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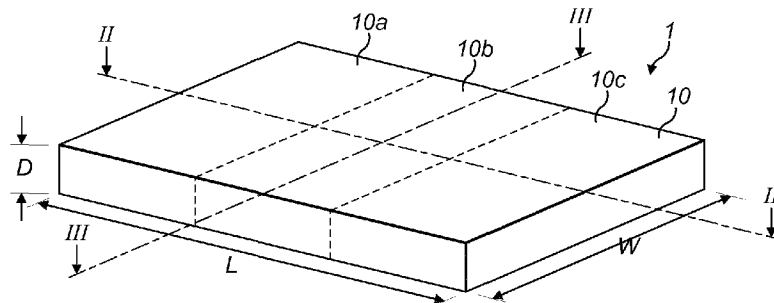


FIG. 1

(57) Abstract: Disclosed is an article (1, 2, 3) for use with apparatus (100, 200) for heating smokable material to volatilise at least one component of the smokable material. The article (1, 2, 3) comprises a mass of smokable material (10). An exterior of the article (1, 2, 3) has a length (L), a width (W) perpendicular to the length (L), and a depth (D) perpendicular to each of the length (L) and the width (W). The length (L) is greater than or equal to the width (W), and the width (W) is greater than the depth (D).

ARTICLE FOR USE WITH
APPARATUS FOR HEATING SMOKABLE MATERIAL

Technical Field

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The present invention relates to apparatus for heating smokable material to volatilise at least one component of the smokable material, to articles for use with such apparatus, and to systems comprising such apparatus and such articles.

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Background

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
15 such products are so-called “heat not burn” products or tobacco heating devices or products, which release compounds by heating, but not burning, material. The material may be, for example, tobacco or other non-tobacco products, which may or may not contain nicotine.

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Summary

A first 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, wherein the article comprises a mass of smokable material, and wherein an
25 exterior of the article has a length, a width perpendicular to the length, and a depth perpendicular to each of the length and the width, wherein the length is greater than or equal to the width, and wherein the width is greater than the depth.

In an exemplary embodiment, the mass of smokable material is fixed relative to
30 the exterior of the article.

In an exemplary embodiment, the depth of the exterior of the article is less than a half of the width of the exterior of the article. In an exemplary embodiment, the depth

of the exterior of the article is less than a quarter of the width of the exterior of the article.

5 In an exemplary embodiment, the article comprises a substrate, and the mass of smokable material is on the substrate.

10 In an exemplary embodiment, the substrate has a length, a width perpendicular to the length of the substrate, and a depth perpendicular to each of the length and the width of the substrate, wherein the length of the substrate is greater than or equal to the width of the substrate, and wherein the width of the substrate is greater than the depth of the substrate.

15 In an exemplary embodiment, the length, width and depth of the substrate are substantially parallel to the length, width and depth, respectively, of the exterior of the article.

In an exemplary embodiment, the substrate comprises heating material that is heatable by penetration with a varying magnetic field to heat the smokable material.

20 In an exemplary embodiment, the substrate consists entirely, or substantially entirely, of the heating material.

25 In an exemplary embodiment, the heating material comprises one or more materials selected from the group consisting of: an electrically-conductive material, a magnetic material, and a magnetic electrically-conductive material.

In an exemplary embodiment, the heating material comprises a metal or a metal alloy.

30 In an exemplary embodiment, the heating material comprises one or more materials selected from the group consisting of: aluminium, gold, iron, nickel, cobalt, conductive carbon, graphite, plain-carbon steel, stainless steel, ferritic stainless steel, copper, and bronze.

In an exemplary embodiment, a first portion of the substrate is more susceptible to eddy currents being induced therein by penetration with a varying magnetic field than a second portion of the substrate.

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In an exemplary embodiment, the article comprises a catalytic material on at least a portion of the substrate.

10 In an exemplary embodiment, the heating material is in contact with the smokable material.

In an exemplary embodiment, the heating material extends to opposite longitudinal ends of the mass of smokable material.

15 In an exemplary embodiment, the heating material extends to opposite lateral sides of the mass of smokable material.

In an exemplary embodiment, a portion of the substrate protrudes beyond an end of the mass of smokable material.

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In an exemplary embodiment, the substrate is within the mass of smokable material.

In an exemplary embodiment, the substrate comprises smokable material.

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In an exemplary embodiment, the substrate defines at least a portion of the exterior of the article.

30 In an exemplary embodiment, the mass of smokable material defines at least a portion of the exterior of the article.

In an exemplary embodiment, the article comprises a cover around the mass of smokable material. In an exemplary embodiment, the cover defines at least a portion

of the exterior of the article. In an exemplary embodiment, the cover may be made of paper, card, cardboard, or a plastics material.

