



(51) International Patent Classification:
A24F 47/00 (2006.01)

(21) International Application Number:
PCT/EP2016/057069

(22) International Filing Date:
31 March 2016 (31.03.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1505600.5 31 March 2015 (31.03.2015) GB

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

(72) Inventors: **SUTTON, Joseph**; c/o British American Tobacco (Investments) Limited, Globe House, 1 Water Street, London Greater London WC2R 3LA (GB). **WOODCOCK, Dominic**; c/o Globe House, 1 Water Street, London Greater London WC2R 3LA (GB). **SEYMOUR, Darren**; c/o PA Consulting Holdings Limited, 123 Buckingham Palace Road, London Greater London SW1W 9SR (GB). **VALLABH, Hitesh**; c/o PA Consulting Holdings Limited, 123 Buckingham Palace Road, London Greater London SW1W 9SR (GB). **LITTEN, Neil**; c/o PA Consulting Holdings Limited, 123 Buckingham Palace Road, London Greater London SW1W 9SR (GB). **SINGH, Harpal**; c/o PA Consulting Holdings Limited, 123 Buckingham Palace Road, London Greater London SW1W 9SR

(GB). **RUSSELL, David**; c/o PA Consulting Holdings Limited, 123 Buckingham Palace Road, London Greater London SW1W 9SR (GB). **BITAR, Ahmad**; c/o PA Consulting Holdings Limited, 123 Buckingham Palace Road, London Greater London SW1W 9SR (GB).

(74) Agent: **EIP**; Fairfax House, 15 Fulwood Place, London Greater London WC1V 6HU (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, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, 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, 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))

(54) Title: APPARATUS FOR HEATING SMOKABLE MATERIAL AND ARTICLE FOR USE THEREWITH

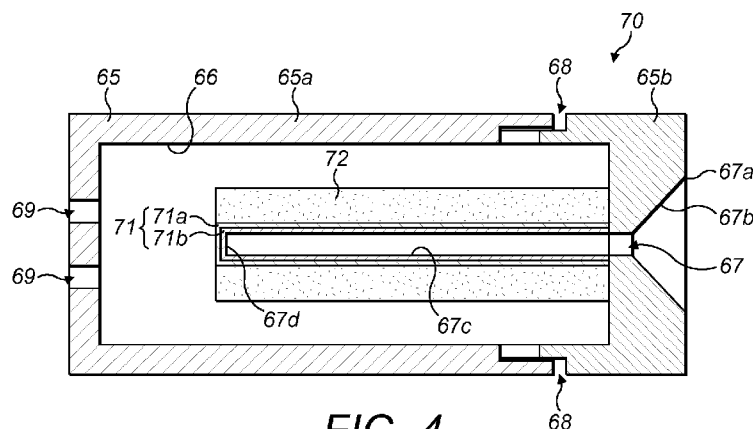


FIG. 4

(57) Abstract: An apparatus (1) is provided for heating smokable material (52) to volatilise at least one component of the smokable material (52). The apparatus (1) has a heater (24) and a magnetic field generator (26) for generating a magnetic field for attracting magnetically-attractable material towards the heater (24). There is also provided an article (50) for use with apparatus (1) for heating smokable material (52) to volatilise at least one component of the smokable material (52). The article (50) has a carrier (51) and smokable material (52) arranged on the carrier (51). The carrier (51) has a permanent magnet to enable the article (50) to be attracted by a magnetic field generator (26) of an apparatus (1) for heating the smokable material (52).

APPARATUS FOR HEATING SMOKABLE MATERIAL
AND ARTICLE FOR USE THEREWITH

Technical Field

5 The present invention relates to apparatus for heating smokable material to volatilise at least one component of the smokable material and to an article for use with an apparatus for heating smokable material.

Background

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

Summary

20 A first aspect of the present invention provides apparatus for heating smokable material to volatilise at least one component of the smokable material, the apparatus comprising:

a heater; and

a magnetic field generator for generating a magnetic field for attracting magnetically-attractable material towards the heater.

25

In an exemplary embodiment, the magnetic field generator comprises an electromagnet.

In an exemplary embodiment, the apparatus comprises a controller for causing
30 heating of the heater simultaneously with generation of the magnetic field by the magnetic field generator.

In an exemplary embodiment, the apparatus comprises a controller for causing heating of the heater and for causing generation of the magnetic field by the magnetic field generator independently of the heating of the heater.

5 In an exemplary embodiment, the heater comprises electrically-conductive material, and the heater is heatable by passing an electric current through the electrically-conductive material.

10 In an exemplary embodiment, the apparatus defines a recess for receiving an article or cartridge comprising a magnetically-attractable carrier and smokable material arranged on the carrier, and the heater is in a heating device that projects into the recess.

In an exemplary embodiment, the magnetic field generator is in the heating device.

15 In an exemplary embodiment, the apparatus defines an opening into the recess at a first end of the recess, and the heating device projects into the recess from a second end of the recess.

20 A second aspect of the present invention provides an article for use with apparatus for heating smokable material to volatilise at least one component of the smokable material, the article comprising:

a carrier; and

smokable material arranged on the carrier;

25 the carrier comprising a permanent magnet to enable the article to be attracted by a magnetic field generator of an apparatus for heating the smokable material.

In an exemplary embodiment, the carrier is ferromagnetic or ferrimagnetic.

30 In an exemplary embodiment, the carrier is made of one or more materials selected from the group consisting of: metal, iron, nickel, cobalt, a metal alloy, a metal

oxide, an iron alloy, a nickel alloy, a cobalt alloy, neodymium, gadolinium, ferrite, magnetite, lodestone, and a rare earth magnet.

5 In an exemplary embodiment, the carrier is for conducting heat through the carrier towards the smokable material.

In an exemplary embodiment, the smokable material is bonded to the carrier.

10 In an exemplary embodiment, the smokable material is bonded by an adhesive to the carrier.

In an exemplary embodiment, the carrier comprises a first layer of material and a second layer of material attached to the first layer of material, and the smokable material is in contact with the first layer of material.

15 In an exemplary embodiment, the smokable material is more readily bondable or adherable to the material of the first layer of material than to the material of the second layer of material.

20 In an exemplary embodiment, the material of the second layer of material is more magnetically-attractable than the material of the first layer of material.

In an exemplary embodiment, the material of the second layer of material is more rigid or more robust than the material of the first layer of material.

25 In an exemplary embodiment, the carrier has a thickness of no more than 300 micrometres.

In an exemplary embodiment, the smokable material comprises tobacco.

30

There is also provided a cartridge for use with apparatus for heating smokable material to volatilise at least one component of the smokable material, the cartridge comprising an article as described above.

5 In an exemplary embodiment, the cartridge comprises a housing defining a chamber, the carrier defines part of an exterior surface of the cartridge, and the smokable material is located within the chamber.

10 In an exemplary embodiment, the housing has an air flow inlet extending therethrough for admitting air into the chamber from an exterior of the housing.

 In an exemplary embodiment, the housing has a volatilised material outlet extending therethrough for permitting volatilised material to pass from the chamber out of the housing.

15 In an exemplary embodiment, the exterior surface of the cartridge comprises a cavity for receiving a heating device for heating the smokable material, and the carrier defines at least part of the cavity.

