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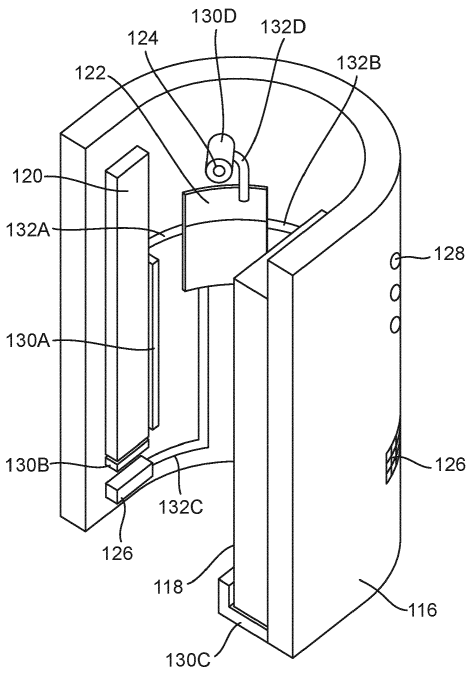
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(54) AEROSOL PROVISION DEVICE

(57) An aerosol provision device comprising a plurality of electrical components (118 120, 122, 124, 126, 128). The device further comprises a plastic body (116) comprising at least one electrically conductive track (132A, 132B, 132C) configured to provide an electrical connection between at least two of the plurality of electrical components (118 120, 122, 124, 126, 128). The at least one electrically conductive track (132A, 132B, 132C) is formed by laser direct structuring.

Fig. 2



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Description

Technical Field

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

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 that burn tobacco by creating products that release compounds without burning. Examples of such products are heating devices which release compounds by heating, but not burning, the material. The material may be for example tobacco or other non-tobacco products, which may or may not contain nicotine.

Summary

[0003] According to a first aspect of the present invention there is provided an aerosol provision device comprising:

a plurality of electrical components; and
a plastic body comprising at least one electrically conductive track configured to provide an electrical connection between at least two of the plurality of electrical components, wherein the at least one electrically conductive track is formed by laser direct structuring.

[0004] The use of a plastic body which comprises at least one electrically conductive track, formed by laser direct structuring, which provides an electrical connection between at least two electrical components within the aerosol provision device may reduce the number of electrical cables required within the device. This may reduce the space required to route such electrical cables, thereby potentially allowing the aerosol provision device to be made more compact. The use of electrically conductive tracks formed by laser direct structuring may also simplify the manufacture and assembly of the aerosol provision device.

[0005] The plastic body may be configured to support at least one of the plurality of electrical components.

[0006] The plastic body may be configured to house at least one of the plurality of electrical components.

[0007] The aerosol provision device may comprise a housing, and the plastic body may be contained within, or at least partially define, the housing.

[0008] The plastic body may be formed from modified polyether ether ketone (PEEK).

[0009] The plurality of electrical components may comprise at least one of: an electrical power source (e.g. a battery), a heating arrangement, a temperature sensor, a controller, a light source, a haptic device, and a speaker.

[0010] The aerosol provision device may comprise at least one electrical connector arranged to connect the electrically conductive track to at least one of the electrical components.

[0011] The at least one electrically conductive track may comprise a plurality of electrically conductive tracks.

[0012] Further, at least two of the electrically conductive tracks may be electrically isolated from one another.

[0013] The plastic body may be made from a plastic material capable of resisting temperatures of at least 200 °C, e.g. at least 220 °C, e.g. at least 250 °C for a sustained period of time.

[0014] The sustained period of time may comprise at least 60 seconds, e.g. at least 2 minutes, e.g. at least 5 minutes.

[0015] The plastic body may be electrically insulative.

[0016] The plastic body may have a high chemical resistance.

[0017] The at least one electrically conductive track may extend in multiple different planes.

[0018] According to a second aspect of the present invention there is provided an aerosol provision system comprising:

an aerosol provision device according to any of the embodiments described above; and
an article comprising an aerosol generating material.

