



(51) International Patent Classification:

A24F 40/10 (2020.01) A24F 40/90 (2020.01)
A24F 40/485 (2020.01)

(21) International Application Number:

PCT/GB2023/051164

(22) International Filing Date:

03 May 2023 (03.05.2023)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

2208019.6 31 May 2022 (31.05.2022) GB

(71) Applicant: **NICOVENTURES TRADING LIMITED**
[GB/GB]; Globe House, 1 Water Street, London WC2R
3LA (GB).

(72) Inventors: **CHEN, Ping Chou**; c/o Nicoventures Trading
Limited, Globe House, 1 Water Street, London WC2R 3LA
(GB). **LAI, Sam**; c/o Nicoventures Trading Limited, Globe
House, 1 Water Street, London WC2R 3LA (GB).

(74) Agent: **GREY, Ian**; Venner Shipley LLP, 200 Aldersgate,
London EC1A 4HD (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, CV, CZ, DE, DJ, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG,
KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY,
MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA,
NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO,
RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH,
TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS,
ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, CV,
GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, 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, ME, 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))
- before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))

(54) Title: DELIVERY DEVICE

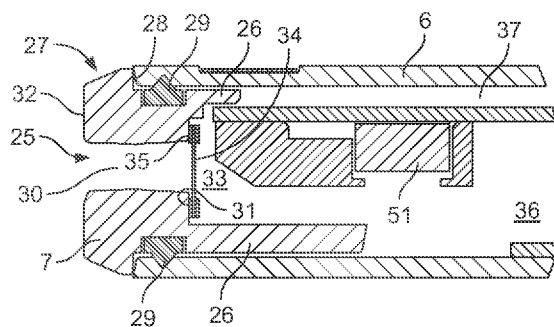


FIG. 3

(57) Abstract: A delivery device is disclosed and comprises an elongate housing; a battery received in the housing; an end cap attached to and closing an end of the housing; and a vent opening in the end cap in fluid communication with the battery. A delivery system comprising the delivery device and a substrate aerosolising module including a heater and a consumable comprising an aerosolisable substrate is also disclosed. The substrate aerosolising module is configured to aerosolise the substrate in response to activation of the delivery device. Also disclosed is an end cap attachable to an end of a housing of the delivery device, and a delivery device and an accessory for charging the delivery device.

Delivery Device

Technical Field

The present specification relates to a delivery device, such as a non-combustible aerosol provision device, or an aerosol-free delivery device. The invention also
5 relates to a delivery device according to the invention in combination with an accessory for charging the delivery device. An end cap attachable to an end of a housing of a delivery device according to the invention is also disclosed.

10 Background

Smoking articles, such as cigarettes, cigars and the like burn tobacco during use to create tobacco smoke. Attempts have been made to provide alternative delivery devices to these articles by creating products that release compounds without combustion. Examples of such delivery devices are electronic cigarettes, also known as a vaping
15 devices, and so-called “heat not burn” products or tobacco heating devices or products, which release compounds by heating, but not burning, a substrate. For example, tobacco heating devices heat an aerosol generating substrate, which may be tobacco or other non-tobacco products which may or may not contain nicotine, to form an aerosol by heating the substrate without burning it.

20

Summary

According to an aspect of the invention, there is provided a delivery device comprising: an elongate housing; a battery received in the housing; an end cap attached to and closing an end of the housing; and a vent opening in the end cap in fluid
25 communication with the battery.

A conduit in the housing may extend between the battery and the vent opening in the end cap.

30 The delivery device may comprise a mouthpiece at an opposite end of the housing and a pressure sensor in the housing, the pressure sensor being configured to detect when a user draws on the device through the mouthpiece and to activate the device based on detection of a user drawing on the mouthpiece.

35 The pressure sensor may be in fluid communication with the vent opening in the end cap.

A conduit in the housing may extend between the pressure sensor and the vent opening in the end cap. The conduit in the housing extending between the pressure sensor and the vent opening may at least partially be the same conduit that extends between the battery and the vent opening in the end cap. Alternatively, there may be different
5 conduits extending between the battery and the vent opening, and between the pressure sensor and the vent opening.

The delivery device may comprise a buzzer or speaker in the housing configured to
10 provide an audible indication to a user relating to a function of the device. The buzzer or speaker may be mounted in the end cap or elsewhere in the housing. The buzzer or speaker may be positioned relative to the vent opening such that the vent opening acts as an acoustic channel to enhance sound delivery and magnitude.

15 The buzzer or speaker may be disposed within the housing so as to generate a sound wave in the conduit.

Irrespective of where the buzzer or speaker is mounted, it can be in fluid communication with the vent opening in the end cap.

20

The delivery device may comprise a conduit in the housing that extends between the buzzer or speaker and the vent opening in the end cap.

The conduit extending between the buzzer or speaker and the vent opening in the end
25 cap may at least partially be the same conduit that extends between the battery and the vent opening in the end cap, and between the pressure sensor and the vent opening in the end cap. Alternatively, the conduit extending between the buzzer or speaker and the vent in the end cap may be separate to any other conduit.

30 In some embodiments, the delivery device may comprise a secondary vent opening in the housing, in addition to the vent opening in the end cap. The vent opening in the housing may be in fluid communication with any or all of the battery, the pressure sensor and/or a buzzer or speaker. One or more of these items may be in fluid communication with both the vent opening in the end cap and the secondary vent
35 opening in the housing. Alternatively, some of them may be in fluid communication

with the vent opening in the end cap and others may be in fluid communication with the secondary vent opening in the housing.

5 A membrane formed from a gas permeable material may extend over the secondary vent opening in the housing.

The end cap can comprise a push-fit portion received within the end of the housing and a head portion that protrudes from the end of the housing. The head portion and the push-fit portion may meet at a shoulder that engages an end face of the housing.
10

A sealing member may be located between the push-fit portion of the end cap and an inner surface of the housing.

15 A membrane formed from a gas permeable material may extend over the vent opening in the end cap. The membrane may be attached to a surface of the end cap. It can be glued to the end cap.

The end cap may comprise an internal surface facing the inside of the housing and an external surface facing outside of the housing. The membrane may be attached to the
20 internal surface of the end cap.

The internal surface of the end cap may comprise a recess, and the membrane may be received in said recess.

