(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 April 2019 (18.04.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/073237 A1

(51) International Patent Classification:
A24F 1/00 (2006.01) *A61M 11/04* (2006.01)
A61M 15/06 (2006.01)

(21) International Application Number:
PCT/GB2018/052910

(22) International Filing Date:
11 October 2018 (11.10.2018)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1716735.4 12 October 2017 (12.10.2017) GB

(71) Applicant: **BRITISH AMERICAN TOBACCO (INVESTMENTS) LIMITED** [GB/GB]; Globe House, 1 Water Street, London WC2R 3LA (GB).

(72) Inventors: **HEPWORTH, Richard**; c/o British American Tobacco (Investments) Limited, Globe House, 1 Water Street, London WC2R 3LA (GB). **MOLONEY, Patrick**; c/o British American Tobacco (Investments) Limited, Globe House, 1 Water Street, London WC2R 3LA (GB). **DICKENS, Colin**; c/o British American Tobacco (Investments) Limited, Globe House, 1 Water Street, London WC2R 3LA (GB).

(74) Agent: **LEWIS, Darren**; D Young & Co LLP, 120 Holborn, London EC1N 2DY (GB).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,

(54) Title: AEROSOL PROVISION SYSTEMS

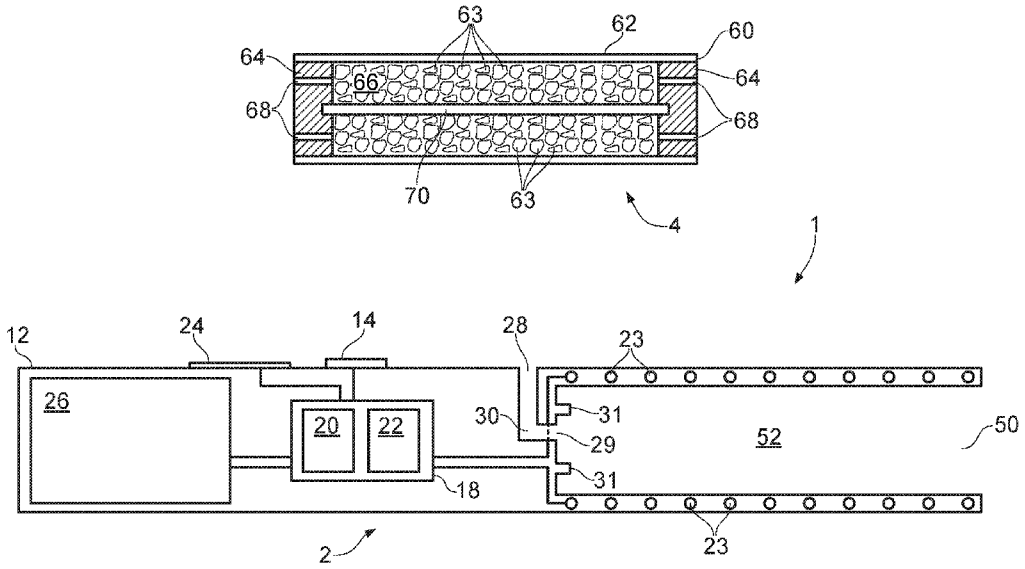

FIG. 1

(57) Abstract: A consumable component for an aerosol provision system comprising: an outer housing comprising an outer wall extending between first and second end walls to define an interior chamber; a plurality of elements of solid aerosol forming material for generating an aerosol for user inhalation, wherein the plurality of elements of solid aerosol forming material are retained within the interior chamber by the housing and wherein the first and second end walls comprise openings to allow air to flow into the interior chamber through the first end wall and out of the interior chamber through the second end wall during use, and a heater located within the interior chamber and configured to heat the elements of solid aerosol forming material during use to generate a vapour for user inhalation.

WO 2019/073237 A1

[Continued on next page]

OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

AEROSOL PROVISION SYSTEMS

Field

The present disclosure relates to aerosol provision systems such as nicotine delivery systems (e.g. electronic cigarettes and the like).

Background

Electronic aerosol provision systems such as electronic cigarettes (e-cigarettes) generally contain an aerosol precursor material, such as a reservoir of a source liquid containing a formulation, typically including nicotine, or a solid material such a tobacco-based product, from which an aerosol is generated for inhalation by a user, for example through heat vaporisation. Thus, an aerosol provision system will typically comprise a heater arranged to vaporise a portion of aerosol precursor material to generate a vapour / aerosol in a flow path extending through the electronic aerosol provision system from an air inlet to an aerosol outlet. As a user inhales on the aerosol outlet and electrical power is supplied to the vaporiser, air is drawn in through the air inlet, along the flow path where the air mixes with vaporised precursor material and forms a condensation aerosol, and continues along the flow path to the aerosol outlet, carrying the condensation aerosol with it, from where it may be inhaled by the user.

Summary

According to a first aspect of certain embodiments there is provided a consumable component for an aerosol provision system comprising: an outer housing comprising an outer wall extending between first and second end walls to define an interior chamber; a plurality of elements of solid aerosol forming material for generating an aerosol for user inhalation when heated, wherein the plurality of elements of solid aerosol forming material are retained within the interior chamber by the housing and wherein the first and second end walls comprise openings to allow air to flow into the interior chamber through the first end wall and out of the interior chamber through the second end wall during use, and a heater located within the interior chamber and configured to heat the elements of solid aerosol forming material during use to generate a vapour for user inhalation.

According to another aspect of certain embodiments there is provided an aerosol provision system for generating a vapour using a consumable component, wherein the consumable component comprises an outer housing comprising an outer wall extending between first and second end walls to define an interior chamber; a plurality of elements of solid aerosol forming material for generating an aerosol for user inhalation when heated, wherein the plurality of elements of solid aerosol forming material are retained within the interior chamber

by the housing and wherein the first and second end walls comprise openings to allow air to flow into the interior chamber through the first end wall and out of the interior chamber through the second end wall during use, and a heater located within the interior chamber and configured to heat the elements of solid aerosol forming material during use to generate a vapour for user inhalation, and the wherein the aerosol provision system comprises: the consumable component; a consumable component receiving section for removably receiving the consumable component for use; and a power source for selectively supplying power to the heater in the consumable component to generate vapour from the solid aerosol forming material for user inhalation.

According to another aspect of certain embodiments there is provided consumable component means for an aerosol provision system comprising: outer housing means comprising outer wall means extending between first and second end wall means to define an interior chamber; a plurality of elements of solid aerosol forming means for generating an aerosol for user inhalation when heated, wherein the plurality of elements of solid aerosol forming means are retained within the interior chamber by the housing means and wherein the first and second end wall means comprise opening means to allow air to flow into the interior chamber through the first end wall means and out of the interior chamber through the second end wall means during use, and heater means located within the interior chamber and configured to heat the elements of solid aerosol forming means during use to generate a vapour for user inhalation.

It will be appreciated that features and aspects of the invention described above in relation to the first and other aspects of the invention are equally applicable to, and may be combined with, embodiments of the invention according to other aspects of the invention as appropriate, and not just in the specific combinations described above.

Brief Description of the Drawings

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

Figure 1 schematically represents an aerosol provision system comprising a device part and a consumable component in accordance with certain embodiments of the disclosure;

Figure 2 schematically represents an aerosol provision system comprising a device part and a consumable component in accordance with certain other embodiments of the disclosure;

Figure 3 schematically represents a consumable component in accordance with certain embodiments of the disclosure;

Figures 4 and 5 schematically represent end walls for a consumable component in accordance with certain embodiments of the disclosure;

Figures 6 and 7 schematically represent consumable components in accordance with certain embodiments of the disclosure;

Figure 8 schematically represent heaters for consumable components in accordance with certain embodiments of the disclosure;

Figure 9 schematically represents a receiving section / zone portion of a device part and a consumable component in accordance with certain embodiments of the disclosure; and

Figures 10 and 11 schematically represent consumable components in accordance with certain embodiments of the disclosure.

Detailed Description

Aspects and features of certain examples and embodiments are discussed / described herein. Some aspects and features of certain examples and embodiments may be implemented conventionally and these are not discussed / described in detail in the interests of brevity. It will thus be appreciated that aspects and features of apparatus and methods discussed herein which are not described in detail may be implemented in accordance with any conventional techniques for implementing such aspects and features.