In an exemplary embodiment, the smokable material comprises tobacco and/or
5 one or more humectants.

In an exemplary embodiment, the smokable material comprises reconstituted
smokable material, such as reconstituted tobacco. In an exemplary embodiment, the
smokable material is in the form of one of a gel, agglomerates, compressed material, or
10 bound material.

In an exemplary embodiment, the mass of smokable material comprises a
plurality of regions, wherein the smokable material in at least one of the regions has a
form or chemical composition that differs from the form or chemical composition,
15 respectively, of the smokable material of at least one other of the regions.

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

20 first and second bodies with a heating zone arranged therebetween, wherein the
first body is movable relative to the second body to compress the heating zone, wherein
the heating zone is for receiving at least a portion of an article comprising smokable
material; and

wherein one or each of the first and second bodies comprises at least a portion
25 of a magnetic field generator for generating a varying magnetic field to be used in
heating the smokable material when the portion of the article is located in the heating
zone.

In an exemplary embodiment, the first body is rotatable relative to the second
30 body to compress the heating zone.

In an exemplary embodiment, the portion of a magnetic field generator
comprises an electrically-conductive coil.

In an exemplary embodiment, the, or each, magnetic field generator is for generating a varying magnetic field that penetrates the heating zone.

5 In an exemplary embodiment, one or each of the first and second bodies comprises heating material that is heatable by penetration with a varying magnetic field to heat the heating zone.

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

a heating zone for receiving at least a portion of an article comprising smokable material, wherein the heating zone has a length, a width perpendicular to the length, and a depth perpendicular to each of the length and the width, wherein the length is greater
15 than or equal to the width, and wherein the width is greater than the depth; and

a magnetic field generator for generating a varying magnetic field to be used in heating the smokable material when the portion of the article is located in the heating zone.

20 In an exemplary embodiment, the magnetic field generator comprises an electrical power source that is offset from the heating zone in a direction parallel to the depth of the heating zone.

In an exemplary embodiment, the electrical power source has a length, a width
25 perpendicular to the length of the electrical power source, and a depth perpendicular to each of the length and the width of the electrical power source, wherein the length of the electrical power source is greater than or equal to the width of the electrical power source, and wherein the width of the electrical power source is greater than the depth of the electrical power source; and

30 wherein the length, width and depth of the electrical power source are substantially parallel to the length, width and depth, respectively, of the heating zone.

In an exemplary embodiment, the apparatus comprises first and second bodies, wherein the heating zone is defined by and is arranged between the first and second bodies, and wherein one or each of the first and second bodies comprises at least a portion of a magnetic field generator for generating a varying magnetic field to be used
5 in heating the smokable material when the portion of the article is located in the heating zone.

In an exemplary embodiment, the portion of a magnetic field generator comprises a two-dimensional electrically-conductive coil.
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In an exemplary embodiment, the apparatus comprises a third body comprising at least a portion of an electrical circuit;
wherein a first side of the second body is attached to the first body via a first element, and a second side of the second body is attached to the third body via a second
15 element; and
wherein the second body is between the first and third bodies.

A fourth aspect of the present invention provides a system, comprising:
apparatus for heating smokable material to volatilise at least one component of
20 the smokable material; and
an article for use with the apparatus, wherein the article comprises a mass of smokable material, and wherein an exterior of the article has a length, a width perpendicular to the length, and a depth perpendicular to each of the length and the width, wherein the length is greater than or equal to the width, and wherein the width is
25 greater than the depth;

wherein the apparatus comprises a heating zone for receiving at least a portion of the article, and a magnetic field generator for generating a varying magnetic field to be used in heating the smokable material when the portion of the article is in the heating zone.
30

In an exemplary embodiment, the apparatus comprises heating material that is heatable by penetration with the varying magnetic field to heat the smokable material when the portion of the article is located in the heating zone.

In an exemplary embodiment, the article comprises heating material that is heatable by penetration with the varying magnetic field to heat the smokable material when the portion of the article is located in the heating zone.

5

In an exemplary embodiment, the apparatus of the system is the apparatus of the second aspect of the present invention. The apparatus of the system may have any one or more of the features discussed above as being present in respective exemplary embodiments of the apparatus.

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In an exemplary embodiment, the apparatus of the system is the apparatus of the third aspect of the present invention. The apparatus of the system may have any one or more of the features discussed above as being present in respective exemplary embodiments of the apparatus.