25 The vent opening may comprise a passage extending through the end cap between the internal and external surfaces, such that the membrane is spaced from the external surface by the length of the passage.

30 According to an embodiment, there is provided a delivery system comprising the delivery device according to the invention, that may comprise a substrate aerosolising module including a heater and a consumable comprising an aerosolisable substrate, the substrate aerosolising module being configured to aerosolise the substrate in response to activation of the delivery device.

35 According to another embodiment, there is provided a delivery device according to the invention, and an accessory for charging the delivery device and to which the delivery

device may be coupled in a charging configuration. The charging accessory may comprise a guide member that locates in the passage in the end cap when the delivery device and charging accessory are in the charging configuration.

- 5 The length of the guide pin of the charging accessory may be less than the length of the passage in the end cap.

The guide pin and/or the passage may be shaped such that gas can still pass through the passage when the delivery device is attached to the accessory with the guide
10 member received in the passage.

The delivery device may comprise a plurality of vent openings in the end cap, each vent opening comprising a passage. The number of passages in the end cap may exceed the number of guide members on the charging accessory such that at least one passage
15 remains free of a guide member when the delivery device is attached to the charging accessory.

According to another embodiment of the invention, there is provided an end cap attachable to an end of a housing of a delivery device to close said end, wherein the end
20 cap comprises a vent opening extending through the end cap, and a membrane comprising a gas permeable material attached to, and extending over, the vent opening in the end cap.

The end cap may comprise a push-fit portion defining an inner end surface for insertion
25 into a housing of a delivery device, and a larger head portion defining an exterior surface. The membrane may be attached to, and extend over, the inner end surface of the end cap.

According to another aspect of the invention, there is provided a delivery device and an
30 accessory for charging the delivery device, the delivery device and the accessory being attachable to each other in a charging configuration, wherein the delivery device comprises:

- a housing; a battery received in the housing; and
 - a vent opening in communication with the battery;
- 35 and the accessory for charging the delivery device comprises:

a locating member that locates in the vent opening when the delivery device and charging accessory are in said charging configuration.

5 The vent opening may comprise a passage in the housing extending between inner and outer surfaces. A gas permeable membrane may be located in the housing and extend across the vent opening at an inner end of the passage, i.e. the membrane may be attached to, or pressed against, the inner surface of the housing. The membrane is therefore recessed within the housing at the end of the passage to protect it from damage.

10

The guide member can be shorter than the length of the passage such that the guide member does not come into contact with the membrane when the delivery device and the charging accessory are in said charging configuration.

15 According to another aspect of the invention, there is provided a delivery device comprising:

a housing;

a battery received in the housing;

a vent opening in the housing in fluid communication with the battery,

20 and

a pressure sensor in the housing, the pressure sensor being configured to detect when a user draws on the device and to activate the device based on said detection,

wherein the pressure sensor is in fluid communication with the vent

25 opening.

The delivery device may comprise a conduit in the housing extending between the battery and the vent opening to fluidly communicate the battery and the vent opening.

30 The delivery device may also comprise a conduit in the housing extending between the pressure sensor and the vent opening to fluidly communicate the pressure sensor and the vent opening.

35 The conduit in the housing extending between the pressure sensor and the vent opening may at least be partially the same conduit as the conduit extending between the battery and the vent opening.

Brief Description of the Drawings

Example embodiments will now be described, by way of example only, with reference to the following schematic drawings, in which:

- 5 FIG. 1 is a schematic drawing of a delivery device in accordance with an example embodiment;
- FIG. 2 is an exploded view of a delivery device shown in Fig. 1;
- FIG. 3 is a partial longitudinal cross-sectional view of one end of a delivery device according to an embodiment of the invention, showing the end cap attached thereto,
- 10 and
- FIG. 4 shows a delivery device according to an embodiment of the invention, together with a charging accessory.

Detailed Description

- 15 As used herein, the term “delivery device” is intended to encompass devices that deliver at least one substance to a user, and includes: non-combustible aerosol provision devices that release compounds from an aerosol-generating material without combusting the aerosol-generating material, such as electronic cigarettes, tobacco heating products, and hybrid systems to generate aerosol using a combination of
- 20 aerosol-generating materials.

Embodiments according to the invention provide a delivery device that includes a housing and a battery contained within the housing. One end of the housing is closed by an end cap. The end cap has a vent opening to allow gases to escape from the

25 housing through the vent opening, thereby preventing a build-up of pressure within the housing, for example in the event of a problem with the device or the battery during use of the device, or whilst the battery is being charged. In the absence of the vent opening the housing may be a sealed unit.

- 30 FIG. 1 is a schematic drawing of a non-combustible aerosol provision device 1, in accordance with an example embodiment. The device 1 comprises two main components 2, 8, each of which have proximal and distal ends.

The first component 2 of the device 1 includes a control module 3, which includes a

35 battery 4 and a circuit board 5. The control module 3 is received within a housing 6 which encloses the control module 3 and forms the external appearance of the device.

The housing 6 may be a tubular sleeve, in which case the control module 3 is inserted into the housing 6 from its distal end during assembly of the device 1. The distal end of the housing 6 is then closed by an end cap 7. However, the housing 6 may, alternatively, be formed from multiple parts or shells that are attached together to form an enclosure
5 around the control module 3. If the housing 6 is formed from two half-shells for instance, the control module 3 may be placed in one half-shell part before the other half-shell part is placed on, and is attached to, the other half-shell part prior to attachment of the end cap 7 to the distal end of the housing 6 thereby encapsulate the control module 3 within the housing 6. The housing 6 is preferably formed from a
10 metal, such as aluminium, although other materials for the housing 6 are also possible. It is also envisaged that the end cap 7 could be partially integrated with the housing, i.e. the end cap 7 could be integral with one half-shell.

The second component 8 of the device 1 includes a heater 9 and a liquid reservoir 10
15 that may collectively form an aerosol-generating module. A mouthpiece (not shown) is integrally or removably attached to the proximal end of the second component 8 through which a user may draw when the device 1 is in use. The first and second components 2, 8 may be modular, i.e. the second component 8 may have its own housing 12 and its distal end can be separable from a proximal end of the first
20 component 2 (at a join marked X in Fig. 1) for repair or replacement. A releasable electrical connection joins the first and second components 2, 8 to enable power and/or control signals to be transmitted between them. However, the first and second components 2, 8 may not be separable, other than by disassembly or destruction of the device 1. More specifically, the first and second components 2, 8 may be permanently
25 connected together during assembly. Alternatively, housing 6 may be a single unitary component integrating both the first and second components 2, 8, i.e. the housing 6 may define a single compartment or chamber in which all the parts of the device 1 are received together.