The present disclosure relates to vapour provision systems, which may also be referred to as aerosol provision systems, such as e-cigarettes. Throughout the following description the term “e-cigarette” or “electronic cigarette” may sometimes be used; however, it will be appreciated this term may be used interchangeably with vapour (aerosol) provision system and electronic vapour (aerosol) provision system. Furthermore, and as is common in the technical field, the terms "vapour" and "aerosol", and related terms such as "vaporise" and "aerosolise", may also be used interchangeably.

Aerosol provision systems in accordance with certain embodiment of the disclosure may comprise a modular assembly including both a reusable part and a replaceable cartridge part, which may also be referred to as a consumable component of the system. For modular systems that use a liquid aerosol precursor material, the reusable device part will typically comprise the power supply and control circuitry. The consumable component (i.e. the replaceable / disposable part) may typically comprise the vapour precursor material and the vaporiser (e.g. often a heating coil wound around a wick). For modular systems that use a solid aerosol precursor material, the reusable device part mau typically comprise the power supply, control circuitry and vaporiser (e.g. a heating oven) and the consumable component will typically comprise the vapour precursor material.

Figure 1 is a cross-sectional view through an example e-cigarette 1 in accordance with certain embodiments of the disclosure. The e-cigarette 1 comprises two main components, namely a reusable (device) part 2 and a consumable component 4. The consumable component may also be referred to as a replaceable / disposable cartridge part. The reusable part 2 and the consumable component 4 are shown separately in Figure 1, but in normal use the consumable component 4 is placed in a consumable component receiving zone 52 of the reusable part 2. The consumable component receiving zone 52 is in effect an opening / receptacle which is dimensioned to receive the consumable component for use. The consumable component may be retained in the consumable component receiving zone by a friction fit or other means, such as a releasable latch or clip, so that it can be withdrawn from the reusable part and replaced with another when it is exhausted or the user wishes to change to a different consumable component, for example to change flavour. The specific manner in which the consumable component is retained in the reusable part during use is not of primary significance to the principles described herein.

The reusable part 2 in this example comprises a battery 26 for providing operating power for the electronic cigarette, control circuitry 18 for controlling and monitoring the operation of the electronic cigarette, a user input button 14 and a visual display 24.

The outer housing 12 may be formed, for example, from a plastics or metallic material and in this example has a generally circular cross section with a diameter of around 1.5 cm and a length of around 12 cm. However, it will be appreciated the overall shape and scale of electronic cigarettes according to different embodiments of the disclosure are not of primary significance to the principles described herein. For example, in some implementations the electronic cigarette may have a significantly larger size, for example to accommodate a larger battery to provide for longer use between charges.

The outer housing 12 defines an opening 50 for the consumable component receiving zone 52 at one end of the electronic cigarette 1 through which the consumable component 4 may be inserted into the consumable component receiving zone for use. In this example the receiving zone 52 has a diameter of around 1 cm and a length of around 4 cm (i.e. the outer housing defines a wall around the consumable component receiving zone having a thickness of around 2.5 mm). The opening 50 at the end of the electronic cigarette 1 may be referred to as a mouthpiece opening, and it is through this mouthpiece opening 50 that aerosol generated by the electronic cigarette 1 during use is inhaled by a user. In some examples the electronic cigarette 1 may further comprise an additional mouthpiece cap which is fitted to the mouthpiece opening end of the electronic cigarette and which tapers to a profile for comfortable placement between a user's lips.

The outer housing 12 has an air inlet 28 connected to an air path 30 through the reusable part 2. The air path 30 opens to the consumable component receiving zone at a consumable component receiving zone air inlet 29. Thus, when a user inhales on the mouthpiece opening 50 (or a mouthpiece attached thereto), air is drawn in through the air inlet 28, along the reusable part air path 30, through the consumable component receiving zone inlet 29 and into the consumable component receiving zone 52. The air continues through the consumable component receiving zone 52 (and more particularly through a consumable component located in the consumable component receiving zone 52 during use) and out through the mouthpiece opening 50 for user inhalation. A surface of consumable component receiving zone around the consumable component receiving zone air inlet 29 includes spacers 31 (e.g. in the form of moulded projections) to ensure the consumable component remains offset from the receiving zone air inlet 29 when located in the consumable component receiving zone 52 to avoid it blocking the receiving zone air inlet 29. Other configurations may not include such spacers 31, but may include other means to avoid blocking the consumable component receiving zone air inlet 29, the example air inlets for the consumable component may be arranged to align with the consumable component receiving zone air inlet when the consumable component is located in the consumable component receiving zone.

The battery 26 in this example is rechargeable and may be of a conventional type, for example of the kind normally used in electronic cigarettes and other applications requiring provision of relatively high currents over relatively short periods. The battery 26 may be recharged through a charging connector in the reusable part housing 12, for example a USB connector.

The user input button 14 in this example is a conventional mechanical button, for example comprising a sprung mounted component which may be pressed by a user to establish an electrical contact. However, the specific manner in which the button is implemented is not significant. For example, other forms of mechanical button(s) or touch-sensitive button(s) (e.g. based on capacitive or optical sensing techniques) may be used in other implementations.

The display 24 is provided to give a user a visual indication of various characteristics associated with the electronic cigarette, for example current power setting information, remaining battery power, and so forth. The display may be implemented in various ways. In this example the display 24 comprises a conventional pixilated LCD screen that may be driven to display the desired information in accordance with conventional techniques. In other implementations the display may comprise one or more discrete indicators, for example LEDs, that are arranged to display the desired information, for example through

particular colours and / or flash sequences. More generally, the manner in which the display is provided and information is displayed to a user using the display is not significant to the principles described herein. For example some embodiment may not include a visual display and may include other means for providing a user with information relating to operating characteristics of the electronic cigarette, for example using audio signalling, or may not include any means for providing a user with information relating to operating characteristics of the electronic cigarette.

The control circuitry 18 is suitably configured / programmed to control the operation of the electronic cigarette to provide functionality in accordance with embodiments of the disclosure as described further herein, as well as for providing conventional operating functions of the electronic cigarette in line with the established techniques for controlling such devices. The control circuitry (processor circuitry) 18 may be considered to logically comprise various sub-units / circuitry elements associated with different aspects of the electronic cigarette's operation. In this example the control circuitry 18 comprises power supply control circuitry 22 for controlling a supply of power to a consumable component for vapour generation as discussed further herein in response to user input (e.g. using input button 14 or other means, such as an inhalation detector), user programming circuitry 20 for establishing configuration settings (e.g. user-defined power settings) in response to user input (e.g. using input button 14 or other means, such as a connected computer), as well as other functional units / circuitry associated functionality in accordance with the principles described herein and conventional operating aspects of electronic cigarettes, such as display driving circuitry and user input detection circuitry. It will be appreciated the functionality of the control circuitry 18 can be provided in various different ways, for example using one or more suitably programmed programmable computer(s) and / or one or more suitably configured application-specific integrated circuit(s) / circuitry / chip(s) / chipset(s) configured to provide the desired functionality.

For the example implementation represented in Figure 1, power is supplied to the consumable component for vapour generation using electromagnetic induction. Accordingly, the power supply control circuitry 22 is configured to drive an induction heating coil 23 surrounding the consumable component receiving zone 52.

Turning now to the consumable component 4 represented in Figure 1, this comprises an outer housing 60 comprising an outer wall 62 extending between first and second end walls 64 to define an interior chamber 66. The consumable component 4 is dimensioned so that it may be received with a friction fit in the receiving zone 52 of the reusable part 1. Thus in this example the consumable component 4 is generally cylindrical with a diameter of around 1 cm (corresponding to the 1 cm diameter of the receiving zone) and a length of around 4 cm.

In some examples the consumable component may be slightly longer than the receiving zone so that an end of the consumable component protrudes from the consumable component receiving zone to facilitate its removal from the receiving zone. In other examples the consumable component may have a sufficiently loose friction fit in the receiving zone that it may be shaken free for removal. In yet other examples there may be different arrangements provided to facilitate removal of the consumable component from the receiving zone. For example, in some cases a slider or plunger based ejection mechanism may be provided which engages with the consumable component when located in the receiving zone 52 so that it may be mechanically ejected. More generally, the specific manner in which the consumable component is inserted into and removed from the receiving zone is not of primary significance to the principles described herein.