20 There is also provided a kit comprising an article as described above or a cartridge as described above, and apparatus having a heating device comprising a heater for heating the smokable material to volatilise at least one component of the smokable material.

25 In an exemplary embodiment, the apparatus is for heating the smokable material to volatilise the at least one component of the smokable material without combusting the smokable material.

30 In an exemplary embodiment, the apparatus comprises a controller for controlling heating of the heater so as to cause heating of the smokable material to volatilise the at least one component of the smokable material without combusting the smokable material.

In an exemplary embodiment, the apparatus defines a recess for receiving the article or cartridge, and the heating device projects into the recess.

5 In an exemplary embodiment, the apparatus defines an opening into the recess at a first end of the recess, and the heating device projects into the recess from a second end of the recess.

10 In an exemplary embodiment, the apparatus is according to the first aspect of the present invention, and the magnetic field generator of the apparatus is for generating a magnetic field for attracting the magnetically-attractable carrier towards the heater.

15 In an exemplary embodiment, the exterior surface of the cartridge comprises a cavity for receiving a heating device for heating the smokable material, the carrier defines at least part of the cavity, the heating device of the apparatus is insertable into the cavity of the cartridge, and the cavity is sized and shaped relative to the heating device of the apparatus so that a space exists between the heating device and the carrier as the heating device is inserted into the cavity.

20 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:

25 Figure 1 shows a schematic cross-sectional view of an example of an article for use with apparatus for heating smokable material to volatilise at least one component of the smokable material;

30 Figure 2 shows a schematic cross-sectional view of an example of another article for use with apparatus for heating smokable material to volatilise at least one component of the smokable material;

Figure 3 shows a schematic cross-sectional view of an example of a cartridge for use with apparatus for heating smokable material to volatilise at least one component of the smokable material;

5 Figure 4 shows a schematic cross-sectional view of an example of another cartridge for use with apparatus for heating smokable material to volatilise at least one component of the smokable material;

10 Figure 5 shows a partially cut-away perspective view of an example of an apparatus for heating smokable material to volatilise at least one component of the smokable material;

 Figure 6 shows a schematic view of a heating device of the apparatus of Figure 5; and

15 Figure 7 shows a schematic view of a heating device of another apparatus for heating smokable material to volatilise at least one component of the smokable material.

Detailed Description

20 As used herein, the term “smokable material” includes materials that provide volatilised components upon heating, typically in the form of an aerosol. “Smokable material” may be a non-tobacco-containing material or a tobacco-containing material. “Smokable material” may, for example, include one or more of tobacco per se, tobacco derivatives, expanded tobacco, reconstituted tobacco, tobacco extract, homogenised tobacco or tobacco substitutes. The smokable material can be in the form of ground tobacco, cut rag tobacco, extruded tobacco, gel or agglomerates. “Smokable material” also may include other, non-tobacco, products, which, depending on the product, may or may not contain nicotine.

30 As used herein, “polyimide” refers to any polymer comprising or substantially formed of imide monomers and may be saturated or unsaturated. The polyimide may be hydrophobic.

Referring to Figure 1 there is shown a schematic cross-sectional view of an example of an article 40 according to an embodiment of the invention. The article 40 comprises a carrier 41 and smokable material 42 arranged on the carrier 41. In this embodiment, the smokable material 42 is bonded by an adhesive (not shown) to the carrier 41. In other embodiments, the smokable material 42 may be bonded to, or arranged on, the carrier 41 by some other mechanism.

The article 40 is usable with apparatus for heating smokable material to volatilise at least one component of the smokable material, such as the apparatus 1 shown in Figure 5. The carrier 41 should be robust enough to withstand contact with a heating device 20 of the apparatus 1 in use. The carrier 41 should also be resistant to heat at least over the expected range of temperatures of the heating device 20 of the apparatus 1 that will arise in operation, such as for example 150 to 300 degrees Celsius or 170 to 220 degrees Celsius, as discussed below, and should not degrade when subjected to such operation temperatures. In this embodiment, the carrier 41 is for conducting heat through the carrier 41 towards the smokable material 42. In this embodiment, the carrier 41 has a thickness of about 300 micrometres. In other embodiments, the thickness of the carrier 41 may be other than 300 micrometres, such as less than 300 micrometres. In some embodiments, by providing that the carrier 41 has a thickness of no more than 300 micrometres, the thermally-resistivity of the carrier 41 is decreased as compared to a carrier 41 of greater thickness, and the quantity of material required to make the carrier 41 is less than is required to make a carrier 41 of greater thickness.

The carrier 41 is a magnetically-attractable carrier 41. That is, the carrier 41 comprises material for causing the carrier 41 to be attractable by a magnet. In this embodiment, the carrier 41 is ferromagnetic. However, in other embodiments this may not be true. In some embodiments, the carrier 41 may be ferrimagnetic. In this embodiment, the carrier 41 is made of nickel. However, in respective variations to this embodiment, the carrier 41 may be made of one or more materials selected from the group consisting of: metal, iron, nickel, cobalt, a metal alloy, a metal oxide, an iron

alloy, a nickel alloy, a cobalt alloy, neodymium, gadolinium, ferrite, magnetite, lodestone, and a rare earth magnet. Although not the case in this embodiment, in some variations to this embodiment, the carrier 41 may comprise a magnet, such as a permanent magnet.

5

By providing that the carrier 41 is a magnetically-attractable carrier 41, when the article 40 is used with the apparatus 1 shown in Figure 5 and described below, the carrier 41 is attracted towards the heater 24 of the apparatus 1 by the magnetic field generated by the magnetic field generator 26 of the apparatus 1, as described in more detail below. This helps to create surface contact between the heater 24 and the carrier 41, which enables efficient conduction of heat from the heater 24 to the carrier 41 in order to heat the smokable material 42. In turn, this may provide more efficient volatilisation of at least one component of the smokable material 42. The carrier 41 should be magnetically-attractable over the expected range of temperatures of the heating device 20 of the apparatus 1 that will arise in operation, such as for example 150 to 300 degrees Celsius or 170 to 220 degrees Celsius, as discussed below.

Referring to Figure 2 there is shown a schematic cross-sectional view of an example of another article 50 according to an embodiment of the invention. The article 50 comprises a carrier 51 and smokable material 52 arranged on the carrier 51. The article 50 of Figure 2 is the same as the article 40 of Figure 1 except for the form of the carrier 51.

In this embodiment, the carrier 51 comprises a first layer of material 51a and a second layer of material 51b attached to the first layer of material 51a. The smokable material 52 is in contact with the first layer of material 51a. In this embodiment, the material of the first layer of material 51a comprises one or more of a paper, such as reconstituted tobacco paper, a polymer, and a plastics material. In this embodiment, the material of the second layer of material 51b is magnetically-attractable. In this embodiment, the material of the second layer of material 51b is ferromagnetic. However, in other embodiments this may not be true. In some embodiments, the material of the second layer of material 51b may be ferrimagnetic. In this embodiment,

the material of the second layer of material 51b is nickel. However, in respective variations to this embodiment, the second layer of material 51b may be made of one or more of the materials discussed above for the carrier 41. Although not the case in this embodiment, in some variations to this embodiment, the second layer of material 51b
5 may comprise a magnet, such as a permanent magnet.

