 July 2022 (2022-07-21) * abstract; figures 1-5 * * paragraph [0058] - paragraph [0061] * * paragraph [0064] - paragraph [0070] *	1-15	
A	JP 2024 500706 A (PHILIP MORRIS PRODUCTS SA [CH]) 10 January 2024 (2024-01-10) * abstract; figure 5 * * paragraph [0150] - paragraph [0151] *	1-15	
A	KR 102 515 109 B1 (AMOGREENTECH CO LTD [KR]) 28 March 2023 (2023-03-28) * abstract; figures 1-6 * * paragraph [0031] * * paragraph [0043] - paragraph [0044] *	1-15	TECHNICAL FIELDS SEARCHED (IPC) A24F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		3 February 2025	Alaguero, Daniel
CATEGORY OF CITED DOCUMENTS		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	
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			

EPO FORM 1503 03.82 (P34C01)

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

EP 24 18 8642

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-02-2025

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
EP 3456150	B1	05-05-2021	AR	108476 A1		22-08-2018
			CN	109076650 A		21-12-2018
			EP	3456150 A1		20-03-2019
			EP	3869908 A1		25-08-2021
			ES	2871880 T3		02-11-2021
			HU	E054675 T2		28-09-2021
			JP	6833157 B2		24-02-2021
			JP	7358571 B2		10-10-2023
			JP	2019518430 A		04-07-2019
			JP	2021048844 A		01-04-2021
			JP	2022130578 A		06-09-2022
			JP	2023169383 A		29-11-2023
			PL	3456150 T3		23-08-2021
			RU	2704113 C1		24-10-2019
			TW	201740827 A		01-12-2017
			US	2020253280 A1		13-08-2020
			WO	2017194769 A1		16-11-2017

WO 2022154527	A1	21-07-2022	KR	20220102837 A		21-07-2022
			WO	2022154527 A1		21-07-2022

JP 2024500706	A	10-01-2024	CN	116600670 A		15-08-2023
			EP	4266923 A1		01-11-2023
			JP	2024500706 A		10-01-2024
			KR	20230125242 A		29-08-2023
			US	2024099378 A1		28-03-2024
			WO	2022136006 A1		30-06-2022

KR 102515109	B1	28-03-2023	NONE			

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82