The outer wall 62 and / or the end walls 64 of the outer housing 60 may be at least partially formed from any one of a paper material, a card material, a tobacco material (for example a compressed tobacco industry by-product such as compressed tobacco fibres, tobacco stems or tobacco particles), a ceramic material, a metallic material, a carbon material, and a plastics material, or a combination thereof. In the example of Figure 1, it is assumed the outer wall 62 is formed from wrapped paper and the end walls 64 are formed from a ceramic material. The outer wall 62 defines a cylinder and the end wall 64 comprise friction fit plugs inserted into respective ends of the cylinder defined by the outer wall 62. The end walls may, for example, have a diameter corresponding to the diameter of the outer wall 62 and have a thickness on of around 3 mm to 5 mm or so. The end walls 64 further comprise openings 68 through which air can enter and exit the inner chamber 66.

The interior chamber 66 of the consumable component 4 contains a plurality of fragments (e.g. granules) of solid aerosol forming material 63 for generating an aerosol for user inhalation when heated. In this example the fragments / elements of solid aerosol forming material comprise an absorbent solid substrate material, e.g. calcium carbonate or carbon, holding a liquid aerosol precursor material, for example a liquid of the kind conventionally used for vapour generation in electronic cigarettes, e.g. a liquid based on glycerol (polypropylene glycol (PG), triacetin, and / or other humectants) and containing additives such as nicotine and / or flavourings. In some examples the fragments of solid aerosol forming material may comprise tobacco, for example shredded / cut tobacco, with or without a liquid aerosol precursor material absorbed therein. The fragments of solid aerosol forming material may, for example, have an average characteristics dimension of at least 1 mm and less than 5 mm, 4 mm or 3 mm. The average characteristics dimension may, for example, be a minimum dimension or a mean dimension for each fragment. The fragments of solid aerosol forming material may be loosely packed in the interior chamber of the consumable

component so that gaps remain between the fragments to allow air to be drawn through the consumable component during use. The fragments of the aerosol forming material may have various shapes, for example, they may be irregular (e.g. formed by crushing / grinding a larger block of material or cutting tobacco leaf) or regular, for example formed by extrusion of a suitable material. The fragments of solid aerosol forming material are retained in the interior chamber by the outer wall 62 and the end walls 64. In this regard the openings 68 in the end walls 64 through which air can enter and exit the inner chamber 66 may have a size selected to reduce the likelihood of fragments of the solid aerosol forming material escaping the interior chamber 66. For example, the openings 68 in the end walls 64 may have a characteristic width that is comparable to, or less than, the characteristic average smallest dimension of the fragments of solid aerosol forming material. In some examples a binder may be used to help prevent settling of the fragments within the consumable component.

Also located within the interior chamber 66 of the consumable component 4 is a heater 70 which is arranged to heat the solid aerosol forming material when supplied with power from the reusable part 2 so as to generate a vapour for user inhalation during use. As noted above, in the example of Figure 1, power is supplied to the consumable component by electromagnetic induction. Thus, the heater 70 in the consumable component 4 comprises a material which is susceptible to electromagnetic induction, for example comprising a ferritic or martensitic steel. In this example the heater 70 is in the form of a solid rod having a diameter of around 2 mm. The heater 70 in this example is supported within the chamber 66 by its ends being located in recesses in the respective end walls, as schematically represented in Figure 1. In other examples, the heater 70 may be mounted differently. For example the heater may be provided with one or more mounting collars which extends from the heater to the inner surface of the outer wall 62. In yet other examples, the heater may not be mounted to the outer housing at all, but may simply be held in place by the fragments of solid vapour precursor material packed around it.

To use the electronic cigarette 1 a user inserts the consumable component 4 into the consumable component receiving zone 52 through the mouthpiece opening 50. If provided, a mouthpiece cap may then be added to the mouthpiece opening end of the electronic cigarette 1. When the electronic cigarette is turned on and a user presses the input button 14, the controller circuitry 18, and in particular the power supply control circuitry 22, is configured to supply electrical power to the inductive heating coil 23 surrounding the consumable component 4 in the consumable component receiving zone 52. Electromagnetic energy is thus transferred from the heating coil 23 to the heater 70 in accordance with conventional electromagnetic heating techniques. The inductive heating coil 23 in this example comprises a helical coil wound extending along a portion of the receiving zone that

surrounds the heater 70 (which in the example of Figure 1 is most of the length of the receiving zone 52). Thus, when the consumable component 4 is received in the receiving zone 52 and the inductive heating coil 23 is driven to induce current in the heater 70, the heater is heated. The operating characteristics of the inductive heating coil 23, for example in terms of the number of turns, current and frequency of operation, may be selected having regard to the well understood principles of inductive heating taking account of the particular heater geometry adopted in a given implementation. In this regard, the inductive heater coil may, for example, be designed so as to heat the heater in the consumable component to a temperature of around 200° on a timescale on the order of a few seconds.

Heat from the heater is transferred to the solid aerosol forming material within the chamber 66 so as to vaporise a portion of the liquid aerosol precursor material absorbed therein to generate a vapour for user inhalation. As the vapour is generated in the consumable component, a user inhales on the mouthpiece opening 50 (or mouth piece attached to the mouthpiece opening). Air is thus drawn in through the air inlet 28, along the air path 30 and into the receiving zone through the receiving zone air inlet. The air then enters the consumable component 4 through the openings 68 in the end wall 64 adjacent the base of the receiving zone 52. The air then passes through the interior chamber 66 of the consumable component 4 by passing through the gaps between the fragments of solid aerosol precursor material. As the air passes through the interior chamber 66 it collects vapour generated by heating the solid aerosol precursor material as discussed above. The combined vapour and air forms a condensation aerosol which is drawn out through the openings 68 in the end wall 64 at the mouthpiece opening end of the receiving zone for subsequent user inhalation.

Thus, the electronic cigarette 1 represented in Figure 1 may be used to generate vapour for user inhalation with a consumable component that is simpler to manufacture than liquid-based cartridges for electronic cigarettes and less prone to leakage, but which is also self-contained and simple and clean to handle and replace, and which can generate vapour more rapidly than a conventional electronic cigarette having a solid aerosol precursor material.

While the example electronic cigarette represented in Figure 1 uses electromagnetic induction to heat the heater 70 in the consumable component 4, it will be appreciated that other implementations may adopt other approaches for heating.

Figure 2 is a cross-sectional view through an example e-cigarette 201 in accordance with certain embodiments of the disclosure. As with the electronic cigarette 1 represented in Figure 1, the electronic cigarette 201 represented in Figure 2 comprises two main

components, namely a reusable part 202 and a consumable component 204. The electronic cigarette 201 represented in Figure 2 is a variation on the electronic cigarette 1 represented in Figure 1. Elements of the electronic cigarette 201 represented in Figure 2 which are functionally similar to, and will be understood from, corresponding elements of the electronic cigarette 1 represented in Figure 1 are identified with corresponding reference numerals and are not discussed again in the interests of brevity. However, the electronic cigarette 201 represented in Figure 2 differs from the electronic cigarette 1 represented in Figure 1 in that it does not use electromagnetic induction to transfer power from the reusable part to the consumable part, but rather uses electrical current supplied to the consumable component through direct electrical contact.

Thus, the consumable component 204 comprises a resistance heater 71 instead of an inductive heater 70 of the kind represented in Figure 1. The heater 71 may, for example, have an overall resistance on the order of 1 or 2 Ohms and be formed from a conventional heating resistance material. The specific form of the heater may be chosen to provide the desired resistance. For example, depending on the resistivity of the material used, the heater 71 may comprise a solid rod similar to the inductive reheated heater 70 in the consumable component 4 represented in Figure 1, or may comprise a wire wound around an electrically insulating substrate. Respective ends of the heater 71 are connected by electrical leads 77, 79 to respective ones of a pair of electrodes 76, 78 mounted on one of the end walls 64. When the consumable component 204 is located in the receiving zone 52 in the reusable part 202 of the electronic cigarette 201, the electrodes 76, 78 on the consumable component align with, and contact, corresponding electrodes 72 and 74 in the receiving zone.