In some embodiments, such as that of Figure 2, the smokable material 52 may be more readily bondable or adherable to the material of the first layer of material 51a than to the material of the second layer of material 51b. In some embodiments, such as
10 that of Figure 2, the material of the second layer of material 51b may be more magnetically-attractable than the material of the first layer of material 51a. In some embodiments, such as that of Figure 2, the material of the second layer of material 51b may be more rigid or robust than the material of the first layer of material 51a. Thus, in some embodiments, the first layer of material 51a may facilitate adhering the
15 smokable material 52 to the carrier 51, and the second layer of material 51b may make the carrier 52 magnetically-attractable and more rigid or robust.

In some embodiments, the article 40, 50 is incorporated into a cartridge for use with apparatus for heating smokable material to volatilise at least one component of the
20 smokable material. Referring to Figure 3 there is shown a schematic cross-sectional view of an example of such a cartridge 60 according to an embodiment of the invention. The cartridge 60 is usable with apparatus for heating smokable material to volatilise at least one component of the smokable material, such as the apparatus 1 shown in Figure 5 and described below.

25

The cartridge 60 comprises a housing 65 defining a chamber 66. In this embodiment, the housing 65 comprises a first housing part 65a and a second housing part 65b that is non-unitary with the first housing part 65a. The first and second housing parts 65a, 65b may be made of any suitable material, such as a plastics material. The
30 first housing part 65a is attached to the second housing part 65b, such as by a snap-fit connection, adhesive, or the like. In other embodiments, the housing 65 may have a

different form. For example, in some embodiments the first and second housing parts 65a, 65b may be unitary, such as following welding, e.g. sonic welding.

5 In this embodiment, air flow inlets 68 extend through the housing 65 for admitting air into the chamber 66 from an exterior of the housing 65. In other embodiments, there may be only one air flow inlet 68 in place of the plurality of air flow inlets 68. In this embodiment, apertures 69 extend through the housing 65. Each of the apertures 69 is a volatilised material outlet 69 for permitting volatilised material generated within the chamber 66 by heating of the smokable material 62 to pass from
10 the chamber 66 out of the housing 65. In other embodiments, there may be only one aperture 69 in place of the plurality of apertures 69.

In this embodiment, the cartridge 60 comprises an article 50 that corresponds to the article 50 of Figure 2. In this embodiment, the exterior surface of the cartridge 60
15 comprises a cavity 67 for receiving a heating device 20 of the apparatus 1 for heating the smokable material 52 in use. The “exterior surface” may be a surface that envelops the rest of the cartridge 60, or that delineates the cartridge 60. The exterior surface of the cartridge 60 comprises a portion that is recessed to provide the cavity 67. In this embodiment, the carrier 51 defines part of the cavity 67. Thus, the carrier 51 defines
20 part of the exterior surface of the cartridge 60.

In this embodiment, the cavity 67 has a mouth 67a, first and second trunk sections 67b, 67c, and a closed end 67d. The cavity 67 has a length extending from the mouth 67a to the closed end 67d, a width perpendicular to the length, and a height
25 perpendicular to the width and the length. The first trunk section 67b connects the mouth 67a to the second trunk section 67c, and the second trunk section 67c connects the first trunk section 67b to the closed end 67d. In this embodiment, the second trunk section 67c is of constant, or substantially constant, cross-sectional shape and size (for example, the width, the height, the diameter, the dimension, or the area) throughout its
30 length between the first trunk section 67b and the closed end 67d. On the other hand, a cross-sectional size (for example, the width, the height, the diameter, the dimension, or the area) of the first trunk section 67b decreases with distance from the mouth 67a

so as to have a tapered profile. The tapered profile helps a user to guide the heating device 20 into the cavity 67 in use.

Referring to Figure 4 there is shown a schematic cross-sectional view of an example of another cartridge 70 according to an embodiment of the invention. The cartridge 70 of Figure 4 is the same as the cartridge 60 of Figure 3, except for the respective forms of the magnetically-attractable carrier and smokable material. Like elements in Figures 3 and 4 are indicated with like reference numerals and will not be described again in detail in the interests of conciseness. The cartridge 70 of Figure 4 is usable with apparatus for heating smokable material to volatilise at least one component of the smokable material, such as the apparatus 1 shown in Figure 5 and described below.

The cartridge 70 of Figure 4 comprises a magnetically-attractable carrier 71 that defines and encircles part of the cavity 67. Thus, the carrier 71 defines part of an exterior surface of the cartridge 70. The cartridge 70 of Figure 4 also comprises smokable material 72 that is located within the chamber 66, and that is arranged on and encircles the carrier 71.

The carrier 71 comprises a first layer of material 71a and a second layer of material 71b attached to the first layer of material 71a. The smokable material 72 is in contact with the first layer of material 71a, and the second layer of material 71b defines the part of the cavity 67. In effect, the first layer of material 71a encircles the second layer of material 71b. In this embodiment, the material of the first layer of material 71a comprises one or more of a paper, such as reconstituted tobacco paper, a polymer, and a plastics material. In this embodiment, the material of the second layer of material 71b is magnetically-attractable. In this embodiment, the material of the second layer of material 71b is ferromagnetic. However, in other embodiments this may not be true. In some embodiments, the material of the second layer of material 71b may be ferrimagnetic. In this embodiment, the material of the second layer of material 71b is nickel. However, in respective variations to this embodiment, the second layer of material 71b may be made of one or more of the materials discussed above for the

carrier 41. Although not the case in this embodiment, in some variations to this embodiment, the second layer of material 71b may comprise a magnet, such as a permanent magnet.

5 In some embodiments, such as that of Figure 4, the smokable material 72 may be more readily bondable or adherable to the material of the first layer of material 71a than to the material of the second layer of material 71b. In some embodiments, such as that of Figure 4, the material of the second layer of material 71b may be more magnetically-attractable than the material of the first layer of material 71a. In some
10 embodiments, such as that of Figure 4, the material of the second layer of material 71b may be more rigid or robust than the material of the first layer of material 71a. Thus, in some embodiments, the first layer of material 71a may facilitate adhering the smokable material 72 to the carrier 71, and the second layer of material 71b may make the carrier 72 magnetically-attractable and more rigid or robust.

15 In each of the cartridges 60, 70 of Figures 3 and 4, the cavity 67 is sized and shaped relative to the heating device 20 of the apparatus 1 so that a space exists between the heating device 20 and the carrier 51, 71 as the heating device 20 is inserted into the cavity 67. Thus, the heating device 20 is insertable into the cavity 67 without contacting
20 the carrier 51, 71. Therefore, rubbing of the heating device 20 against the carrier 51, 71 during insertion of the heating device 20 is minimised or avoided. This can help reduce or avoid the carrier 51, 71 being torn or otherwise damaged by insertion of the heating device 20, and reduces wear of the heating device 20. In use, after the heating device 20 has been inserted into the cavity 67, the carrier 51, 71 is magnetically-
25 attracted towards a heater 24 of the heating device 20 by a magnetic field generated by the magnetic field generator 26 of the heating device 20, as discussed in more detail below. This helps to create surface contact between the heater 24 and the carrier 51, 71, which enables efficient conduction of heat from the heater 24 to the carrier 51, 71 in order to heat the smokable material 52, 72. In turn, this may provide more efficient
30 volatilisation of at least one component of the smokable material 52, 72.