30 When the device of Figure 1 is used, and a user draws on the mouthpiece, air is drawn into an air inlet of the heater 9, as indicated by the arrow 11. The heater 9 is controlled by the control module 3 and heats the incoming air. The heated air is directed to the liquid reservoir 10, where an aerosol is generated. The aerosol exits the device 1 at an air outlet, as indicated by the arrow A, into the mouth of a user of the device 1. The
35 device 1 may be puff-actuated, i.e. the device 1 may include a puff-sensor 16 (see Fig. 2), such as a pressure sensor, capable of detecting a change in pressure within the housing

6 that occurs when a user puffs or draws on the mouthpiece. The puff-sensor 13 may be configured to activate the heater 9 and other components of the delivery device 1 to generate the aerosol in response to detecting such a change in pressure. Puff activation typically requires a comparison of two pressures, i.e. a pressure in the airflow path at the mouthpiece (which reduces when the user draws on the mouthpiece), and a pressure within the device housing that is taken as a reference value (i.e. representative of ambient pressure).

The heater is activated when the pressure on the mouthpiece side falls below the reference pressure (i.e. ambient) by at least a threshold amount. Mis-activation occurs when the reference pressure increases as opposed to the external pressure decreasing, which may result in a sufficient pressure differential to activate the heater even though the user may not be drawing on the mouthpiece.

Depending on the device, two separate pressure sensors could be used (i.e. one to measure the pressure in the airflow channel at the mouthpiece, and one to provide a reference pressure measurement), or a single differential pressure sensor could be used (i.e. a single component that measures the pressure different between opposite sides of the sensor). If two separate sensors are used, the pressure sensor that measures a reference pressure should be in fluid communication with the vent opening, whereas the sensor which detects the draw on the mouthpiece does not have to be in fluid communication with the vent opening.

The pressure sensors or differential pressure sensor may be configured to convert the measurements of pressure to corresponding electrical signals. A microprocessor is coupled to the heating element and the sensor and is configured to receive the corresponding electrical signals and operate in an active mode only in an instance in which a prederermined threshold pressure, or predetermined differential threshold pressure has been reached, so as to activate the heating element to vaporize components of the aerosol-generating material.

FIG. 2 is a more detailed exploded view of the first component 2 shown in Figure 1, the second component 8 being omitted. It can be seen from Fig. 2 that the housing 6 is in the form of a sleeve and the remaining components of the control module 3 are inserted into the housing 6 from one end. The end is then closed by the end cap 7.

As shown in FIG. 2, the control module 3 includes a frame or carrier 13 in which the battery 4 is received and retained. The circuit board 5 is mounted to the top, outside surface of the carrier 13 and is supported by both the carrier 13 and by the outside of one major face 4a of the battery 4. An insulated spacer or support pad 15 may be
5 located between the major face 4a of the battery 4 and the circuit board 5 where they overlie each other. The support pad 15 may be adhesive, so that the circuit board 5 is held in place on the major face 4a of the battery 4 by the adhesive pad 15. Various electrical circuit and control elements, including the pressure sensor 16, may be mounted to the circuit board 5, which also has connectors 17 for electrical connection of
10 the circuit board 5 to the aerosol generating module of the second component 8. These connectors 17 are positioned on a section of the circuit board 5 that overhangs one end of the carrier 13.

A metal or conductive plate 18 is mounted to the underside of the carrier 13 and to the
15 other major face 4b of the battery 4 on the opposite side of the battery 4 to the circuit board 5. An insulated pad 19 or spacer may be located between the other major face 4b of the battery 4 and the metal plate 18 and may be adhesive so that the metal plate 18 is held in place on the other major face 4b of the battery 4. The metal plate 18 forms an electrical connection between the battery 4 and the circuit and control elements on the
20 circuit board 5. It will be understood that the carrier 13 is open, in the sense that it does not completely cover or surround the battery 4. Even with the circuit board 5 and metal plate 18 mounted to the carrier 13 and extending over the major faces 4a, 4b of the battery 4, the battery 4 is still partially exposed. This enables any heat or gases generated by the battery 4, which may occur either as a result of normal use, or due to a
25 malfunction, to escape or dissipate internally into regions of the housing 6 that surround the battery 4, rather than being trapped within the carrier 13.

The control module 3 may include a press button on/off switch 20, which is mounted to the metal plate 18 and is accessible through an aperture in the housing 6. Pressing the
30 on/off switch 20 connects, or disconnects, the battery 4 from the circuitry 16 on the circuit board 5, thereby switching the device on or off, or performing other control functions as required. However, a switch 20 is not essential as the device 1 can be activated solely by the puff sensor 16, referred to above.

35 As the housing 6 is a sealed unit once assembled, gas may collect within the housing 6 resulting in a build-up of pressure. Therefore, a vent opening 25 (see Fig. 3) is provided

in the end cap 7 to enable any gases to escape and to maintain a nominal or atmospheric pressure within the housing 6. The vent opening 25 also allows air to circulate into and out of the housing 6 to minimise temperature differences internally and externally of the delivery device 1.

5

A partial cross-sectional side elevation of a delivery device 1 according to an embodiment of the invention is illustrated in Figure 3, and from which it can be seen that the end cap 7 has a first portion 26 slideably received within the end of the housing 6 and a second, larger, head portion 27 which is outside the housing 6 and defines a shoulder 28 that sits against the end face of the housing 6. The first portion 26 can be a push-fit, preferably a friction or snug fit, in the housing 6 and can include a sealing element 29 to form a seal between the first portion 26 and the inner wall of the housing 6. The end cap 7 can be removable or permanently attached to the housing 6. For example, the end cap 7 could be glued to the housing 6 in addition, or alternatively to, it being a push-fit. The end cap 7 and the housing 6 may also have complimentary screw threads to enable the end cap 7 to be screwed to the housing 6.