[0019] According to a third aspect of the present invention there is provided a method of forming a component for use in an aerosol provision device, the method comprising:

forming a plastic body;
irradiating a track on the plastic body using a laser;
plating the irradiated track with an electrically conductive material.

[0020] The step of plating the irradiated track with an electrically conductive material may comprise plating the track with an electrically conductive material multiple times.

[0021] The step of forming the plastic body may comprise forming a plastic body having a three-dimensional shape with support features for mounting electrical components to the plastic body.

[0022] The step of forming the plastic body may comprise forming a plastic body from a material which comprises an additive comprising a metallic inorganic compound which is configured to activated by the laser.

Brief Description of the Drawings

[0023] Embodiments will now be described, by way of example only, and with reference to the accompanying drawings in which:

Fig. 1 shows a side view of an aerosol provision

system in accordance with an embodiment of the present invention;

Fig. 2 shows a perspective view of a plastic body of an aerosol provision device in accordance with an embodiment of the present invention;

Fig. 3 shows a plan view of part of a plastic body including an electrically conductive track comprising an electrical connector at an end thereof; and

Fig. 4 is a flow chart of a method in accordance with an embodiment of the present invention.

Detailed Description

[0024] As used herein, the term "aerosol-generating 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 gel which may or may not contain an active substance and/or flavourants. Aerosol-generating material may include any plant based material, such as tobacco-containing material and may, for example, include one or more of tobacco, tobacco derivatives, expanded tobacco, reconstituted tobacco or tobacco substitutes. Aerosol-generating material also may include other, non-tobacco, products, which, depending on the product, may or may not contain nicotine. Aerosol-generating material may for example be in the form of a solid, a liquid, a gel, a wax or the like. Aerosol-generating material may for example also be a combination or a blend of materials. Aerosol-generating material may also be known as "smokable material".

[0025] The aerosol-generating material may comprise a binder and an aerosol former. Optionally, an active 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 some embodiments, the aerosol-generating material is substantially tobacco free.

[0026] The aerosol-generating material may comprise or be an "amorphous solid". The amorphous solid may be a "monolithic solid". In some embodiments, the amorphous solid may be a dried gel. The amorphous solid is a solid material that may retain some fluid, such as liquid, within it. In some embodiments, the aerosol-generating material may, for example, comprise from about 50wt%, 60wt% or 70wt% of amorphous solid, to about 90wt%, 95wt% or 100wt% of amorphous solid.

[0027] The aerosol-generating material may comprise an aerosol-generating film. The aerosol-generating film may comprise or be a sheet, which may optionally be shredded to form a shredded sheet. The aerosol-generating sheet or shredded sheet may be substantially tobacco free.

[0028] 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. Any of the aerosol provision systems described herein may be a non-combustible aerosol provision system.

[0029] In some embodiments, the delivery system is a non-combustible aerosol provision system, such as a powered non-combustible aerosol provision system.

[0030] 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.

[0031] 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.

[0032] In some embodiments, the non-combustible aerosol provision system is a hybrid system to generate aerosol using a combination of aerosol-generating materials, 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.

[0033] 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.

[0034] 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.

[0035] 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 or an exothermic power source. In some embodiments, the exothermic power source comprises a carbon substrate which may be energised so as to distribute power in the form of heat to an aerosol-generating material or to a heat transfer material in proximity to the exothermic power source.

[0036] 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.

[0037] 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.

[0038] 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 the aerosol provision device before it is heated to produce an aerosol, which the user subsequently inhales. The article may be, for example, of a predetermined or specific size that is configured to be placed within a heating chamber of the device which is sized to receive the article.

[0039] With reference to Fig. 1, an aerosol provision system 2 in accordance with an embodiment of the present invention is shown. The aerosol provision system 2 comprises an aerosol provision device 4 for generating aerosol from an aerosol generating material. The aerosol provision system 2 further comprises a replaceable article 6 comprising the aerosol generating material. In broad outline, the aerosol forming device 4 may be used to heat the article 6 to generate an aerosol or other inhalable medium, which is inhaled by a user of the device 4.