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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:

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Figure 1 shows a schematic perspective 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;

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Figure 2 shows a schematic cross-sectional view of the article of Figure 1;

Figure 3 shows another schematic cross-sectional view of the article of Figure 1 taken at ninety degrees to the schematic cross-sectional view of Figure 2;

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Figure 4 shows a schematic perspective 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 5 shows a schematic perspective 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;

5 Figure 6 shows a schematic perspective view of a portion of an example of apparatus for heating smokable material to volatilise at least one component of the smokable material;

10 Figure 7 shows a schematic perspective view of a portion of an example of another apparatus for heating smokable material to volatilise at least one component of the smokable material in a partially disassembled state; and

Figure 8 shows a schematic perspective view of a portion of the apparatus of Figure 7 in a partially disassembled state.

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Detailed Description

As used herein, the term “smokable material” includes materials that provide volatilised components upon heating, typically in the form of vapour or 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, reconstituted tobacco, reconstituted smokable material, liquid, gel, gelled sheet, powder, or agglomerates, or the like. “Smokable material” also may include other, non-tobacco, products, which, depending on the product, may or may not contain nicotine. “Smokable material” may comprise one or more humectants, such as glycerol or propylene glycol.

30 As used herein, the term “heating material” or “heater material” refers to material that is heatable by penetration with a varying magnetic field.

As used herein, the terms "flavour" and "flavourant" refer to materials which, where local regulations permit, may be used to create a desired taste or aroma in a product for adult consumers. They may include extracts (e.g., liquorice, hydrangea, Japanese white bark magnolia leaf, chamomile, fenugreek, clove, menthol, Japanese
5 mint, aniseed, cinnamon, herb, wintergreen, cherry, berry, peach, apple, Drambuie, bourbon, scotch, whiskey, spearmint, peppermint, lavender, cardamom, celery, cascarilla, nutmeg, sandalwood, bergamot, geranium, honey essence, rose oil, vanilla, lemon oil, orange oil, cassia, caraway, cognac, jasmine, ylang-ylang, sage, fennel, piment, ginger, anise, coriander, coffee, or a mint oil from any species of the genus
10 Mentha), flavour enhancers, bitterness receptor site blockers, sensorial receptor site activators or stimulators, sugars and/or sugar substitutes (e.g., sucralose, acesulfame potassium, aspartame, saccharine, cyclamates, lactose, sucrose, glucose, fructose, sorbitol, or mannitol), and other additives such as charcoal, chlorophyll, minerals, botanicals, or breath freshening agents. They may be imitation, synthetic or natural
15 ingredients or blends thereof. They may be in any suitable form, for example, oil, liquid, gel, powder, or the like.

Induction heating is a process in which an electrically-conductive object is heated by penetrating the object with a varying magnetic field. The process is described
20 by Faraday's law of induction and Ohm's law. An induction heater may comprise an electromagnet and a device for passing a varying electrical current, such as an alternating current, through the electromagnet. When the electromagnet and the object to be heated are suitably relatively positioned so that the resultant varying magnetic field produced by the electromagnet penetrates the object, one or more eddy currents
25 are generated inside the object. The object has a resistance to the flow of electrical currents. Therefore, when such eddy currents are generated in the object, their flow against the electrical resistance of the object causes the object to be heated. This process is called Joule, ohmic, or resistive heating. An object that is capable of being inductively heated is known as a susceptor.

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It has been found that, when the susceptor is in the form of a closed circuit, magnetic coupling between the susceptor and the electromagnet in use is enhanced, which results in greater or improved Joule heating.

Magnetic hysteresis heating is a process in which an object made of a magnetic material is heated by penetrating the object with a varying magnetic field. A magnetic material can be considered to comprise many atomic-scale magnets, or magnetic dipoles. When a magnetic field penetrates such material, the magnetic dipoles align with the magnetic field. Therefore, when a varying magnetic field, such as an alternating magnetic field, for example as produced by an electromagnet, penetrates the magnetic material, the orientation of the magnetic dipoles changes with the varying applied magnetic field. Such magnetic dipole reorientation causes heat to be generated in the magnetic material.

When an object is both electrically-conductive and magnetic, penetrating the object with a varying magnetic field can cause both Joule heating and magnetic hysteresis heating in the object. Moreover, the use of magnetic material can strengthen the magnetic field, which can intensify the Joule heating.

In each of the above processes, as heat is generated inside the object itself, rather than by an external heat source by heat conduction, a rapid temperature rise in the object and more uniform heat distribution can be achieved, particularly through selection of suitable object material and geometry, and suitable varying magnetic field magnitude and orientation relative to the object. Moreover, as induction heating and magnetic hysteresis heating do not require a physical connection to be provided between the source of the varying magnetic field and the object, design freedom and control over the heating profile may be greater, and cost may be lower.

Referring to Figures 1, 2 and 3 there are shown a schematic perspective view and two schematic cross-sectional views taken at ninety degrees to each other, of an example of an article according to an embodiment of the invention. In this embodiment, the article 1 comprises a mass of smokable material 10 and a substrate 20, and the mass of smokable material 10 is arranged on the substrate 20. The article 1 is for use with apparatus for heating the smokable material 10 to volatilise at least one component of the smokable material 10 without burning the smokable material 10. Example such apparatus are described below.