10
15

The vent opening 25 in the end cap 7 through which air or other gases can escape from the housing 6 is defined by a passage 30 that extends through the end cap 7 between inner and outer end surfaces 31, 32 of the end cap 7. The inner surface 31 is located in a recess 33 within the end cap 7. A membrane 34 which, as a minimum requirement, is sufficiently permeable to allow air and/or gas to pass through it with little or no resistance, extends over the vent opening 25 and is mounted to the inner surface 31 of the end cap 7 within the recess 33. In addition to being air and/or gas permeable, the membrane 34 may also be waterproof or at least have a degree of water resistance. For example, and with reference to the Ingress Protection (IP) standard drawn up by the International Electrotechnical Commission (IEC), the device 1 may have what is commonly referred to as an 'IP67 rating', which means that it is resistant to the seeping of dust or dirt into the device 1, which includes access through the membrane 34. This rating also means that the device 1 can be submerged in fresh water to a depth of up to 1.5 metres for a period of half an hour, without the water penetrating the device 1, and so the membrane 34 covering the vent 25 in the end cap 7 needs to be able to prevent such penetration.

20
25
30

To allow for the passage of gas or air, it is envisaged that the membrane 34 may have a hole size of 0.65µm, and a thickness of between 0.11mm-0.19mm, with a venting

35

capacity of 1900-2400ml/cm²/min at a pressure of 7kpa. One such material that meets these requirements is made by Dong Guan PUW EPTFE Material Co., LTD., under product no. PUW867.

5 The membrane 34 is attached to the inside surface 31 of the end cap 7 so that it is spaced from the external surface 32 of the end cap 7 by the length of the passage 30 extending through the end cap 7 making it less accessible and so better protected against damage and making it impossible for pressure to be applied to the membrane 34 using a finger. Preferably, the membrane 34 is larger than the vent opening 25 and
10 so has a peripheral region that extends beyond the opening 25 and faces the inside surface 31 of the end cap 7. A ring of permanent adhesive 35 is applied in an annular pattern around the entire peripheral region, and attaches the membrane 34 to the inside surface 31 of the end cap 7 across the vent opening 25. Other ways for attaching the membrane 34 to the inside surface 31 of the end cap 7 so that it extends across the
15 vent opening 25 are also contemplated. For example, the membrane 34 could be over-moulded by the end cap 7. Alternatively, the membrane 34 can be sandwiched between the inner surface of the end cap 7 and another mechanical component.

There may also be more than one vent opening 25 in the end cap 7, with a membrane
20 34 mounted to the inner surface 31 and extending across each vent opening 25. There may be a separate membrane 34 for each vent opening 25 or a single membrane 34 extending across all of the vent openings 25.

Although the passage 30 forming the vent opening 25 may be cylindrical, a tapering or
25 partly tapering passage 30 extending through the end cap 7 is also contemplated. Irrespective of whether the passage 30 is tapered, it may also have a non-circular cross-section. For example, the vent opening 25 in the outer surface 32 of the end cap 7 may be smaller than the vent opening 25 in the inner surface 31 of the end cap 7.

30 The delivery device 1 may be mountable to an accessory 40, such as a charging unit. Fig. 4 shows a delivery device 1 being lowered, in the direction of arrow D, onto an accessory 40. In this arrangement, the passage 30 extending through the end cap 7 may act as a guide or opening into which a post or other locating or guide member 41 on the accessory 40 may fit or locate so that the delivery device 1 and accessory 40 are
35 correctly located or aligned relative to each other to facilitate charging. The locating member 41 may be a sufficiently loose fit in the passage 30 such that air or gas may still

flow through the passage 30 even in the presence of the locating member 41. The passage 30 and the locating member 41 may also have different profiles or cross-sectional shapes to allow for the gas to flow through the passage 30 past the locating member 41. In some embodiments, there may be more passages 30 extending through the end cap 7 than there are locating members 41 on the accessory 40. This means that even if some passages 30 are blocked by the locating members 41, gas can still escape from the housing 6 via the remaining passages 30 in which no locating member 41 is received.

10 It will be appreciated that the locating member 41 on the accessory 40 will at least be slightly shorter than the length of the passage 30 in the end cap 7 so that the locating member 41 will not reach or touch the membrane 34 attached to the inside surface 31 of the end cap 7 which could otherwise cause the membrane 34 to rupture or the adhesive 35 holding the membrane 34 in place to fail, resulting in the membrane 34 becoming
15 detached from the end cap 7.

Although reference is made to an embodiment in which the vent opening is in the end cap, it is also contemplated that the vent opening can be elsewhere, such as in the housing, and the locating member may still locate in the passage providing the vent opening. A gas permeable membrane may still be located in the housing and extend
20 across the vent opening at an inner end of the passage, and the locating member can be shorter than the length of the passage such that the guide member does not contact the membrane when the delivery device and the charging accessory are in said charging configuration.

25 In some embodiments, a secondary vent opening 50 (see Fig. 2) can be provided through the wall of the housing 6, in addition to the vent opening 25 in the end cap 7. A secondary vent opening 50 in the housing 6 provides the same function as the vent opening 25 in the end cap 7, but guards against any build up of gas within the housing 6 in the event that the vent opening 25 in the end cap 7 becomes blocked, or as a result of the vent opening 25 in the end cap 7 being closed by having a locating member 41 of a charging accessory 40 being received in it. The secondary vent opening 50 may also have a gas and air permeable membrane (not shown) extending across it within the housing 6.

35

In other embodiments of the invention, there may be a plurality of vent openings, either in the end cap 7, in the housing, or in a combination of both the end cap and the housing. Each of the vent openings is covered by a semi-permeable membrane.

5 The vent opening 25 in the end cap 7 is in fluid communication with the battery 4, i.e. there is an open pathway or conduit 36 for the flow of air/gases from the battery 4 or battery compartment to the vent opening 25. This ensures that gases generated by the battery 4 are free to flow directly to the vent opening 25 without obstruction. Similarly, if a secondary vent opening 50 in the housing 6 exists, that secondary vent opening 50
10 may also be in fluid communication with the battery 4. The conduit by which the battery 4 is in fluid communication with the vent opening 25 may at least partially be shared by the conduit 37 which fluidly communicates any secondary opening 50 in the housing 6 with the battery 4. The secondary vent opening 50 may be in fluid communication with at least one of the battery 4, the pressure sensor 16 and any
15 speaker or buzzer (see below) received within the housing 6.