[0040] The aerosol forming device 4 comprises a body 8. The body may be considered to form a housing which surrounds and houses various components of the device 4. An article aperture 10 is formed at one end of the body 8, through which the article 6 may be inserted for heating by an aerosol generator 12.

[0041] The device 4 may also include a user-operable control element 14, such as a button or switch, which operates the device 4 when pressed. For example, a user may turn on the device 4 by operating the switch 14.

[0042] The aerosol generator 12 defines a longitudinal axis, which aligns with an axis of the article 6.

[0043] In use, the article 6 may be fully or partially inserted into the aerosol generator 12 where it may be heated by one or more components of the aerosol generator 12.

[0044] The device 4 includes an apparatus, i.e. the aerosol generator 12, for heating aerosol-generating material. The apparatus includes an aerosol generating assembly, a controller (control circuit), and a power source. The apparatus forms part of the body 8. The aerosol generating assembly is configured to heat the aerosol-generating material of an article 6 inserted through the article aperture 10, such that an aerosol is generated from the aerosol generating material. The power source supplies electrical power to the aerosol generating assembly, and the aerosol generating assembly converts the supplied electrical energy into heat energy for heating the aerosol-generating material. The power source may be, for example, a battery, such as a rechargeable battery or a non-rechargeable battery. Examples of suitable batteries include, for example, a lithium battery (such as a lithium-ion battery), a nickel battery (such as a nickel-cadmium battery), and an alkaline battery.

[0045] The power source may be electrically coupled to the aerosol generating assembly to supply electrical power when required and under control of the controller to heat the aerosol generating material. The control circuit may be configured to activate and deactivate the aerosol generating assembly based on a user input. The user input may be via a button press or opening a door of the device (for example, a door covering a consumable receiving receptacle). The control circuit may be configured to activate and deactivate automatically, for example on insertion of an article.

[0046] The aerosol generating assembly may comprise various components to heat the aerosol generating material via an inductive heating process. Induction heating is a process of heating an electrically conducting heating element (such as a susceptor) by electromagnetic induction. An induction heating assembly may comprise an inductive element, for example, one or more inductor coils, and a device for passing a varying electric current, such as an alternating electric current, through the inductive element. The varying electric current in the inductive element produces a varying magnetic field. The varying magnetic field penetrates a susceptor (heating element) suitably positioned with respect to the inductive element, and generates eddy currents inside the susceptor. The susceptor has electrical resistance to the eddy currents, and hence the flow of the eddy currents against this resistance causes the susceptor to be heated by Joule heating. In cases where the susceptor comprises ferromagnetic material such as iron, nickel or cobalt, heat may also be generated by magnetic hysteresis losses in the susceptor, i.e. by the varying orientation of magnetic dipoles in the magnetic material as a result of their alignment with the varying magnetic field. In inductive heating, as compared to heating by conduction for example, heat is generated inside the susceptor, allowing for rapid heating. Further, there need not be any physical contact between the inductive element and the susceptor, allowing for enhanced freedom in construction and application. In some embodiments, the aerosol provision device may comprise a resistive heating arrangement.

[0047] The aerosol provision system 2 shown in Figure 1 may comprise any of the features of the various embodiments discussed below.

[0048] Figure 2 shows a perspective view of a plastic body 116 which may form part of the body 8 of the aerosol generating device 4 shown in Figure 1. The plastic body 116 may house/support a plurality of electrical components including, but not limited to: an electrical power source 118 (e.g. a battery), a heating arrangement 120 (e.g. a resistive or inductive heating arrangement), a

controller 122 (e.g. comprising a processor), a temperature sensor 124 (e.g. a thermistor), a haptic device 126, a speaker 126 and/or a light source 128 (e.g. an LED).

[0049] The plurality of electrical components may be housed within the plastic body 116. In some embodiments, the aerosol provision device may comprise a housing, and the plastic body 116 may at least partially define the housing of the aerosol provision device. For example, the plastic body 116 may form part of the body 8 shown in Figure 1. In some embodiments the plastic body 116 may be contained within the housing. As such, the plastic body 116 may be an internal component of the aerosol provision device. In such embodiments, the plastic body 116 may, for example, form part of an internal support structure which defines the internal structure of the aerosol provision device.