To use the electronic cigarette 201 a user inserts the consumable component 204 into the consumable component receiving zone 52 through the mouthpiece opening 50. If provided, a mouthpiece cap may then be added to the mouthpiece opening end of the electronic cigarette 201. When the electronic cigarette is turned on and ready for use, the user presses the input button 14 and the controller circuitry 18, and in particular the power supply control circuitry 22, is configured to supply electrical power to the heater 71 via the electrodes 72, 74 in the receiving zone and the electrodes 76, 78 on the consumables component 204. Thus, when the consumable component 4 is received in the receiving zone 52 and power is supplied to the heater by the power supply control circuitry via the respective electrodes and connecting leads, the heater is heated. The operating characteristics of the power supplied, for example in terms of voltage and any pulse width / frequency modulation scheme applied, may be selected having regard to the well understood principles of resistance heating in electronic cigarettes. In this regard, the power supply control circuitry may, for example, be

designed so as to supply power (current) to the heater so as to heat the heater to a temperature of around 200° on a timescale on the order of a second.

Heat from the heater 71 is transferred to the solid aerosol forming material within the chamber 66 so as to vaporise a portion of the liquid aerosol precursor material absorbed therein to generate a vapour for user inhalation in the same manner as discussed above for the electronic cigarette 1 represented in Figure 1.

Figure 3 is a schematic perspective view of the consumable component 4 for the electronic cigarette 1 represented in Figure 1 in a partially disassembled state. From this it can be seen in this example the fragments of solid aerosol precursor material 63 are fairly regular in shape and each have a generally cylindrical form with a length of around 2 mm and a diameter of around 1 mm. These may be formed, for example, by extrusion, i.e. by cutting lengths from an extruded cylinder. As noted above, other forms of solid aerosol precursor material may be used, such as irregular fragments or regular fragments of other shapes, for example spherical shapes, and, furthermore may in other examples comprise cut / shredded tobacco or other sheet material, such as paper.

Figures 4A to 4C are respective cross-section, face and perspective views of an end wall 64 of the kind used in the consumable components 4, 204 of the electronic cigarettes 1, 201 represented in Figures 1 and 2. As noted above, the end wall comprises a ceramic material and may be formed in accordance with conventional techniques. The end wall in this example comprises six openings 68 arranged around a circle around halfway between the centre and the edge of the end wall 64. However, in some example implementations the openings in an end wall may be more tightly packed around a location in the end wall where the heater is mounted, i.e. in this example the central part of the end wall. This can help reduce thermal conduction between the heater and the outer parts of the end wall / outer housing of the consumable component. Also apparent in Figure 4A is a recess 67 dimensions to receive an end of the heater 70, 71 as discussed above.

Figures 4D to 4G are cross-section views representing variations of the end wall 64 shown in Figures 4A to 4C in accordance with various embodiments of the disclosure. In the example of Figure 4D, the end wall 64 is provided with a chamfer 85 to facilitate insertion into the outer housing 62 during assembly. In the example of Figure 4E, the end wall 64 is provided with a chamfer 85 to facilitate insertion into the outer housing 62 during assembly and a flange / lip 87 arranged to abut the end of the outer housing 62 when the end wall 64 is properly inserted. The example of Figure 4F shows in more detail how an end of the heater 70, 71 may be received in a recess 67 of the end wall 64 to provide physical support for the heater 70, 71. Figure 4G shows an example in which the end wall 64 is provided with a

protruding boss 67, rather than a recess 67, to support a heater 73, which in this example comprises a tubular portion into which the protruding boss 69 is inserted to support the heater 73. It will, of course, be appreciated that different aspects of the different examples represented in figure 4A to 4G may be combined with other aspects of these examples, for example, an end wall of the kind represented in Figure 4G may be provided with a chamfer 85 and / or a flange 87 of the kind represented in Figure 4E and so forth.

Figures 5A to 5C schematically represent respective cross-section, face and perspective views of an alternative form of end wall 94 for use in a consumable component of the kind represented in Figures 1 and 2 in accordance with other examples of the disclosure. Whereas the end walls 64 discussed above with reference to Figures 1 to 4 are formed of a ceramic material, the end wall 94 represented in Figures 5A to 5C is formed from card and comprises a circular face 67 comprising openings 98 for allowing air into the consumable component and a sidewall portion 96 arranged to couple the end wall 98 to the outer housing 62 of the consumable component, e.g. by a friction fit. The end wall 98 may be coupled to the tubular outer wall 62 of a consumable component by being inserted, e.g. face first, in the manner of a plug, as schematically shown in the cross-section representation in Figure 5D, or may be placed over the tubular outer wall 62 of a consumable component in the manner of a cap, as schematically shown in the cross-section representation in Figure 5E. In either case the end wall may be retained by a friction fit, or other means, for example using an adhesive. The heater in a consumable component using an end wall of the kind represented in Figures 5A to 5C may be mounted to the end wall, for example by passing through an opening in the end wall, or might not be mounted to the end wall. For the examples represented in Figures 5A to 5E it is assumed the heater is not mounted to the end wall, and instead the end wall has an additional opening 98 towards the centre of the end face 97.

Figure 6 schematically represents in cross-section view a consumable component 304 which is a variation on that represented in Figure 1. Elements of the consumable component 304 represented in Figure 6 which are functionally similar to, and will be understood from, corresponding elements of the consumable component 4 represented in Figure 1 are identified with corresponding reference numerals and are not discussed again in the interests of brevity. However, the consumable component 304 represented in Figure 6 differs from the consumable component 4 represented in Figure 1 by having a secondary wall 600 arranged within the outer housing 62 so as to define an air gap 602 between the outer housing 62 and the secondary wall 600. The secondary wall 600 may be formed of the same, or a different, material to the outer housing 62. The fragments of solid aerosol precursor material 63 are retained by the secondary wall 600 and the end walls 64. The

presence of the air gap 602 can help prevent the outer wall 62 becoming undesirably hot during use in situations where this is considered a potential concern.

Figure 7 schematically represents in cross-section view a consumable component 404 which is another variation on that represented in Figure 1. Elements of the consumable component 404 represented in Figure 7 which are functionally similar to, and will be understood from, corresponding elements of the consumable component 4 represented in Figure 1 are identified with corresponding reference numerals and are not discussed again in the interests of brevity. The consumable component 404 represented in Figure 7 differs from the consumable component 4 represented in Figure 1 in that rather than contain a heater in the form of a central rod, the heater in the example of Figure 7 comprises a distributed arrangement of metallic bodies / particles 702 which are susceptible to electromagnetic induction heating. During use these metallic bodies / particles are heated by induced electromagnetic currents in a corresponding manner to that discussed above with reference to Figure 1. The distributed particles can provide for more distributed heating throughout the chamber containing the fragments of solid aerosol forming material.

Other forms of heater may be used in other implementations.

For example, Figure 8A schematically represents in perspective view a heater 801 having a generally planar form but with cylindrical endpoints for mounting. In some respects this may be considered to correspond to a flattened form of a rod of the kind discussed above with reference to Figures 1 and 2.

Figure 8B schematically represents in perspective view a heater 811 which has the form of a rod similar to the heater is 70, 71 discussed above with reference to Figures 1 and 2, but further comprises vanes 812 which are attached to the heater 811 and which extend out to the inner wall of the outer housing of a consumable component so as to support the heater 811 without mounting to the end walls.

Figure 8C schematically represents in perspective view a heater 821 having a generally tubular form. Such a heater may, for example, be mounted to an end wall in the manner represented in Figure 4G.

It will be appreciated the heaters represented in Figures 8A to 8C may be formed from materials similar to those discussed above for the heater is 70, 71 represented in Figures 1 and 2, i.e. from materials susceptible to magnetic induction / resistive heating according to the manner of energy transfer.