If the delivery device 1 is puff-actuated and the housing 6 is a single unitary component, it is possible that a mis-activation of the device 1 can occur as a result of changes in pressure within the housing 6 that are not caused by a user drawing on the mouthpiece.
20 For example, a change in pressure within the housing 6 may occur as a result of an inadvertent compression of the housing 6 sufficient to deform the wall of the housing 6. In this circumstance, the vent opening 25 in the end cap 7 may prevent misactivation by dissipating any increase in pressure within the housing 6 caused as a result of any such compression and deformation of the housing 6. The vent opening 25 balances the
25 pressure inside the housing 6 with ambient pressure to prevent puff mis-activation. To achieve this function, the pressure sensor 16 that measures a reference pressure within the housing 6 is in fluid communication with the vent opening 25, or if a differential pressure sensor is used, then it at least has the ability to detect a draw on the mouthpiece and a pressure in the housing 6 with the interior of the housing 6 being
30 in communication with the vent opening 25. The pressure sensor 16 may be in communication with the vent opening 25 in the end cap 7 and/or in fluid communication with any secondary vent opening 50. The conduit by which the pressure sensor is in fluid communication with the vent opening 25 in the end cap 7 may be at least partially shared with the fluid conduit 36 that communicates the battery
35 4 with the vent opening 25 in the end cap 7. This embodiment can be realised irrespective of whether the vent opening is in the end cap 7 or in the housing 6, the only

requirement being that the pressure sensor is in fluid communication with the vent opening.

5 The delivery device 1 may also comprise a sound generator 51, such as a buzzer, speaker or vibrator mounted to the housing 6, to the end cap, or to a module 52 attached to the end cap 7. The buzzer or speaker 51 may vibrate or generate audible sounds indicative of a function of the delivery device 1. The buzzer or speaker 51 may also be mounted such that they are in fluid communication with the vent opening 25 in the end cap 7 in order to improve or enhance the transmission and/or tone of the sound generated by
10 the buzzer or speaker 51. The buzzer/speaker can also be fixed to a thin wall/membrane that acts as a diaphragm and effectively transmits sound to a passage or conduit leading to the vent opening, whilst sealing the buzzer/speaker off from the passage. The buzzer/speaker is mounted such that the vent opening acts as an acoustic passage to enhance sound delivery and magnitude.

15 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,
20 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,
25 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.

30

Claims

1. A delivery device comprising:
an elongate housing;
5 a battery received in the housing;
an end cap attached to and closing an end of the housing; and
a vent opening in the end cap in fluid communication with the battery.
2. A delivery device according to claim 1, comprising a conduit in the housing
10 extending between the battery and the vent opening in the end cap.
3. A delivery device according to claim 1 or 2, comprising a mouthpiece at an
opposite end of the housing and a pressure sensor in the housing, the pressure sensor
being configured to detect when a user draws on the device through the mouthpiece
15 and to activate the device based on said detection.
4. A delivery device according to claim 3, wherein the pressure sensor is in fluid
communication with the vent opening in the end cap.
- 20 5. A delivery device according to claim 4, comprising a conduit in the housing
extending between the pressure sensor and the vent opening in the end cap.
6. A delivery device according to claim 5, when dependent on claim 2, wherein the
conduit in the housing extending between the pressure sensor and the vent opening is
25 at least partially the same conduit that extends between the battery and the vent
opening in the end cap.
7. A delivery device according to any preceding claim, comprising buzzer or
speaker in the housing configured to provide an audible indication to a user relating to
30 a function of the device.
8. A delivery device according to claim 7, wherein the buzzer or speaker is
positioned relative to the vent opening such that the vent opening acts as an acoustic
channel to enhance sound delivery and magnitude.

9. A delivery device according to claim 7 or 8, comprising a conduit in the housing extending between the buzzer or speaker and the vent opening in the end cap.
10. A delivery device according to claim 9, wherein the buzzer or speaker is
5 disposed within the housing so as to generate a sound wave in the conduit.
11. A delivery device according to any of claims 7 to 10, wherein the buzzer or speaker is in fluid communication with the vent opening in the end cap.
- 10 12. A delivery device according to any of claims 9 to 11, when dependent on claim 6, wherein the conduit extending between the buzzer or speaker and the vent opening in the end cap is at least partially the same conduit that extends between the battery and the vent opening in the end cap,
15 and between the pressure sensor and the vent opening in the end cap.
13. A delivery device according to any preceding claim, comprising a secondary vent opening in the housing in fluid communication with the battery, in addition to the vent opening in the end cap.
- 20 14. A delivery device according to claim 13, comprising a membrane formed from a gas permeable material extending over the secondary vent opening in the housing.
15. A delivery device according to any preceding claim, wherein the end cap comprises a push-fit portion received within the end of the housing and a head portion
25 that protrudes from said end of the housing.
16. A delivery device according to any preceding claim, comprising a membrane formed from a gas permeable material extending over the vent opening in the end cap.
- 30 17. A delivery system comprising the delivery device according to any preceding claim, comprising a substrate aerosolising module including a heater and a consumable comprising an aerosolisable substrate, the substrate aerosolising module being configured to aerosolise the substrate in response to activation of the delivery device.
- 35 18. A delivery system according to claim 17, and an accessory for charging the delivery device, wherein the delivery device and the accessory are attachable to each

other in a charging configuration, the accessory comprising a guide member that locates in the passage in the end cap when the delivery device and charging accessory are in said charging configuration.

5 19. A delivery system and charging accessory according to claim 18, wherein the length of the guide member of the accessory is less than the length of the passage in the end cap.

10 20. A delivery system and charging accessory according to claim 18 or 19, wherein the guide member and/or the passage are shaped such that gas can still pass through the passage when the delivery device is attached to the accessory with the guide pin received in the passage.

15 21. An end cap attachable to an end of a housing of a delivery device to close said end, the end cap comprising:

a vent opening extending through the end cap and a membrane comprising a gas permeable material attached to, and extending over, the vent opening in the end cap.

20 22. An end cap according to claim 21, comprising a push-fit portion defining an inner end surface for insertion into a housing of a delivery device, and a larger head portion defining an exterior surface, wherein the membrane is attached to, and extends over, the inner end surface of the end cap.