[0050] In some embodiments, the plurality of electrical components may be supported by the plastic body 116. For example, the plastic component 116 may comprise a first support 130A and a second support 130B arranged to support the heating arrangement 120. Similarly, the plastic body may comprise a third support 130C arranged to support the electrical power source 118 and a fourth support 130D arranged to support the temperature sensor 124. Any number of the first, second, third and fourths supports 130A-130D may be integrally formed with the plastic body 116. The form of the supports may depend on the components being supported. The supports may be integrally formed with the plastic body 116, for example during its formation. In some embodiments the plastic body 116 may comprise supports which are attached or mounted to the plastic body 116 during manufacture/assembly of the device. Supporting the components by the plastic body 116 may advantageously provide a simple and efficient means for supporting the electrical components within the device.

[0051] As visible in Figure 2, the plastic body 116 comprise a plurality of electrically conductive tracks (hereinafter "electrical tracks") including, for example, a first electrical track 132A, a second electrical track 132B, a third electrical track 132C and a fourth electrical track 132D. The first electrical track 132A provides an electrical connection between the controller 122 and the heating arrangement 120. The second electrical track 132B provides an electrical connection between the electrical power source 118 and the controller 122. The third electrical track 132C provides an electrical connection between the controller 122 and the haptic component 126. The fourth electrical track 132D provides an electrical connection between the controller 122 and the temperature sensor 124. Whilst not shown, further electrical tracks may be provided to provide an electrical connection to the light source 128 and speaker 126. Each of the first to fourth electrical tracks 132A-132D are formed by laser direct structuring. The Applicant has recognised that the use of electrically conductive tracks which are formed by laser direct structuring on the plastic body 116 may provide a convenient means for achieving an electrical connection between various electrical components without needing to route electrical cables within the device. This may, therefore, reduce the amount of cable routing space required within the device which may minimise the size of the device, or provide more space for other components within the device, e.g. more battery space.

[0052] As depicted in Figure 2, in some embodiments at least two of the electrically conductive tracks 132A-132D are electrically isolated from one another. Electrical isolation of the conductive tracks 132A-132D may be achieved through suitable arrangement of the electrical components relative to the plastic body 116.

[0053] The specific form of the electrical track may depend on the plastic body, or the portion of the plastic body, where the electrical track is formed. In some embodiments, as depicted in Figure 2, the at least one electrical track, e.g. the first second, third and fourth electrical tracks 132A-132D extends in multiple (e.g. at least two) different planes. This may advantageously allow for electrical connection between electrical components in the device which are not arranged in a single plane. This arrangement may thus facilitate more complex arrangement of electrical components within the device, whilst still providing an electrical connection with an electrically conductive track, than may have otherwise been possible. In some embodiments, the plastic body 116 may be non-planar. In other words, the plastic body 116 may not be a flat sheet of plastic, and may instead have a more complex three dimensional form. The precise form may depend on the purpose of the plastic body 116 as part of the device.

[0054] Whilst various electrical components shown and electrically conductive tracks have been depicted and described above, it will be appreciated that any number of different electrical components any suitable number of electrical tracks may be included.

[0055] The plastic body 116 may be made from any suitable plastic material. In some embodiments, the plastic body is formed from, i.e. made from, a modified polyether ether ketone (PEEK).

[0056] At least some parts of an aerosol provision device may reach relatively high temperatures during use. As such, it may be desirable for the plastic body 116 to be capable of withstanding such temperatures. In addition, the plastic body 116 may experience such temperatures for an extended period of time during use of the aerosol provision device. Accordingly, in some embodiments, the plastic body 116 may be made from a plastic material capable of resisting temperatures of at least 200 °C, e.g. at least 220 °C, e.g. at least 250 °C for a sustained period of time. This may help to ensure that the plastic body 116 is capable of withstanding the increased temperatures it may be exposed to during use, thereby ensuring it suitable performs its function, e.g. as part of the housing of the aerosol provision device, or as a support component within the device. The sustained period of time may comprise at least 60 seconds, e.g.

at least 2 minutes, e.g. at least 5 minutes.