Figure 9 is a cross-sectional view through a part of an example e-cigarette 501 in accordance with certain embodiments of the disclosure. As with the electronic cigarette 1

represented in Figure 1, the electronic cigarette 502 represented in Figure 2 comprises two main components, namely a reusable part 502 and a consumable component 504. In Figure 9 only a portion of the reusable part 502 in the vicinity of its receiving zone is shown with the consumable component 504 in place for use (i.e. in the receiving zone). The electronic cigarette 501 represented in Figure 9 is a variation on the electronic cigarette 1 represented in Figure 1. Elements of the electronic cigarette 501 represented in Figure 9 which are functionally similar to, and will be understood from, corresponding elements of the electronic cigarette 1 represented in Figure 1 are identified with corresponding reference numerals and are not discussed again in the interests of brevity. However, the electronic cigarette 501 represented in Figure 9 differs from the electronic cigarette 1 represented in Figure 1 in that the interior chamber of the consumable component 504 is divided into two sections (zones) by a central wall 564. Each section of the interior chamber contains fragments/elements of solid aerosol precursor material and a respective heater 507, 508, such as those discussed above with reference to Figure 1. The central wall 564 may, for example, be formed in the same way as the end walls 64. The central wall 564 includes openings 568 to allow air to flow through the central wall during inhalation. The reusable part 502 comprises a first induction heating coil 523 and a second induction heating coil 524 which may be independently driven to induce electric currents, and so heat, respective ones of the heaters 507, 508. Thus the electronic cigarette 501 represented in Figure 9 differs from that represented in Figure 1 by virtue of having two separate chambers that may, for example, contain different aerosol precursor materials and which may be independently heated to generate vapour with different characteristics, for example different flavours and / or relative amount of nicotine. It will be appreciated in other example implementations there may be more than two separate chambers in a consumable component. Furthermore, the different chambers may in some implementations contain the same aerosol precursor materials and be provided so that different uses of the device can begin with a "fresh" portion of consumable material for each session of use. It will be appreciated that in some implementations there may be no walls dividing the different zones of aerosol forming material, and instead a single heater may run the length of the consumable component through multiple notional zones, with localised heating of the heater provided by suitably arranged induction coils which can be selectively activated at different locations along the length of the heater (for example as schematically shown did in Figure 9).

Figure 10 schematically represents in cross-section view a consumable component 604 for use in an electronic cigarette according to certain other embodiments of the disclosure. This consumable component may, for example, be used in conjunction with the reusable component of the electronic cigarette represent in Figure 1. The consumable component 604

represented in Figure 10 is in many respects similar to, and will be understood from, the other consumable components discussed above and elements of the consumable component 604 represented in Figure 10 which are functionally similar to, and will be understood from, corresponding elements of the other consumable components discussed herein are identified with corresponding reference numerals and are not discussed again in the interests of brevity. The consumable component 604 in Figure 10 differs from the consumable component 4 in Figure 1 in having a shorter heater 670 which is not mounted directed to the end walls 64, but is instead mounted via intervening thermal insulating elements, such as ceramic tubing, 671, 672. In this example configuration the thermal insulating elements are mounted on posts 677 protruding from the respective end walls. This arrangement can help reduce the amount of heat transferred to the end walls 64 in implementations where this is a concern.

Figure 11 schematically represents in cross-section view a consumable component 704 for use in an electronic cigarette according to certain other embodiments of the disclosure. This consumable component may, for example, be used in conjunction with the reusable component of the electronic cigarette represent in Figure 1. The consumable component 704 represented in Figure 11 is in many respects similar to, and will be understood from, the other consumable components discussed above and elements of the consumable component 704 represented in Figure 11 which are functionally similar to, and will be understood from, corresponding elements of the other consumable components discussed herein are identified with corresponding reference numerals and are not discussed again in the interests of brevity. The consumable component 704 in Figure 11 differs from the consumable component 4 in Figure 1 in having a shorter heater 770 which is mounted at only one end to one of the end walls 64. This arrangement can help reduce the amount of heat transferred to the other end wall, in implementations where this is considered a concern, for example if an end wall that protrudes from the electronic cigarette would be expected to become particularly hot during normal use if it were in contact with the heater.

Thus, a range of different arrangements of electronic cigarettes have been described. It will, however, be appreciated there are many modifications and variations that can be made to the above-described examples in other implementations. For example, whereas in the above-described examples the electronic cigarettes have comprised a button for manual activation of power supplied to the heater in the consumable component, other example implementations may include a puff detector, for example in the form of a pressure sensor coupled to an air path through the electronic cigarette, configured to trigger the supply of power to the heater automatically in response to user inhalation.

In other examples, an electronic cigarette in accordance with the principles described herein may additionally comprise a temperature sensor for monitoring the temperature of the heater. This may be used, for example, to allow the temperature of the heater to be regulated during use. The temperature sensor may, for example, be mounted in the consumable component itself, for example a thermistor, with appropriate connection to the reusable component, or the sensor may be remote from the consumable component. For example the temperature sensor may be an infrared radiation sensor arranged to detect heat from the consumable component.

In some examples, some of the functionality of the elements discussed above may be provided by a single element. For example, in one configuration a consumable component may be provided with a metallic outer housing which both retains the fragments of solid aerosol forming material and act as a heater (inductive or resistive).

In some example implementations the consumable component may comprise the only source of vapour precursor / forming material for the aerosol provision system / electronic cigarette. That is to say, in some cases the consumable component does not in effect correspond with an additional insert, for example for use as a flavour modifier in an electronic cigarette that also comprises a vaporiser for heating a liquid formulation, but is the main source of vapour for the electronic cigarette.

Thus, there has been described a consumable component for an aerosol provision system comprising: an outer housing comprising an outer wall extending between first and second end walls to define an interior chamber; a plurality of elements of solid aerosol forming material for generating an aerosol for user inhalation when heated, wherein the plurality of elements of solid aerosol forming material are retained within the interior chamber by the housing and wherein the first and second end walls comprise openings to allow air to flow into the interior chamber through the first end wall and out of the interior chamber through the second end wall during use, and a heater located within the interior chamber and configured to heat the elements of solid aerosol forming material during use to generate a vapour for user inhalation.

In order to address various issues and advance the art, this disclosure shows by way of illustration various embodiments in which the claimed invention(s) may be practiced. The advantages and features of the disclosure are of a representative sample of embodiments only, and are not exhaustive and / or exclusive. They are presented only to assist in understanding and to teach the claimed invention(s). It is to be understood that advantages, embodiments, examples, functions, features, structures, and / or other aspects of the disclosure are not to be considered limitations on the disclosure 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 claims. Various embodiments may suitably comprise, consist of, or consist essentially of, various combinations of the disclosed elements, components, features, parts, steps, means, etc. other than those specifically described herein, and it will thus be appreciated that features of the dependent claims may be combined with features of the independent claims in combinations other than those explicitly set out in the claims. The disclosure may include other inventions not presently claimed, but which may be claimed in future.

CLAIMS

1. A consumable component for an aerosol provision system comprising:

an outer housing comprising an outer wall extending between first and second end walls to define an interior chamber;

a plurality of elements of solid aerosol forming material for generating an aerosol for user inhalation, wherein the plurality of elements of solid aerosol forming material are retained within the interior chamber by the housing and wherein the first and second end walls comprise openings to allow air to flow into the interior chamber through the first end wall and out of the interior chamber through the second end wall during use, and

a heater located within the interior chamber and configured to heat the elements of solid aerosol forming material during use to generate a vapour for user inhalation.

2. The consumable component of claim 1, wherein the plurality of elements of solid aerosol forming material comprise elements of a solid substrate material holding a liquid aerosol precursor material.

3. The consumable component of claim 1 or 2, wherein the plurality of elements of solid aerosol forming material comprise tobacco.

4. The consumable component of claim any of claims 1 to 3, wherein the plurality of elements of solid aerosol forming material comprise calcium carbonate.

5. The consumable component of any of claims 1 to 4, wherein an average characteristic dimension for the plurality of elements of solid aerosol forming material is more than 1 mm.

6. The consumable component of any of claims 1 to 5, wherein an average characteristic dimension for the plurality of elements of solid aerosol forming material is less than 5 mm, 4 mm or 3 mm.

7. The consumable component of any of claims 1 to 6, wherein the heater comprises an inductive susceptor configured to be inductively heated.

8. The consumable component of any of claims 1 to 6, wherein the heater comprises a resistance heater, and wherein the consumable component further comprises electrical contacts on the outer housing electrically connected to the resistance heater.

9. The consumable component of any of claims 1 to 8, wherein at least a part of the heater has a planar form, a tubular form, or a rod-shaped form, and / or comprises a plurality of electrically conductive elements distributed through the plurality of elements of solid aerosol forming material.

10. The consumable component of any of claims 1 to 9, wherein the heater is mounted to at least one of the first and second end walls.

11. The consumable component of any of claims 1 to 10, wherein at least one of the first and second end walls comprises a cap fitted over an end of the outer wall or a plug fitted into an end of the outer wall.

12. The consumable component of any of claims 1 to 11, wherein at least a portion of the outer housing comprises at least one of: a paper material, a card material, a tobacco material, a ceramic material, a metallic material, a carbon material, and a plastics material.