In other embodiments, the cavity 67 may have a different shape. For example, in some embodiments, the cavity 67 is of constant, or substantially constant, cross-sectional shape and size (for example, the width, the height, the diameter, the dimension, or the area) throughout its length between the mouth 67a and the closed end 67d.

In each of the cartridges 60, 70 described above, the carrier 51, 71 defines part of an exterior surface of the cartridge 60, 70 by way of the carrier 51, 71 defining part of a cavity 67 comprised in the exterior surface of the cartridge 60, 70. In other embodiments, the carrier may define a part of an exterior surface of the cartridge that is not part of a cavity comprised in the exterior surface of the cartridge. That is, in some embodiments, the part of the exterior surface defined by the carrier 51, 71 may not comprise a recessed portion of the exterior surface.

In some embodiments in which the article is incorporated into a cartridge, the carrier may take any of the other forms discussed above, and the cartridge may take any of the other forms discussed above.

Referring to Figure 5, there is shown a partially cut-away perspective view of an example of an apparatus 1 for heating smokable material to volatilise at least one component of the smokable material according to an embodiment of the invention. The apparatus 1 is usable with the cartridges 60, 70 and variants thereof discussed above with reference to Figures 3 and 4. The apparatus 1 comprises a body 10 and a mouthpiece 30. The outward appearance of the apparatus 1 when assembled is defined by the combination of the body 10 and the mouthpiece 30.

The body 10 is generally tubular and elongate, has first and second opposite longitudinal ends 11, 12, and defines an interface for co-operating with the cartridge 60, 70. In this embodiment, the interface comprises a recess 13 for receiving the cartridge 60, 70. In other embodiments, the interface can take a different form, such as a shelf, a surface, or a projection, and optionally requires mechanical mating with the cartridge 60, 70 in order to co-operate with the cartridge 60, 70. The first longitudinal

end 11 of the body 10 defines an opening 14 into the recess 13 at a first end of the recess 13. The opening 14 is shaped and sized so that the cartridge 60, 70 is movable through the opening 14 to allow a user to insert the cartridge 60, 70 into the recess 13 and/or to remove the cartridge 60, 70 from the recess 13, as will be described in more detail below. The body 10 houses electrical components of the apparatus 1. The electrical components in this embodiment comprise an electrical power source 15, a controller 16, an actuator 17, and a heating device 20. In this embodiment, the heating device 20 comprises a support 22, the heater 24, and the magnetic field generator 26.

10 In this embodiment, the mouthpiece 30 is generally tubular and elongate and has first and second opposite longitudinal ends 31, 32. The mouthpiece 30 comprises an inlet 34 at the second longitudinal end 32 of the mouthpiece 30, an outlet 35 at the first longitudinal end 31 of the mouthpiece 30, and a channel 36 fluidly connecting the inlet 34 with the outlet 35. The second longitudinal end 32 of the mouthpiece 30
15 comprises a connector (not shown) that is releasably engageable with a connector (not shown) of the first longitudinal end 11 of the body 10, so as to connect the mouthpiece 30 to the body 10. In other embodiments, the mouthpiece 30 and the body 10 may be permanently connected, such as through a hinge or flexible member. When the apparatus 1 is in use, the first longitudinal end 31 of the mouthpiece 30 forms a first
20 longitudinal end of the apparatus 1, and the second longitudinal end 12 of the body 10 forms a second longitudinal end of the apparatus 1.

The mouthpiece 30 is locatable relative to the body 10 so as to cover the opening 14 into the recess 13. When the mouthpiece 30 is so located relative to the body 10,
25 the first longitudinal end 31 of the mouthpiece 30 forms the first longitudinal end of the apparatus 1, and the channel 36 of the mouthpiece 30 is in fluid communication with the recess 13 via the inlet 34 of the mouthpiece 30. In some embodiments, the mouthpiece 30 may include a feature that would contact the cartridge 60, 70 when the cartridge 60, 70 is in the recess 13, to press the cartridge 60, 70 into the recess 13 and
30 help ensure that the cartridge 60, 70 is correctly positioned relative to the heating device 20.

In this embodiment, the heating device 20 projects into the recess 13 from a second end of the recess. The heating device 20 extends along a longitudinal axis of the recess 13. In other embodiments, the heating device 20 may project into the recess 13 from other than the second end of the recess 13, such as from a side of the recess 13 that extends from the first end of the recess 13 to the second end of the recess 13. In some embodiments, the heating device 20 may form a side of the recess 13, rather than project into the recess 13 as such. The heating device 20 has a rectangular cross-sectional shape in a plane perpendicular to the axis. However, in other embodiments, the cross-sectional shape of the heating device 20 may be other than rectangular, such as square, elliptical, cylindrical or polygonal. The heating device 20 is for reception into the cavity 67 of the cartridge 60 shown in Figure 3 or the cavity 67 of the cartridge 70 shown in Figure 4. The heating device 20 has a length in the direction of the axis, a width perpendicular to the length, and a height perpendicular to the width and the length. The width and height of the heating device 20 are less than the width and height, respectively, of the cavities 67 of the cartridges 60, 70, to facilitate insertion of the heating device 20 into one of the cavities 67 as discussed above. The body 10 comprises a retainer 18 that is fixed to the heating device 20 so as to retain the heating device 20 in position relative to the body 10.

The support 22 is for supporting the heater 24 and, in this embodiment, the magnetic field generator 26. In this embodiment, the support 22 is an electrical insulator and is resistant to heat. More particularly, the support 22 is resistant to heat at least over the expected range of temperatures of the heater 24 that will arise in operation, such as for example 150 to 300 degrees Celsius or 170 to 220 degrees Celsius. In this embodiment, the support is a ceramic, but in other embodiments the support may be made from another material, such as polyimide. As discussed elsewhere herein, the controller 16 is in some embodiments arranged to ensure that the heater 24 is heated to a temperature within this range. Accordingly, the support 22 is able to withstand the heating of the heater 24 during use of the apparatus 1.

30

In this embodiment, the heater 24 comprises electrically-conductive material. In this embodiment, the electrically-conductive material is copper, but in other

embodiments the electrically-conductive material may comprise any one or more of a metal, a metal alloy, steel, stainless steel, copper and nichrome. In this embodiment, the electrically-conductive material has been etched in such a manner as to be patterned to provide electrically-conductive tracks. In other embodiments, the electrically-conductive material may be printed in such a manner as to be patterned, or may be patterned by some other process. In still further embodiments, the electrically-conductive material may be non-patterned. The heater 24 is heatable by passing an electric current through the electrically-conductive material. By suitably patterning the electrically-conductive material, a cross sectional area and length of an electric current flow-path in the electrically-conductive material are set, so that heating of the heater 24 can be achieved by passing a predetermined electric current through the electrically-conductive material.