[0057] The plastic body 116 may be electrically insulative, this may ensure that the electrical tracks 132A-132D can suitably perform their function. In some embodiments, the plastic body 116 has a high chemical resistance. Having a high chemical resistance may advantageously ensure that the plastic body 116 does not deteriorate in the presence of chemicals, e.g. any chemicals forming part of, or formed from, an aerosol generating article which may be inserted into the aerosol provision device of which the plastic body 116 forms part of.

[0058] In any of the embodiments discussed above, the electrical components 118-128 may be electrically connected to their respective electrical tracks 132A-132D by any suitable means. For example, in some embodiments, the electrical components 118-128 may be soldered to their respective electrical tracks 132A-132D. However, this is not essential and in some embodiments the electrical components 118-128 may be connected via an electrical connector. Such embodiments are described in more detail below.

[0059] Figure 3 shows a plan view of a portion of a plastic body 216 in accordance with an embodiment of the present invention. As depicted, the plastic body 216 comprises an electrically conductive track 232. A electrical connector 234 is mounted to the electrically conductive track 232, for example at an end therof. The electrical connector 234 may be arranged to connect the electrically conductive track 232 to an electrical component, e.g. any of the electrical components discussed above. The electrical connector 234 may thus facilitate the connection of an electrical component to the electrically conductive track 232. The electrical component may comprise a corresponding electrical connector configured to mate with the electrical connector 234. In some embodiments, at least one of the electrical tracks may comprise an electrical connector. The presence of an electrical connector may improve the ease of installation of electrical components into the aerosol provision device 4. The presence of such an electrical connector 234 may also make it possible to remove and replace electrical components with the device 4 more easily.

[0060] The electrical connector 234 may have any suitable form. In some embodiments, the electrical connector 234 comprises at least one connector pin 236, e.g. two connector pins 236, which provide an electrical connection to an electrical component attached thereto.

[0061] Figure 4 is a flow chart depicting a method of forming a component for use in an aerosol provision device in accordance with an embodiment of the present invention. The method will be described with reference to the plastic body 116 shown in Figure 2, although it should be appreciated that the method may be used to form any suitable component having any suitable form for use in an aerosol provision device. In step S1, the method comprises forming a plastic body, e.g. a plastic body 116 as described above. The step S1 of forming the plastic body may comprise forming a plastic body having a three-dimensional shape with support features for mounting electrical components to the plastic body. The support features may, for example, comprise the supports 130A-130D shown in Figure 2. The three-dimensional shape may be any shape which is non-planar.

[0062] Step S1 of forming the plastic body 116 may comprise forming a plastic body 116 from a material which comprises an additive comprising a metallic inorganic compound which is configured to activated by a laser.

[0063] In step S2, the method comprises irradiating a track, e.g. at least one of tracks 132A-132D, on the plastic body 116 using a laser. Any appropriate laser, e.g. an infrared laser, may be used.

[0064] In step S3, the method comprises plating the irradiated track with an electrically conductive material, e.g. an electrically conductive metal. Step S3 may comprise plating the track with an electrically conductive material multiple times.

[0065] At least method step S2 and step S3 may be performed multiple times to form multiple electrically conductive tracks.

[0066] The above method of forming a component may advantageously form a component, for use in an aerosol provision device, comprising at least one electrically conductive track that can provide an electrical connection between various electrical components within the device. This method of forming the component may form part of a larger method of manufacturing/assembling of the device. Through formation of the component according to this method, further manufacturing/assembly steps, for example those related to the production and arrangement of electrical cables for use in the device may be minimised or even omitted entirely. This may, therefore, make the manufacture/assembly process more efficient.