13. The consumable component of any of claims 1 to 12, wherein the plurality of elements of solid aerosol forming material are arranged into zones within the consumable component and wherein the heater is configured to selectively independently heat elements of solid aerosol forming material in the different zones.

14. An aerosol provision system for generating a vapour using the consumable component of any of claims 1 to 13, the aerosol provision system comprising:

the consumable component;

a consumable component receiving section for removably receiving the consumable component for use; and

a power source for selectively supplying power to the heater in the consumable component to generate vapour from the solid aerosol forming material for user inhalation.

15. The aerosol provision system of claim 14, wherein the aerosol provision system further comprises electrical contacts for supplying power to the heater in the consumable component via corresponding electrical contacts on the housing of the consumable component.

16. The aerosol provision system of claim 14, wherein the aerosol provision system further comprises an induction heating coil for inductively supplying power to the heater.

17. The aerosol provision system of any of claims 14 to 16, wherein the aerosol provision system further comprises a sensor for measuring a temperature associated with the consumable component during use.

18. The aerosol provision system of any of claims 14 to 17, wherein the consumable component comprises the only source of vapour precursor material for the aerosol provision system.

19. Consumable component means for an aerosol provision system comprising:

outer housing means comprising outer wall means extending between first and second end wall means to define an interior chamber;

a plurality of elements of solid aerosol forming means for generating an aerosol for user inhalation, wherein the plurality of elements of solid aerosol forming means are retained within the interior chamber by the housing means and wherein the first and second end wall means comprise opening means to allow air to flow into the interior chamber through the first end wall means and out of the interior chamber through the second end wall means during use, and

heater means located within the interior chamber and configured to heat the elements of solid aerosol forming means during use to generate a vapour for user inhalation.

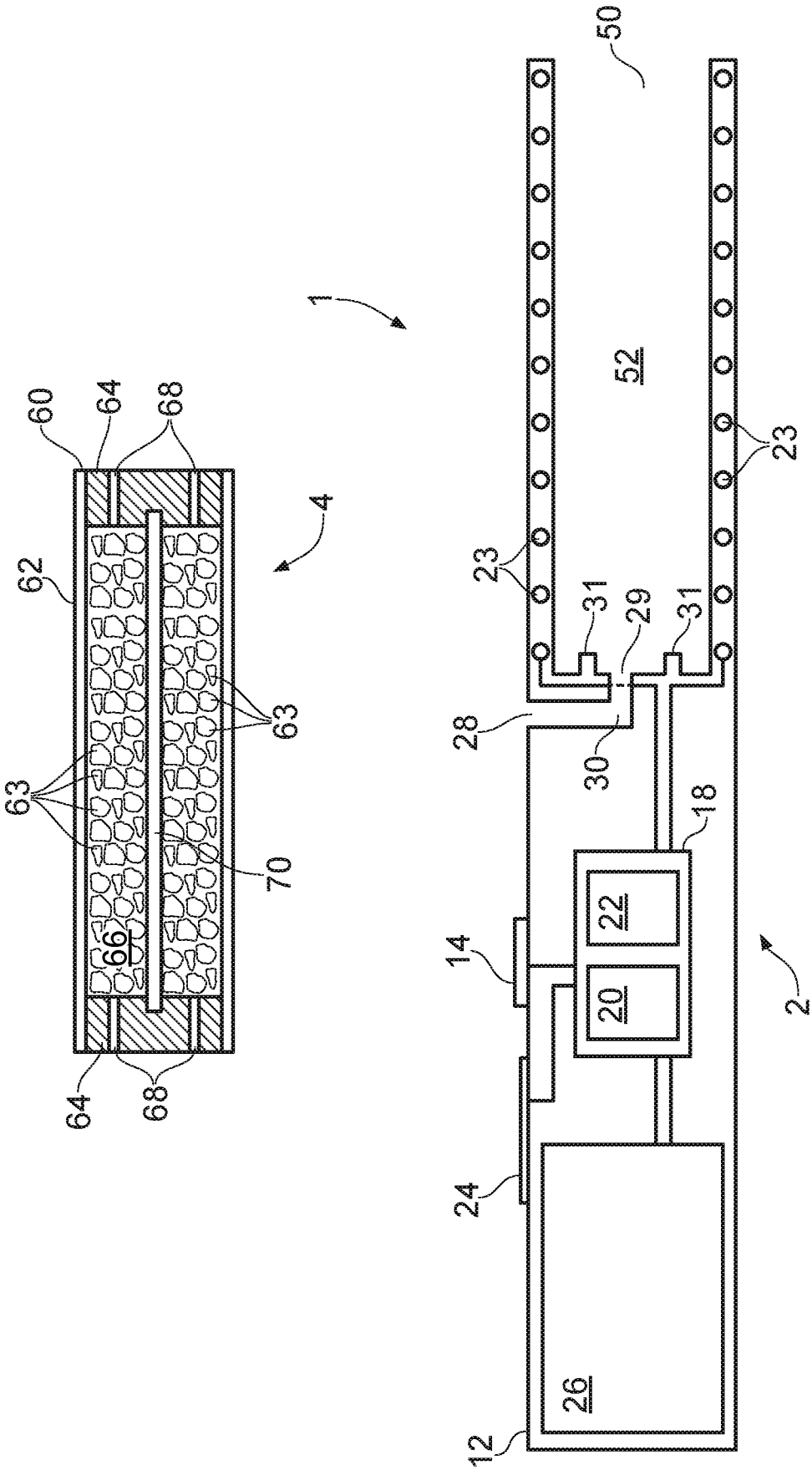

FIG. 1

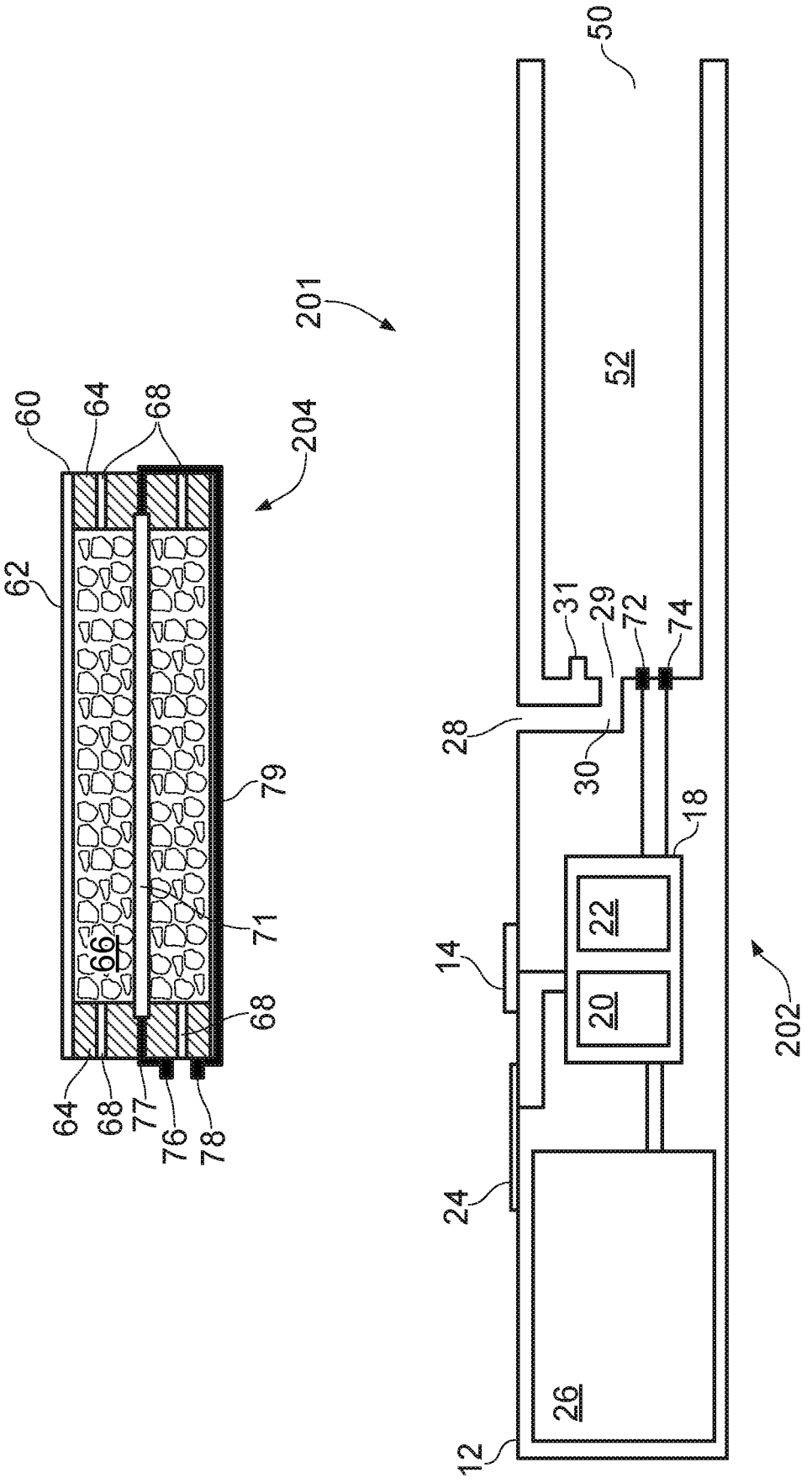
50
52
201
204
60
64
68
62
79
71
66
68
64
68
77
76
78
31
29
72
74
28
30
18
14
22
20
24
26
12
202