In this embodiment, the magnetic field generator 26 comprises an electromagnet 26. In other embodiments, the magnetic field generator 26 may take a different form. For example, in some embodiments, the magnetic field generator 26 may be a permanent magnet. The magnetic field generator 26 is for generating a magnetic field for attracting magnetically-attractable material towards the heater 24. In this embodiment, the magnetic field generator 26 is arranged relative to the recess 13 and the heater 24 so that, when the cartridge 60, 70 is received in the recess 13 with the heating device 20 inserted in the cavity 67 of the cartridge 60, 70, the magnetic field generator 26 is for generating a magnetic field for attracting the magnetically-attractable carrier 51, 71 towards the heater 24. This helps to create surface contact between the heater 24 and the carrier 51, 71, which enables efficient conduction of heat from the heater 24 to the carrier 51, 71 in order to heat the smokable material 52, 72 arranged thereon. The magnetic field generator 26 should be for generating a magnetic field for attracting magnetically-attractable material towards the heater 24 over the expected range of temperatures of the heating device 20 of the apparatus 1 that will arise in operation, such as for example 150 to 300 degrees Celsius or 170 to 220 degrees Celsius.

Referring to Figure 6, there is shown a schematic view of the heating device 20 of the apparatus 1 of this embodiment. In this embodiment, the heater 24 is at a first surface of the heating device 20, and the support 22 forms a second, opposite surface of the heating device 20. Moreover, in this embodiment, the magnetic field generator 26 is located within the support 22 and out of direct contact with the heater 24. That is, within the housing device 20, the heater 24 is electrically insulated from the magnetic field generator 26 by material of the support 22. In other embodiments, this may not be true. In other embodiments, the heating device 20 may take a different form. For example, in some embodiments, the magnetic field generator 26 may form the second surface of the heating device 20, or may be at the first surface of the heating device 20 with the heater 24. In some embodiments, the magnetic field generator 26 may be separate or spaced from the heating device 20. In any event, the magnetic field generator 26 should be located relative to the heater 24 so as to be operable to generate a magnetic field for attracting magnetically-attractable material towards the heater 24.

15

In this embodiment, the electrical power source 15 is a rechargeable battery. In other embodiments, the electrical power source 15 may be other than a rechargeable battery, such as a non-rechargeable battery or a capacitor.

20

The controller 16 is for causing and controlling heating of the heater 24. More specifically, in this embodiment, the controller 16 is for controlling the supply of electrical power from the electrical power source 15 to the heater 24. In this embodiment, the controller 16 also is for controlling generation of the magnetic field by the magnetic field generator 26. More specifically, in this embodiment, the controller 16 is for controlling the supply of electrical power from the electrical power source 15 to the magnetic field generator 26.

25

In this embodiment, the controller 16 is for causing heating of the heater 24 simultaneously with generation of the magnetic field by the magnetic field generator 26. Thus, the controller 16 is operable to cause the heater 24 to heat at the same time as causing the magnetic field generator 26 to generate the magnetic field. The heater 24 may be connected to the controller 16 in series or in parallel with the magnetic field

30

generator 26. In some embodiments, the controller 16 may be for causing heating of the heater 24 and for causing generation of the magnetic field by the magnetic field generator 26 independently of the heating of the heater 24. Thus, the controller 16 may be operable to cause the heater 24 to heat independently of causing the magnetic field generator 26 to generate the magnetic field. In some embodiments, the controller 16 may be operable in the simultaneous and the independent mode, and the mode of operation of the controller 16 is selectable, such as by a user. In this embodiment, the controller 16 comprises an integrated circuit (IC), such as an IC on a printed circuit board (PCB). In other embodiments, the controller 16 may take a different form.

The controller 16 is operated in this embodiment by user-actuation of the actuator 17. The actuator 17 is located at the exterior of the body 10 and takes the form of a push-button. In other embodiments, a different form of actuator 17 may be provided, such as a toggle switch, a dial, or the like. Actuation of the actuator 17 by a user causes the controller 16 (a) to cause an electric current to be applied across the magnetic field generator 26, so as to cause the magnetic field generator 26 to generate the magnetic field, and (b) to cause an electric current to be applied across the electrically-conductive material of the heater 24, so as to cause the heater 24 to heat. Such actuation of the actuator 17 may cause completion of an electrical circuit in the controller 16.

As the electric current is so applied across the electrically-conductive material, the heater 24 heats up. In this embodiment, the electrical resistance of the electrically-conductive material changes as the temperature of the heater 24 increases. The controller 16 monitors the electrical resistance of the heated electrically-conductive material, and then adjusts the magnitude of the electrical current applied across the electrically-conductive material on the basis of the monitored electrical resistance as necessary, in order to ensure that the temperature of the heater 24 remains within the above-discussed temperature range of about 150 degrees Celsius to about 300 degrees Celsius, or about 170 degrees Celsius to about 220 degrees Celsius. Within this temperature range, the smokable material 52, 72 in the cartridge 60, 70 is heated sufficiently to volatilise at least one component of the smokable material 52, 72 without

combusting the smokable material 52, 72. Accordingly, the controller 16, and the apparatus 1 as a whole, is arranged to heat the smokable material 52, 72 to volatilise the at least one component of the smokable material 52, 72 without combusting the smokable material 52, 72. In other embodiments, the temperature range of heating may
5 be other than this range.

In other embodiments, the temperature of the heater 24 may be controlled in a different manner. For example, in some embodiments the controller 16 may monitor a current flow through the electrically-conductive material, or an output from a sensor for
10 sensing a temperature of, or proximate, the heater 24, and then adjust the magnitude of the electrical current applied across the electrically-conductive material on the basis of the monitored current flow as necessary, in order to ensure that the temperature of the heater remains within the above-discussed temperature range. Other ways of controlling the temperature of the heater 24 could be used in other embodiments.

15 In some embodiments, the heating device 20 may comprise a plurality of magnetic field generators and an associated plurality of heaters. In some such embodiments, the controller 16 may be for causing a first subset (e.g. one) of the magnetic field generators to generate a magnetic field for attracting magnetically-
20 attractable material towards a first subset (e.g. one) of the heaters, and for causing just the first subset of the heaters to become heated. On a future operation of the apparatus, the controller 16 may cause a second subset (e.g. one) of the magnetic field generators to generate a magnetic field for attracting magnetically-attractable material towards a second subset (e.g. one) of the heaters, and for causing just the second subset of the
25 heaters to become heated. Thus, when the apparatus is used with a cartridge comprising a plurality of charges, such as discrete charges, of smokable material that respectively align with the plurality of heaters when the cartridge co-operates with the interface of the apparatus, successive one(s) of the charges may be heated on successive operations of the apparatus.

30 Although not shown in the Figures, the body 10 has an inlet for admitting air into the apparatus 1 from an exterior of the apparatus 1, and the retainer 18 has a hole

therethrough which places the recess 13 in fluid communication with the inlet. Therefore, when the mouthpiece 30 is connected to the body 10 to assemble the apparatus 1, there is defined an overall flow path that extends from the exterior of the apparatus 1, then through the inlet, then through the hole in the retainer 18, then through the recess 13, then through the channel 36 of the mouthpiece 30 to the exterior of the apparatus 1.