[0067] 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 provision device comprising:

   a plurality of electrical components; and
   a plastic body comprising at least one electrically conductive track configured to provide an electrical connection between at least two of the plurality of electrical components, wherein the at least one electrically conductive track is formed by laser direct structuring.

2. An aerosol provision device according to any preceding claim, wherein the plastic body is configured to support at least one of the plurality of electrical components.

3. An aerosol provision device according to any preceding claim, wherein the plastic body is configured to house at least one of the plurality of electrical components.

4. An aerosol provision device according to any preceding claim, wherein the device comprises a housing, and wherein the plastic body is contained within, or at least partially defines, the housing.

5. An aerosol provision device according to any preceding claim, wherein the plastic body is formed from modified polyether ether ketone (PEEK).

6. An aerosol provision device according to any preceding claim, wherein the plurality of electrical components comprise at least one of: an electrical power source (e.g. a battery), a heating arrangement, a temperature sensor, a controller, a light source, a haptic device, and a speaker.

7. An aerosol provision device according to any preceding claim, comprising at least one electrical connector arranged to connect the electrically conductive track to at least one of the electrical components.

8. An aerosol provision device according to any preceding claim, wherein the at least one electrically conductive track comprises a plurality of electrically conductive tracks.

9. An aerosol provision device according to any preceding claim, wherein the plastic body is made from a plastic material capable of resisting temperatures of at least 200 °C, e.g. at least 220 °C, e.g. at least 250 °C for a sustained period of time.

10. An aerosol provision device according to any preceding claim, wherein the at least one electrically conductive track extends in multiple different planes.

11. An aerosol provision system comprising:

    an aerosol provision device according to any preceding claim; and
    an article comprising an aerosol generating material.

12. A method of forming a component for use in an aerosol provision device, the method comprising:

    forming a plastic body;
    irradiating a track on the plastic body using a laser;
    plating the irradiated track with an electrically conductive material.

13. A method according to claim 12, wherein the step of plating the irradiated track with an electrically conductive material comprises plating the track with an electrically conductive material multiple times.

14. A method according to claim 12 or 13, wherein the step of forming the plastic body comprises forming a plastic body having a three-dimensional shape with support features for mounting electrical components to the plastic body.

15. A method according to claim any of claims 12 to 14, wherein the step of forming the plastic body comprises forming a plastic body from a material which comprises an additive comprising a metallic inorganic compound which is configured to activated by the laser.