25 23. A delivery device and an accessory for charging the delivery device, the delivery device and the accessory being attachable to each other in a charging configuration, wherein the delivery device comprises:

a housing; a battery received in the housing; and

a vent opening in the housing, the vent opening being in fluid

30 communication with the battery; and

wherein the accessory for charging the delivery device comprises:

a locating member that is received in the vent opening when the delivery device and charging accessory are in said charging configuration.

35 24. A delivery device and an accessory for charging the delivery device according to claim 29, wherein the housing comprises outer and inner surfaces and the vent opening

comprises a passage extending through the housing from said outer to inner surfaces, a gas permeable membrane being located on said inner surface of the housing and extending across the vent opening.

- 5 25. A delivery device and an accessory according to claim 24, wherein the locating member is shorter than the length of the passage such that the locating member does not contact the membrane when the delivery device and the charging accessory are in said charging configuration.

1 / 4

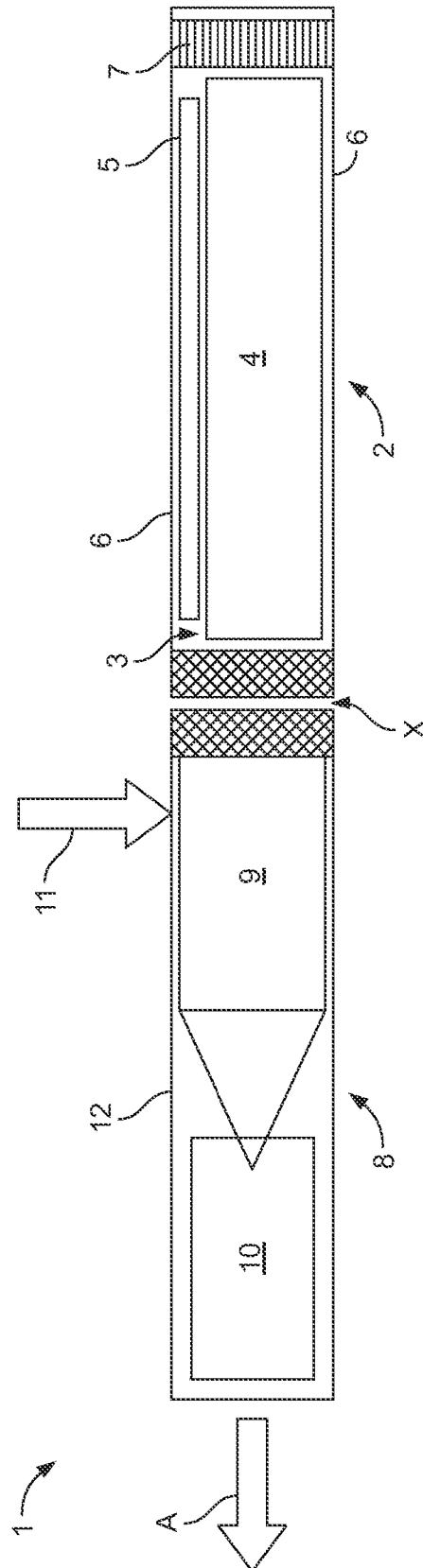


FIG. 1

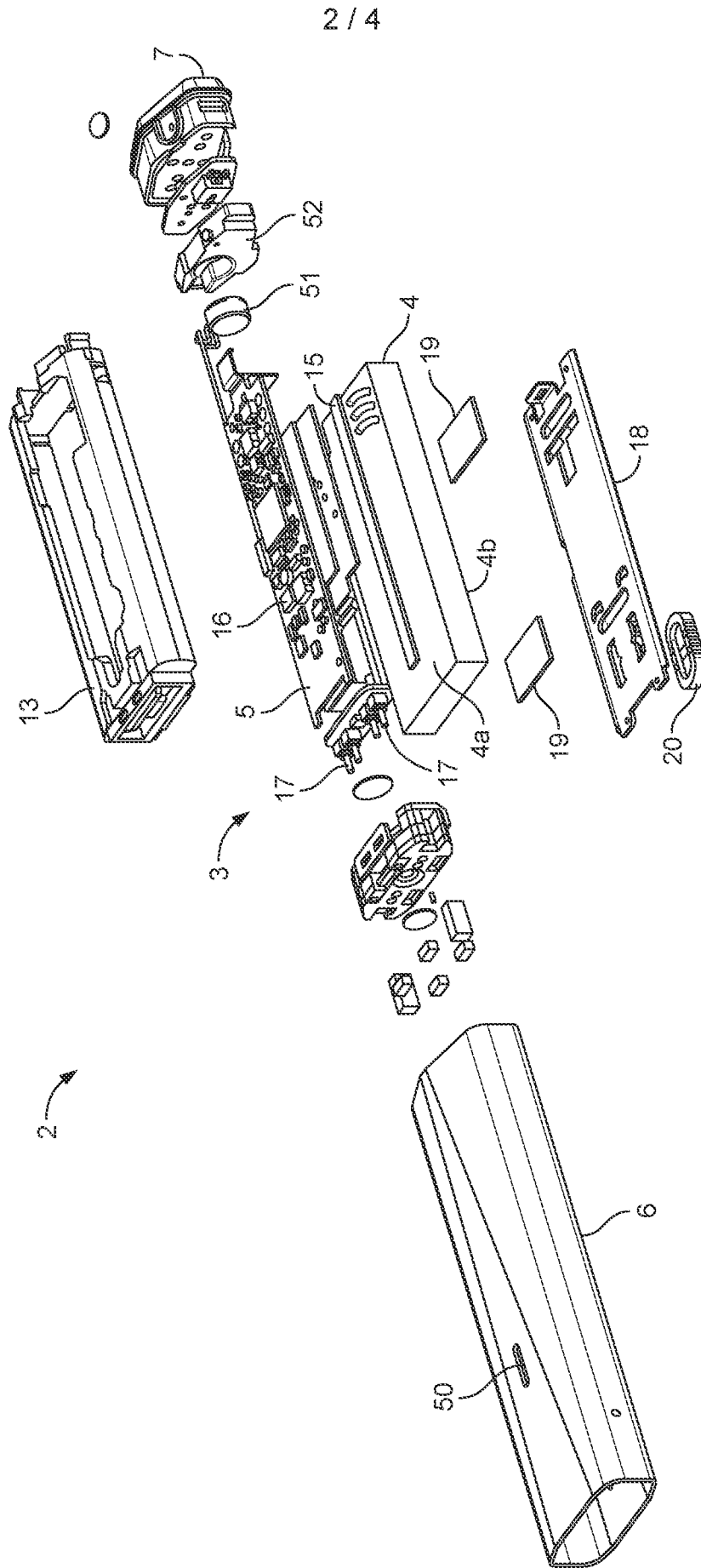


FIG. 2

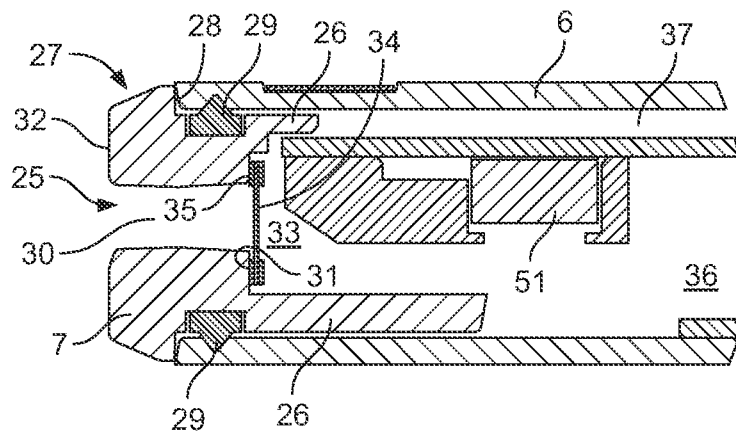


FIG. 3

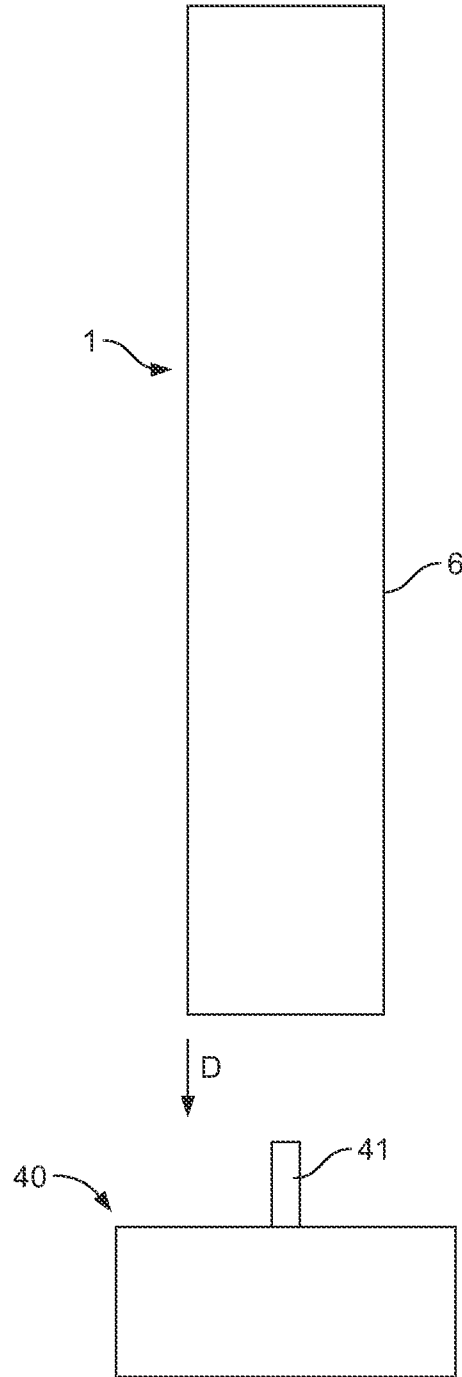


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2023/051164

A. CLASSIFICATION OF SUBJECT MATTER INV. A24F40/10 A24F40/485 A24F40/90 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		
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, 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	US 2021/111575 A1 (JONES MARK [CA] ET AL) 15 April 2021 (2021-04-15)	1-12, 15, 17-20, 23