An exemplary operation of the apparatus 1 of this embodiment will now be described. A user ensures that the mouthpiece 30 is at a location relative to the body 10 at which the cartridge 60, 70 is movable through the opening 14. The user then passes the cartridge 60, 70 through the opening 14 and into the recess 13, so as to locate the cartridge 60, 70 within the recess 13 with the heating device 20 in the cavity 67 of the cartridge 60, 70. The user then moves the mouthpiece 30 relative to the body 10 to a location at which the mouthpiece 30 covers the opening 14, with the first longitudinal end 31 of the mouthpiece 30 forming the first longitudinal end of the apparatus 1, and with the channel 36 of the mouthpiece 30 in fluid communication with the recess 13 via the inlet 34 of the mouthpiece 30. The mouthpiece 30 is retained at this location through engagement of the connector of the mouthpiece 30 with the connector of the body 10.

When the actuator 17 is subsequently actuated by the user, the controller 16 is operated to cause electric currents to be applied across the magnetic field generator 26 and across the electrically-conductive material of the heater 24. This application of the electric currents causes the magnetic field generator 26 to generate the magnetic field and to move the carrier 51, 71 of the cartridge 60, 70 towards the heater 24. In embodiments in which the carrier 51, 71 is flexible or bendable, this moving may comprise flexing or bending of the carrier 51, 71. The application of the electric currents also causes the heater 24 to heat up so as to heat the smokable material 52, 72 of the cartridge 60, 70. This causes at least one component of the smokable material 52, 72 to volatilise without combusting the smokable material 52, 72. The user draws on the outlet 35 of the mouthpiece 30. This causes a reduction in pressure in the recess 13, which causes air to be drawn into the recess 13 and the chamber 66 via the inlet of the body 10 and the hole in the retainer 18, in turn. Typically, this causes the volatilised

component(s) of the smokable material 52, 72 to be cooled, so that they condense to form an aerosol in the chamber 66. The user's continued drawing causes the aerosol to be drawn from the chamber 66 and into the user's mouth via the apertures 69 of the cartridge 60, 70 and the channel 36 of the mouthpiece 30. Each time air is drawn into
5 the chamber 66, aerosol is produced. This can be repeated until the volatile component(s) of the smokable material 52, 72 are exhausted.

When all, or substantially all, of the volatile component(s) of the smokable material 52, 62 of the cartridge 60, 70 has/have been spent, the user may move the
10 mouthpiece 30 relative to the body 10 to a location at which the cartridge 60, 70 is movable through the opening 14. The user may then remove the cartridge 60, 70 from the recess 13 via the opening 14. The user can subsequently insert another, unspent cartridge 60, 70 into the recess 13 and repeat the above process.

15 In some embodiments, the cartridge 60, 70 is retained in the recess 13 by the magnetic-attraction of the magnetic field on the carrier 51, 71. In some embodiments, the controller 16 is for causing the magnetic field generator 26 to cease generating the magnetic field at the same time as, or after, causing the heater 24 to cease heating. Such operations may be caused by user-actuation (or user-deactivation) of the actuator 17,
20 by the controller 16 determining that a predetermined time period has passed since the heater 24 began heating, or by the mouthpiece 30 being moved relative to the body 10. Accordingly, in some embodiments, the heater 24 and carrier 51, 71 have some time to cool before the user is able easily to remove the cartridge 60, 70 from the recess 13. This helps to reduce the risk of a user coming into contact with a hot surface during use
25 of the apparatus 1.

In a variation to the apparatus 1 discussed above with reference to Figures 5 and 6, the heating device 20 of the apparatus may take the form shown in Figure 7 while all other elements of the apparatus are as described above for the apparatus 1 of Figures 5
30 and 6. In this embodiment of the apparatus, the heater 24 comprises a first heater portion 24a and a second heater portion 24b. The first heater portion 24a is at the first surface of the heating device 20, and the second heater portion 24b is at the second,

opposite surface of the heating device 20. Moreover, in this embodiment, the magnetic field generator 26 is located within the support 22 and out of direct contact with the heater 24. That is, within the housing device 20, the first and second heater portions 24a, 24b are electrically insulated from the magnetic field generator 26 by material of the support 22. In this embodiment, the magnetic field generator 26 may be located relative to the first and second heater portions 24a, 24b so as to be operable to generate a magnetic field for attracting magnetically-attractable material towards each of the first and second heater portions 24a, 24b. The apparatus comprising the heating device 20 of Figure 7 is particularly suitable for use with the cartridge 70 shown in Figure 4. Each of the first and second heater portions 24a, 24b is operable to heat a respective portion of the carrier 71, and a respective portion of the smokable material 72 arranged thereon, at opposite sides of the cavity 67 of the cartridge 70.

While the apparatuses 1 discussed above are usable with the cartridges 60, 70 shown in Figures 3 and 4, the apparatuses 1 are also usable with the articles 40, 50 and variants thereof discussed above with reference to Figures 1 and 2. The magnetic field generator 26 of the apparatus 1 of Figures 5 and 6 is operable to generate a magnetic field for attracting the magnetically-attractable carrier 41, 51 of the articles 40, 50 towards the heater 24. Similarly, the magnetic field generator 26 of the apparatus described with reference to Figure 7 is operable to generate a magnetic field for attracting the magnetically-attractable carrier 41, 51 of the articles 40, 50 towards one of the first and second heater portions 24a, 24b.

In each of the above described embodiments, the smokable material 42, 52, 72 comprises tobacco. However, in respective variations to each of these embodiments, the smokable material 42, 52, 72 may consist of tobacco, may consist substantially entirely of tobacco, may comprise tobacco and smokable material other than tobacco, may comprise smokable material other than tobacco, or may be free of tobacco. In some embodiments, the smokable material 42, 52, 72 may include an aerosol forming agent, such as glycerol.

In each of the above described embodiments, the article or cartridge 40, 50, 60, 70 is a consumable article or cartridge. Once all, or substantially all, of the volatile components(s) of the smokable material 42, 52, 72 in the article or cartridge 40, 50, 60, 70 has/have been spent, the user may remove the article or cartridge 40, 50, 60, 70 from the apparatus 1 and dispose of the article or cartridge 40, 50, 60, 70. The user may subsequently re-use the apparatus 1 with another of the articles or cartridges 40, 50, 60, 70. However, in other respective embodiments, the article or cartridge 40, 50, 60, 70 may be non-consumable, and the apparatus 1 and the article or cartridge 40, 50, 60, 70 may be disposed of together once the volatile components(s) of the smokable material 42, 52, 72 has/have been spent.

In some embodiments, an apparatus 1 discussed above may be sold, supplied or otherwise provided separately from the article 40, 50 or cartridge 60, 70 with which the apparatus 1 is usable. However, in some embodiments, the apparatus 1 and one or more of the articles 40, 50 or cartridges 60, 70 may be provided together as a kit.

In order to address various issues and advance the art, the entirety of this disclosure shows by way of illustration and example various embodiments in which the claimed invention may be practised and which provide for superior apparatus for heating smokable material to volatilise at least one component of the smokable material, and superior articles and cartridges for use with such apparatus. 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 teach the claimed and otherwise disclosed features. 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 and/or spirit of the disclosure. Various embodiments may suitably comprise, consist of, or consist in essence of, various combinations of the disclosed elements, components, features, parts, steps, means, etc. The disclosure may include other inventions not presently claimed, but which may be claimed in future.