FIG. 2

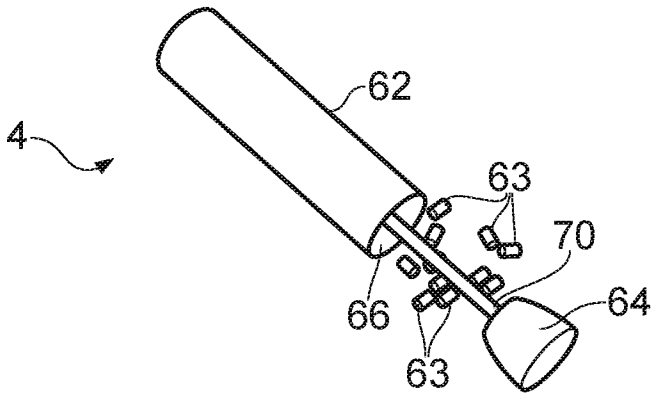

FIG. 3

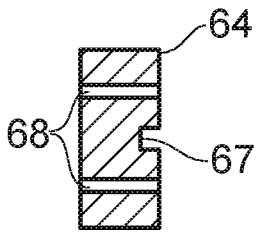

FIG. 4A

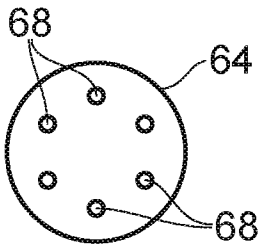

FIG. 4B

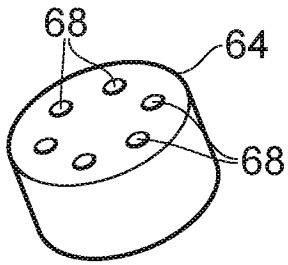

FIG. 4C

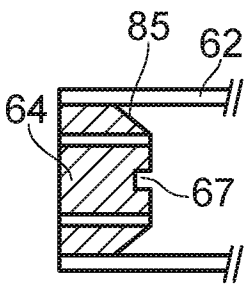

FIG. 4D

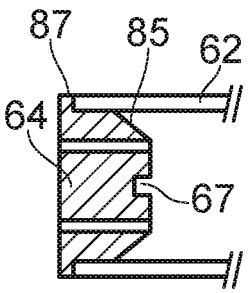

FIG. 4E

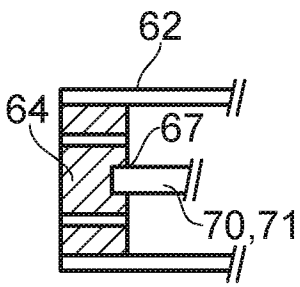

FIG. 4F

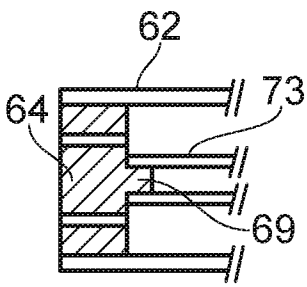

FIG. 4G

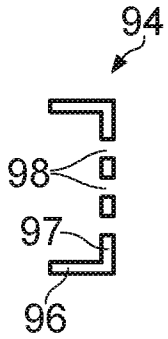

FIG. 5A

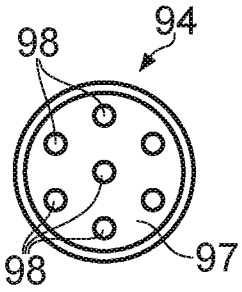

FIG. 5B

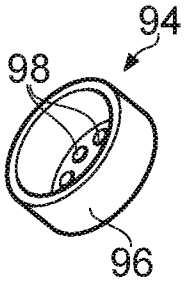

FIG. 5C

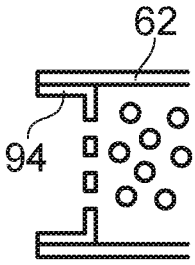

FIG. 5D

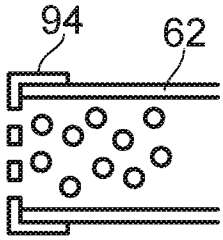

FIG. 5E

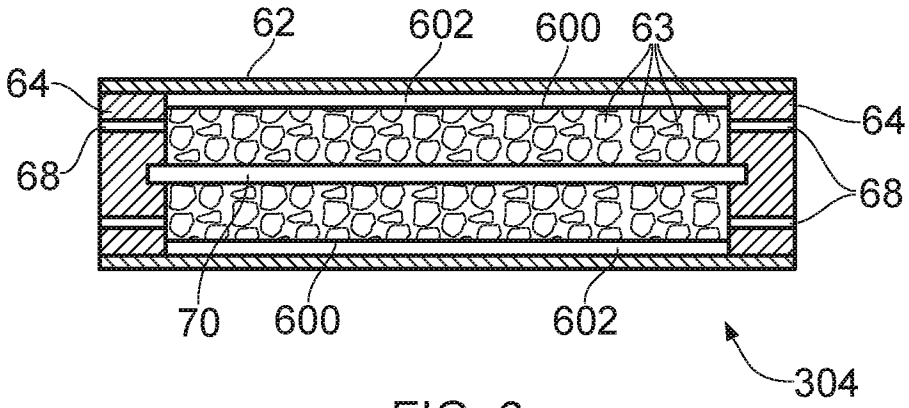

FIG. 6

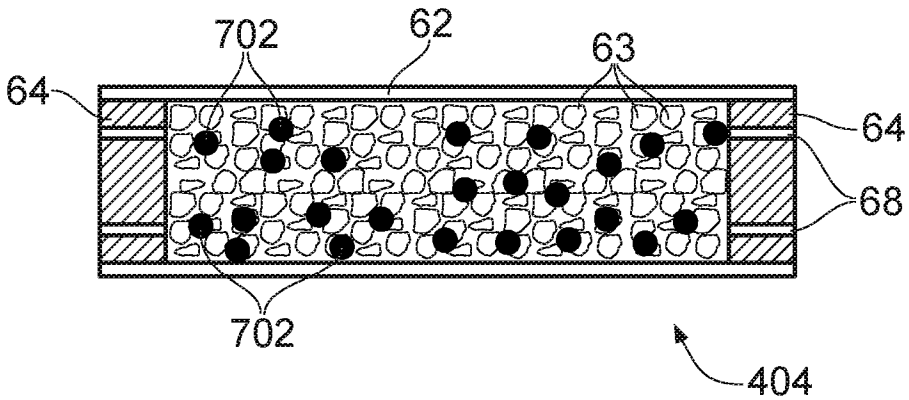

FIG. 7

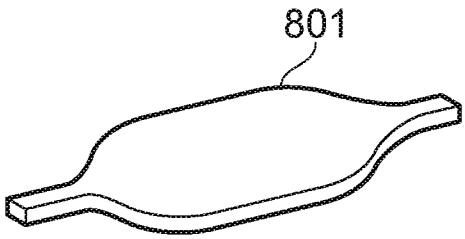

FIG. 8A

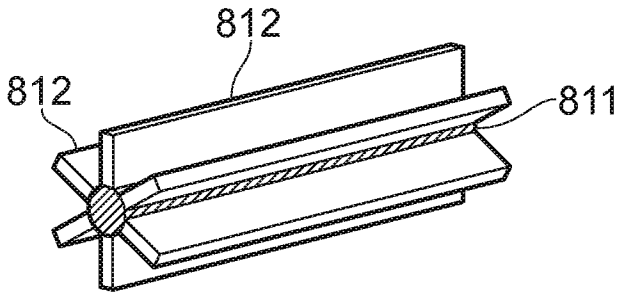

FIG. 8B

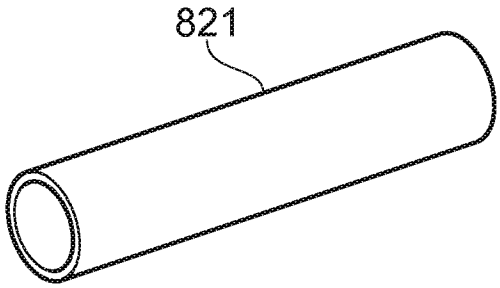

FIG. 8C

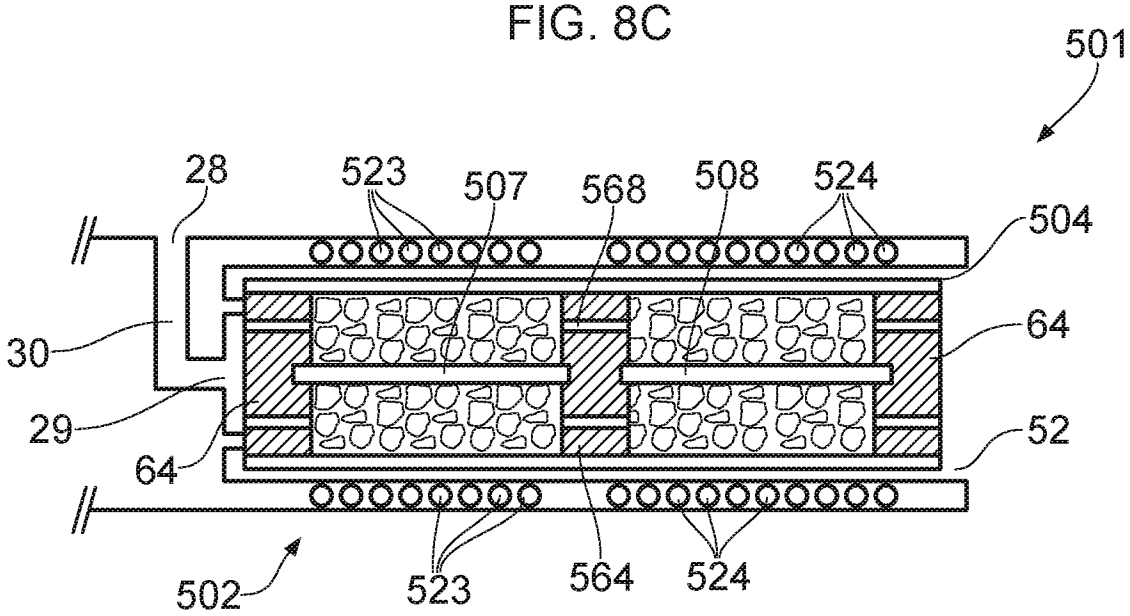

FIG. 9

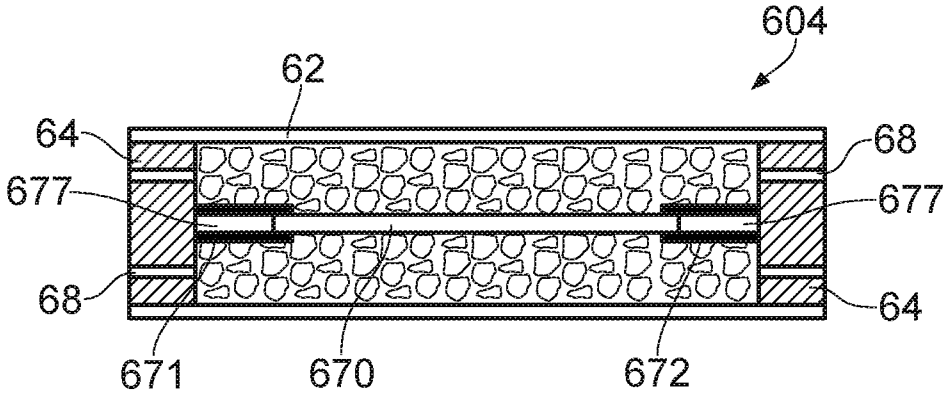

FIG. 10

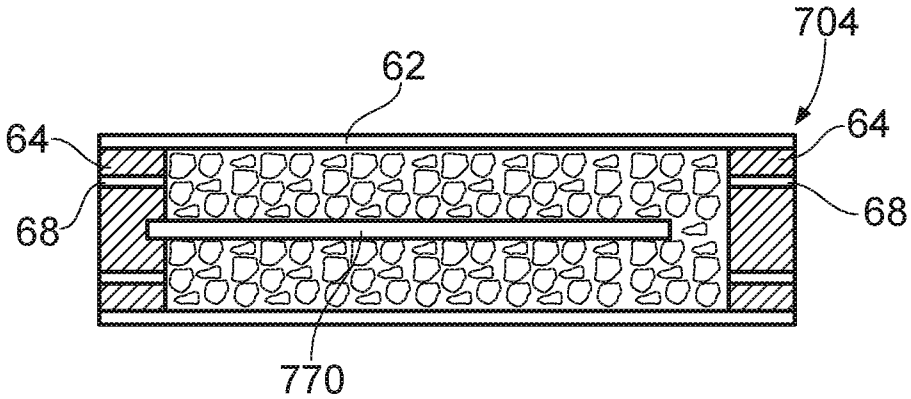

FIG. 11

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2018/052910

A. CLASSIFICATION OF SUBJECT MATTER
INV. A24F1/00 A61M15/06 A61M11/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A24F A61M

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

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

EPO-Internal, BIOSIS, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	EP 3 251 529 A1 (JAPAN TOBACCO INC [JP]) 6 December 2017 (2017-12-06) abstract; figures 1-3 paragraph [0033] paragraph [0041] - paragraph [0049]	1-19