Fig. 1

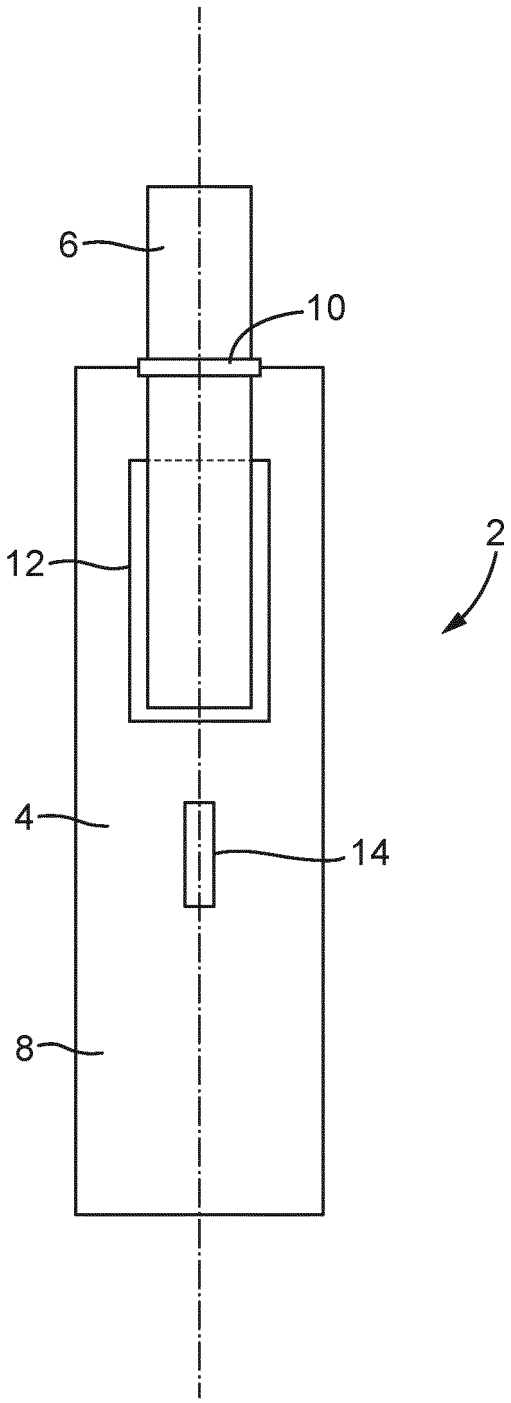


Fig. 2

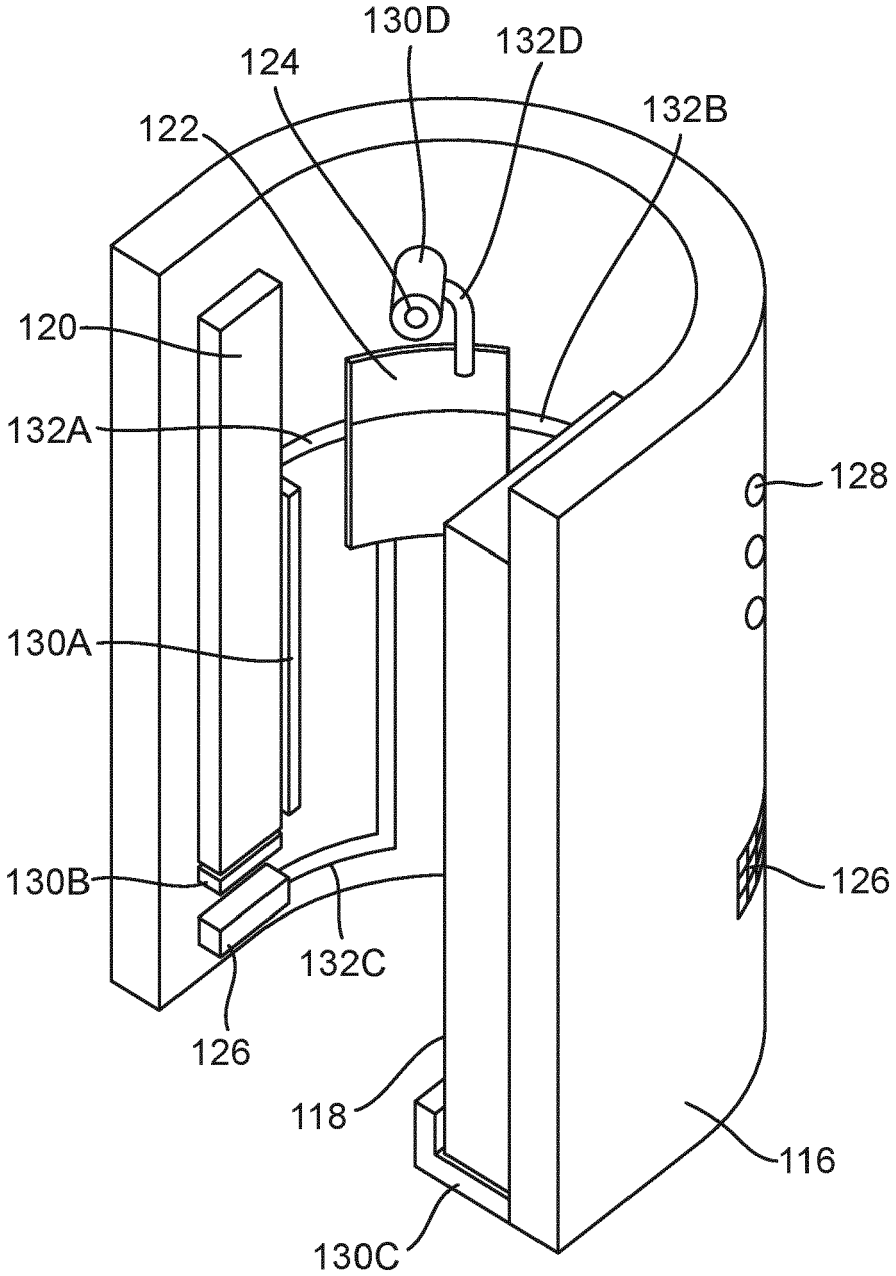

130D
132D
124
122
132B
120
132A
128
130A
130B
126
132C
126
118
116
130C

Fig. 3

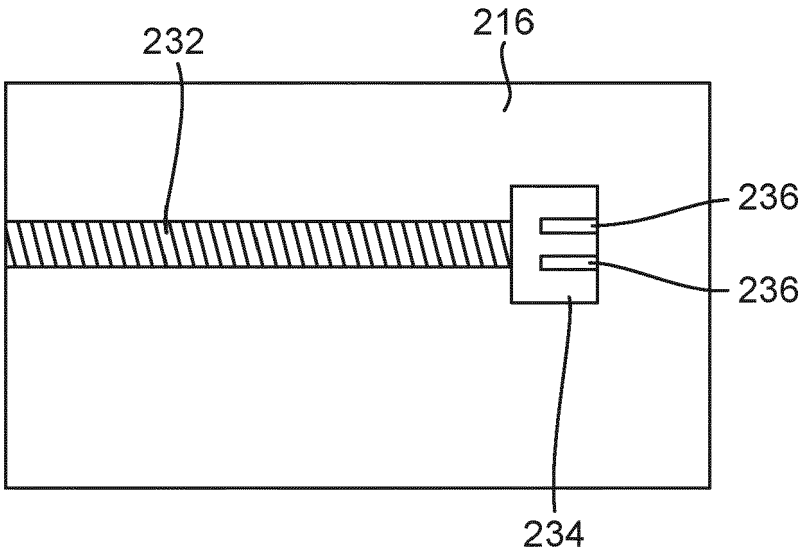
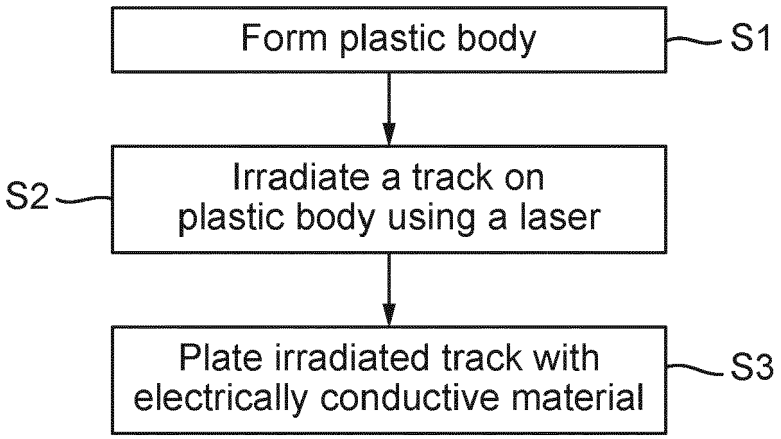

232
216
236
236
234

Fig. 4


Form plastic body
S1
Irradiate a track on plastic body using a laser
S2
Plate irradiated track with electrically conductive material
S3

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 24 15 7458

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	WO 2022/198515 A1 (SHENZHEN SMOORE TECHNOLOGY LTD [CN]) 29 September 2022 (2022-09-29)	1-15	INV. A24F40/70 C23C18/16
Y	* paragraph [0051] - paragraph [0063]; figure 7 * & US 2024/008556 A1 (XU WENXIAO [CN] ET AL) 11 January 2024 (2024-01-11) * paragraph [0050] - paragraph [0062]; figure 7 *	15	C23C18/20 ADD. C25D5/02 C25D5/56 A24F40/40 A24F40/20
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Place of search	Date of completion of the search	Examiner
Munich	26 July 2024	Koob, Michael

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