Y	paragraph [0038] - paragraph [0056]; figures 1-12	13, 14, 16, 18-25

Y	WO 2019/154811 A1 (MCNEIL AB [SE]) 15 August 2019 (2019-08-15)	14, 16, 21, 22, 24, 25

X	WO 2017/108268 A1 (PHILIP MORRIS PRODUCTS SA [CH]) 29 June 2017 (2017-06-29)	1-13, 15, 17
Y	page 5, line 34 - page 9, line 16; figures 1-4	13, 14, 16, 18-25

-/--		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> 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	
26 July 2023	28/09/2023	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Klintebäck, Daniel	

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2023/051164

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 805 636 A2 (SIS RESOURCES LTD [IL]) 26 November 2014 (2014-11-26)	1-13, 15, 17
Y	paragraph [0018] - paragraph [0034]; figures 1-18	13, 14, 16, 18-25

X	US 2011/226236 A1 (BUCHBERGER HELMUT [AT]) 22 September 2011 (2011-09-22)	1-12, 15, 17
Y	paragraph [0111] - paragraph [0121]; figures 8-13	13, 14, 16, 18-25

X	US 2008/092912 A1 (ROBINSON JOHN HOWARD [US] ET AL) 24 April 2008 (2008-04-24)	1-12, 15, 17
Y	paragraph [0079] - paragraph [0126]; figures 1-5	13, 14, 16, 18-25

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2023/051164

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2021111575 A1	15-04-2021	CA 3103590 A1	15-04-2021
		US 2021111575 A1	15-04-2021
		US 2021226461 A1	22-07-2021

WO 2019154811 A1	15-08-2019	AU 2019217497 A1	13-08-2020
		CA 3090194 A1	15-08-2019
		CN 111698916 A	22-09-2020
		DK 3749121 T3	21-03-2022
		EP 3749121 A1	16-12-2020
		ES 2906425 T3	18-04-2022
		JP 2021512645 A	20-05-2021
		KR 20200116960 A	13-10-2020
		PH 12020551158 A1	07-06-2021
		PL 3749121 T3	02-05-2022
		RU 2765709 C1	02-02-2022
		US 2021145053 A1	20-05-2021
		WO 2019154811 A1	15-08-2019
		ZA 202005517 B	31-05-2023