X	WO 2015/177264 A1 (PHILIP MORRIS PRODUCTS SA [CH]) 26 November 2015 (2015-11-26) abstract; figures 1-6 page 3, paragraph 2 page 8, paragraphs 2, 3	1-3, 7-11, 14-19
A	WO 2017/055795 A1 (NICOVENTURES HOLDINGS LTD [GB]) 6 April 2017 (2017-04-06) abstract; claims 1-18; figure 1	1-19

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 December 2018	04/01/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Weijland, Albert

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2018/052910

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3251529 A1	06-12-2017	AU 2015384410 A1	05-10-2017
		CN 107249364 A	13-10-2017
		EA 201791920 A1	29-12-2017
		EP 3251529 A1	06-12-2017
		JP WO2016135959 A1	25-05-2017
		KR 20170106454 A	20-09-2017
		US 2017347704 A1	07-12-2017
		WO 2016135959 A1	01-09-2016
WO 2015177264 A1	26-11-2015	AR 100578 A1	19-10-2016
		AU 2015261887 A1	21-07-2016
		CA 2937719 A1	26-11-2015
		CN 105263346 A	20-01-2016
		DK 2975957 T3	08-05-2017
		EP 2975957 A1	27-01-2016
		ES 2618299 T3	21-06-2017
		HU E032683 T2	30-10-2017
		JP 6001201 B1	05-10-2016
		JP 2016532432 A	20-10-2016
		KR 20150144816 A	28-12-2015
		LT 2975957 T	10-03-2017
		PH 12016501298 A1	15-08-2016
		PL 2975957 T3	31-07-2017
		PT 2975957 T	10-03-2017
		SG 11201605924U A	30-08-2016
		TW 201609004 A	16-03-2016
		US 2016295921 A1	13-10-2016
		WO 2015177264 A1	26-11-2015
		ZA 201604455 B	30-08-2017
WO 2017055795 A1	06-04-2017	AU 2016329886 A1	22-03-2018
		BR 112018005787 A2	16-10-2018
		CA 2998563 A1	06-04-2017
		CN 108135267 A	08-06-2018
		EP 3355729 A1	08-08-2018
		KR 20180044410 A	02-05-2018
		PH 12018500459 A1	10-09-2018
		WO 2017055795 A1	06-04-2017