CLAIMS

1. Apparatus for heating smokable material to volatilise at least one component of the smokable material, the apparatus comprising:
5 a heater; and
a magnetic field generator for generating a magnetic field for attracting magnetically-attractable material towards the heater.
2. Apparatus according to claim 1, wherein the magnetic field generator comprises
10 an electromagnet.
3. Apparatus according to claim 1 or claim 2, comprising a controller for causing heating of the heater simultaneously with generation of the magnetic field by the magnetic field generator.
15
4. Apparatus according to any of claims 1 to 3, comprising a controller for causing heating of the heater and for causing generation of the magnetic field by the magnetic field generator independently of the heating of the heater.
- 20 5. Apparatus according to any of claims 1 to 4, wherein the apparatus defines a recess for receiving an article or cartridge comprising a magnetically-attractable carrier and smokable material arranged on the carrier, wherein the heater is in a heating device that projects into the recess.
- 25 6. Apparatus according to claim 5, wherein the magnetic field generator is in the heating device.
7. An article for use with apparatus for heating smokable material to volatilise at least one component of the smokable material, the article comprising:
30 a carrier; and
smokable material arranged on the carrier;

the carrier comprising a permanent magnet to enable the article to be attracted by a magnetic field generator of an apparatus for heating the smokable material.

8. An article according to claim 7, wherein the smokable material is bonded to the carrier.

9. An article according to claim 7 or claim 8, wherein the carrier comprises a first layer of material and a second layer of material attached to the first layer of material, wherein the smokable material is in contact with the first layer of material.

10. An article according to claim 9, wherein the material of the second layer of material is more magnetically-attractable than the material of the first layer of material.

11. A cartridge for use with apparatus for heating smokable material to volatilise at least one component of the smokable material, the cartridge comprising an article according to any of claims 7 to 10.

12. A cartridge according to claim 11, comprising a housing defining a chamber, wherein the carrier defines part of an exterior surface of the cartridge, and wherein the smokable material is located within the chamber.

13. A cartridge according to claim 12, wherein the housing has an air flow inlet extending therethrough for admitting air into the chamber from an exterior of the housing.

14. A cartridge according to claim 12 or claim 13, wherein the housing has a volatilised material outlet extending therethrough for permitting volatilised material to pass from the chamber out of the housing.

15. A cartridge according to any of claims 12 to 14, wherein the exterior surface of the cartridge comprises a cavity for receiving a heating device for heating the smokable material, and wherein the carrier defines at least part of the cavity.

16. A kit comprising an article according to any of claims 7 to 10 or a cartridge according to any of claims 11 to 15, and apparatus having a heating device comprising a heater for heating the smokable material to volatilise at least one component of the smokable material.

17. A kit according to claim 16, wherein the apparatus comprises a controller for controlling heating of the heater so as to cause heating of the smokable material to volatilise the at least one component of the smokable material without combusting the smokable material.

18. A kit according to claim 16 or claim 17, wherein the apparatus is according to any of claims 1 to 6, and the magnetic field generator of the apparatus is for generating a magnetic field for attracting the magnetically-attractable carrier towards the heater.