WO 2017108268 A1	29-06-2017	CA 3005654 A1	29-06-2017
		CN 108289510 A	17-07-2018
		EP 3393278 A1	31-10-2018
		IL 259250 A	31-07-2018
		JP 6937758 B2	22-09-2021
		JP 2019505192 A	28-02-2019
		KR 20180091831 A	16-08-2018
		RU 2018125861 A	23-01-2020
		US 2022322491 A1	06-10-2022
		WO 2017108268 A1	29-06-2017

EP 2805636 A2	26-11-2014	CA 2833132 A1	18-10-2012
		CN 103687503 A	26-03-2014
		EA 201391511 A1	30-06-2014
		EP 2696711 A2	19-02-2014
		EP 2805636 A2	26-11-2014
		JP 2014516624 A	17-07-2014
		KR 20140047601 A	22-04-2014
		RU 2014110005 A	20-09-2015
		US 2014034071 A1	06-02-2014
		US 2017215482 A1	03-08-2017
		US 2018255837 A1	13-09-2018
		US 2021022394 A1	28-01-2021
		US 2023008018 A1	12-01-2023
WO 2012142293 A2	18-10-2012		

US 2011226236 A1	22-09-2011	AT 507187 A4	15-03-2010
		AT 507188 A4	15-03-2010
		CN 102264249 A	30-11-2011
		CN 102264420 A	30-11-2011
		CN 105919162 A	07-09-2016
		CN 105963833 A	28-09-2016
		EP 2358223 A1	24-08-2011
		EP 2358418 A1	24-08-2011
		EP 3117860 A1	18-01-2017
		EP 3284500 A1	21-02-2018
		EP 3527086 A1	21-08-2019
		EP 3738632 A1	18-11-2020
		EP 4026440 A1	13-07-2022

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2023/051164

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
		EP 4162823 A1	12-04-2023	
		ES 2588985 T3	08-11-2016	
		ES 2649363 T3	11-01-2018	
		ES 2720054 T3	17-07-2019	
		ES 2805877 T3	15-02-2021	
		ES 2911514 T3	19-05-2022	
		ES 2936139 T3	14-03-2023	
		HK 1231420 A1	22-12-2017	
		HU E028517 T2	28-12-2016	
		HU E043017 T2	29-07-2019	
		HU E050043 T2	30-11-2020	
		HU E058124 T2	28-07-2022	
		JP 5612585 B2	22-10-2014	
		JP 5969559 B2	17-08-2016	
		JP 6359053 B2	18-07-2018	
		JP 6736605 B2	05-08-2020	
		JP 2012506263 A	15-03-2012	
		JP 2015013192 A	22-01-2015	
		JP 2016190071 A	10-11-2016	
		JP 2018153650 A	04-10-2018	
		JP 2020179211 A	05-11-2020	
		PL 2358223 T3	30-03-2018	
		PL 2358418 T3	30-12-2016	
		PL 3117860 T3	30-08-2019	
		PL 3284500 T3	16-11-2020	
		PL 3527086 T3	06-03-2023	
		PL 3738632 T3	30-05-2022	
		RU 2011120430 A	27-11-2012	
		US 2011226236 A1	22-09-2011	
		US 2014283825 A1	25-09-2014	
		US 2014299125 A1	09-10-2014	
		US 2017197043 A1	13-07-2017	
		US 2017197044 A1	13-07-2017	
		US 2017197046 A1	13-07-2017	
		US 2021077752 A1	18-03-2021	
		US 2021146067 A1	20-05-2021	
		WO 2010045670 A1	29-04-2010	
		WO 2010045671 A1	29-04-2010	
<hr style="border-top: 1px dashed black;"/>				
US 2008092912	A1	24-04-2008	CN 101557728 A	14-10-2009
			CY 1122411 T1	27-01-2021
			DK 3398460 T3	22-07-2019
			DK 3491944 T3	08-06-2020
			EP 2083643 A1	05-08-2009
			EP 3260002 A1	27-12-2017
			EP 3266322 A1	10-01-2018
			EP 3345496 A1	11-07-2018
			EP 3398460 A1	07-11-2018
			EP 3491944 A1	05-06-2019
			EP 3494819 A1	12-06-2019
			EP 3508076 A1	10-07-2019
			EP 3677129 A1	08-07-2020
			EP 3831225 A1	09-06-2021
			ES 2646180 T3	12-12-2017
			ES 2735215 T3	17-12-2019
			ES 2795364 T3	23-11-2020
			ES 2862174 T3	07-10-2021
			ES 2862208 T3	07-10-2021

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2023/051164

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		HK 1248477 A1	19-10-2018
		HK 1249373 A1	02-11-2018
		HK 1258137 A1	08-11-2019
		HU E044786 T2	28-11-2019
		HU E049177 T2	28-09-2020
		HU E054098 T2	30-08-2021
		HU E054433 T2	28-09-2021
		JP 5247711 B2	24-07-2013
		JP 2010506594 A	04-03-2010
		LT 3398460 T	10-09-2019
		LT 3491944 T	25-06-2020
		PL 3260002 T3	26-07-2021
		PL 3345496 T3	27-09-2021
		PL 3398460 T3	30-09-2019
		PL 3491944 T3	05-10-2020
		PT 3398460 T	18-07-2019
		PT 3491944 T	02-06-2020
		SI 3398460 T1	30-10-2019
		SI 3491944 T1	30-09-2020
		TR 201910343 T4	22-07-2019
		US 2008092912 A1	24-04-2008
		US 2010200006 A1	12-08-2010
		US 2012060853 A1	15-03-2012
		US 2015040930 A1	12-02-2015
		US 2015047656 A1	19-02-2015
		US 2017020200 A1	26-01-2017
		US 2018146713 A1	31-05-2018
		US 2018235285 A1	23-08-2018
		US 2018235286 A1	23-08-2018
		US 2019142070 A1	16-05-2019
		US 2019166916 A1	06-06-2019
		US 2019166917 A1	06-06-2019
		US 2021352954 A1	18-11-2021
		US 2022167656 A1	02-06-2022
		US 2022256907 A1	18-08-2022
		WO 2008108889 A1	12-09-2008