1 / 4

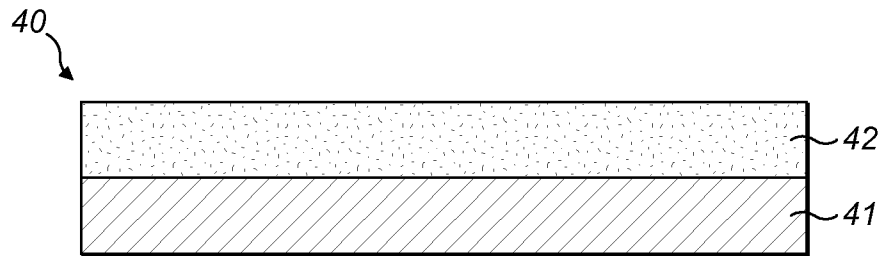


FIG. 1

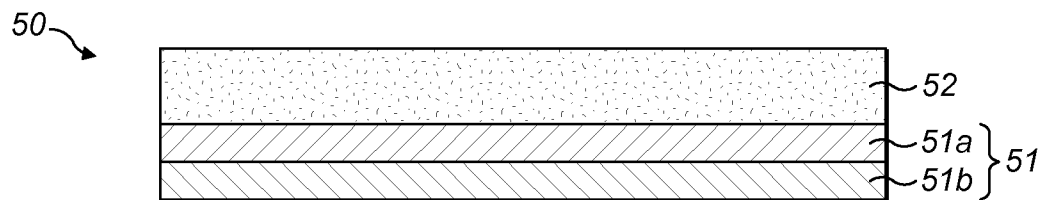


FIG. 2

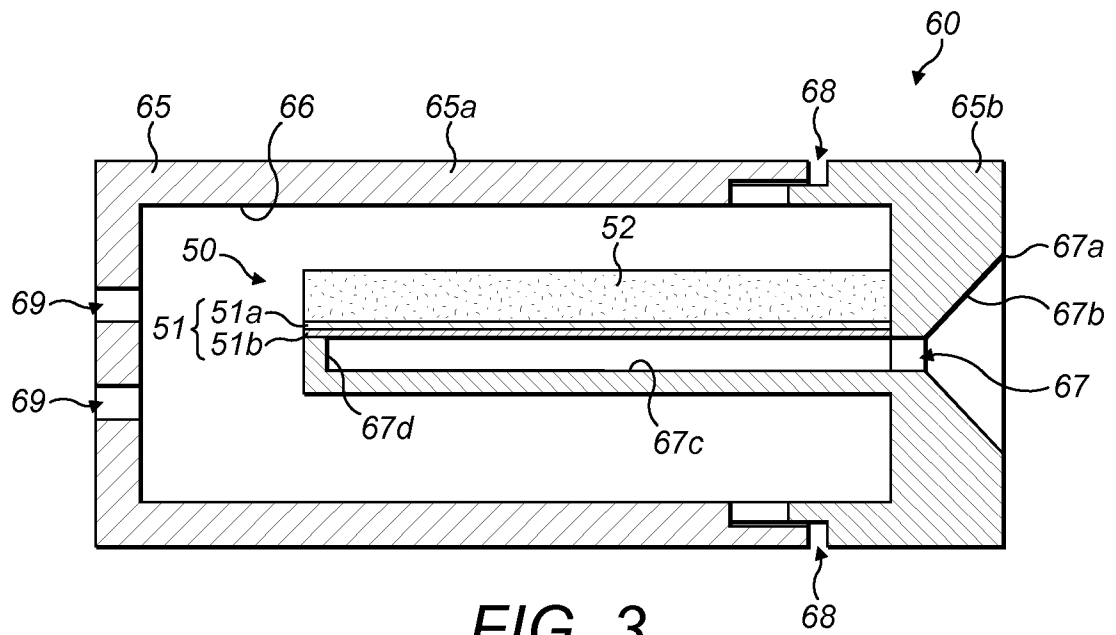


FIG. 3

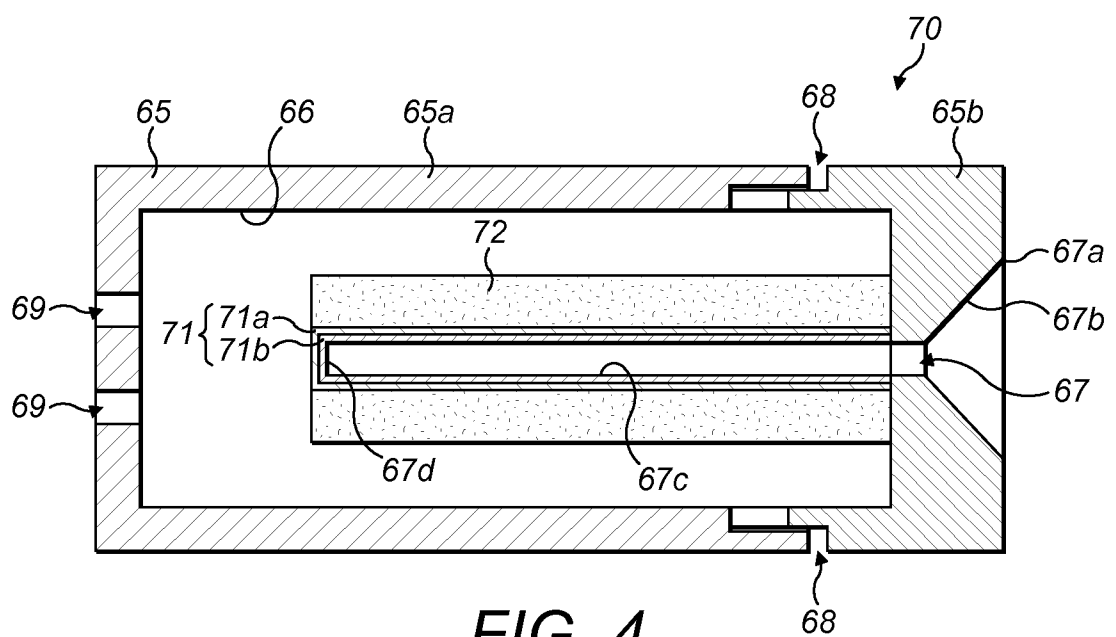


FIG. 4

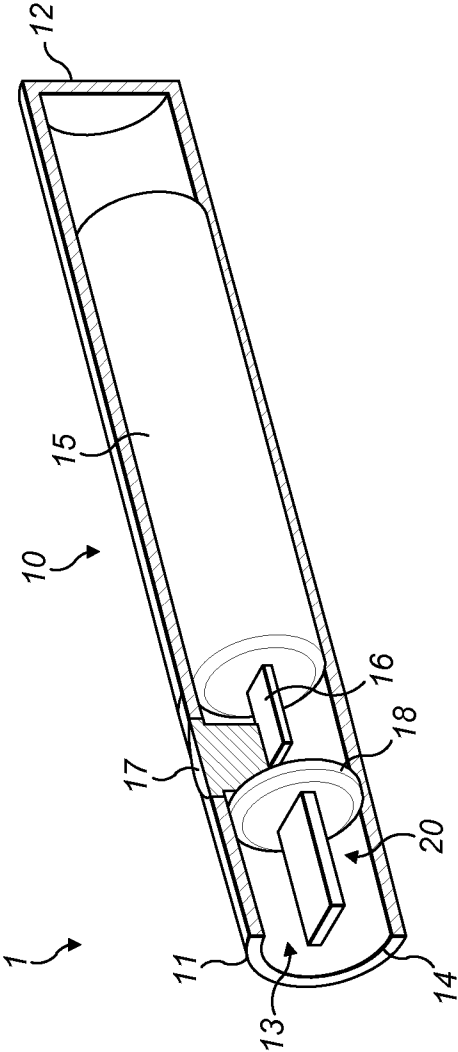
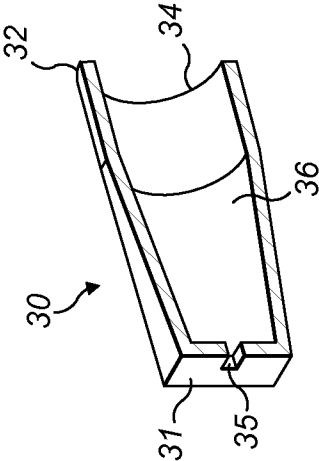


FIG. 5



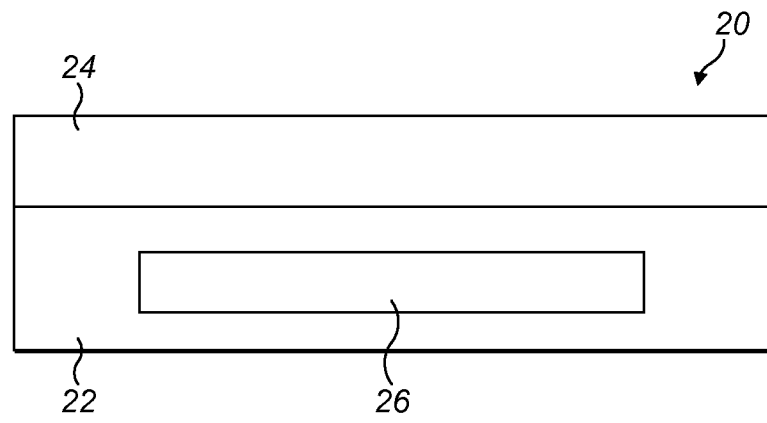


FIG. 6

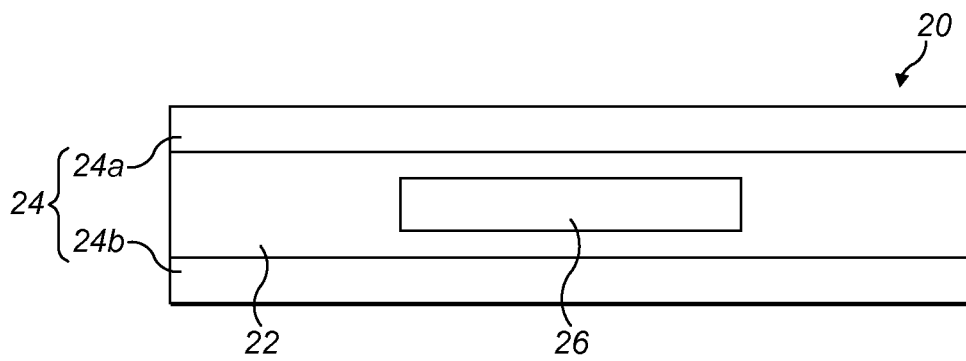


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2016/057069

A. CLASSIFICATION OF SUBJECT MATTER
 INV. A24F47/00
 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 2007/256697 A1 (YANG ZUYIN [US]) 8 November 2007 (2007-11-08)	1,3-6
A	paragraphs [0013] - [0016], [0018], [0020]; figures	2,7-18
A	----- US 2014/270730 A1 (DEPIANO JOHN [US] ET AL) 18 September 2014 (2014-09-18) paragraph [0044]; figure 1 -----	1



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

30 June 2016

Date of mailing of the international search report

12/07/2016

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

Kock, Søren

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2016/057069

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007256697 A1	08-11-2007	US 2005045193 A1	03-03-2005
		US 2007256697 A1	08-11-2007

US 2014270730 A1	18-09-2014	US 2014270730 A1	18-09-2014
		US 2016143364 A1	26-05-2016