The article 1 has an exterior, which may contact the apparatus in use. The exterior of the article 1 has a length L, a width W, and a depth D. The width W is perpendicular to the length L. The depth D is perpendicular to each of the length L and the width W. In this embodiment, the length L is greater than the width W, and the width W is greater than the depth D. In this embodiment, the exterior of the article 1 is a rectangular cuboid, so that the article 1 is elongate with a substantially rectangular cross-section. However, in other embodiments, the length L may be equal or substantially equal to the width W, so that the article 1 is not elongate as such. In some such embodiments, the exterior of the article 1 may be a square cuboid. In some embodiments, the exterior of the article 1 may be other than cuboid. For example, in some embodiments, some or all of the edges of the exterior of the article 1 may be bevelled or rounded. In some embodiments, the article 1 may have other than a substantially rectangular cross-section, such as an elliptical cross-section.

15

The mass of smokable material 10 is fixed relative to the exterior of the article 1. In this embodiment, the mass of smokable material 10 defines all of the exterior of the article 1. In other embodiments, some or all of the exterior of the article 1 may instead be defined by a component of the article 1 other than the mass of smokable material 10, such as a cover that may extend at least partially around the smokable material 10. Such a cover may be made of, for example, paper, card, cardboard, or a plastics material, or the like. Such a cover preferably would be permeable or have gaps therethrough. The cover may, for example, be made of a woven or non-woven material.

20

In this embodiment, the substrate 20 comprises heating material that is heatable by penetration with a varying magnetic field to heat the smokable material 10. Examples of such heating material are described below. In this embodiment, the substrate 20 is within the mass of smokable material 10. More specifically, in this embodiment, the substrate 20 is entirely enveloped or surrounded by the mass of smokable material 10. Therefore, as the heating material is heated by a varying magnetic field in use, heat dissipated from the heating material heats the mass of smokable material 10.

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In this embodiment, the substrate 20 is spaced from both opposite longitudinal ends of the mass of smokable material 10 and from opposite lateral sides of the mass of smokable material 10. This may help to ensure that heat generated in the substrate 20 is efficiently transferred to the smokable material. However, in other embodiments, the substrate 20 may extend to only one or to both of the opposite longitudinal ends of the mass of smokable material 10, and/or to only one or to both of the opposite lateral sides of the mass of smokable material 10. This can help to provide yet more uniform heating of the smokable material 10 in use. In some embodiments, a portion of the substrate 20 may protrude beyond an end, such as a longitudinal end, of the mass of smokable material 10 so as to form part of the exterior of the article 1, as described below with reference to Figure 5. The portion of the substrate 20 may be contactable by a temperature monitor of the apparatus with which the article 1 is usable, as discussed in more detail below. The portion of the substrate 20 may comprise or consist of the heating material.

15

Referring to Figure 4 there is shown a schematic perspective view of an example of another article according to an embodiment of the invention. The article 2 of this embodiment is identical to the article 1 of Figures 1 to 3, except for the form and location of the substrate 20 relative to the mass of smokable material 10. Any of the herein-described possible variations to the article 1 of Figures 1 to 3 may be made to the article 2 of Figure 4 to form separate respective embodiments. The article 2 is for use with apparatus for heating the smokable material 10 to volatilise at least one component of the smokable material 10 without burning the smokable material 10, such as one of the example apparatus described below.

20

The exterior of the article 2 again has a length L, a width W, and a depth D. The width W is perpendicular to the length L, and the depth D is perpendicular to each of the length L and the width W. In this embodiment, the length L is greater than the width W, and the width W is greater than the depth D. In this embodiment, the exterior of the article 2 is a rectangular cuboid, so that the article 2 is elongate with a substantially rectangular cross-section. However, as indicated above, any of the above-described possible variations to the article 1 of Figures 1 to 3 may be made to the article 2 of Figure 4 to form separate respective embodiments.

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The mass of smokable material 10 is fixed relative to the exterior of the article 2. However, in contrast to the article 1 of Figures 1 to 3, in this embodiment the mass of smokable material 10 defines only a portion of the exterior of the article 2. The substrate 20 defines another portion of the exterior of the article 2. In this embodiment, the exterior of the article 2 is defined by the combination of the mass of smokable material 10 and the substrate 20. However, in other embodiments, some or all of the exterior of the article 2 may instead be defined by a component of the article 2 other than the mass of smokable material 10 or substrate 20, such as a cover that may extend at least partially around the smokable material 10. Such a cover may be made of, for example, paper, card, cardboard, or a plastics material, or the like.

In this embodiment, the heating material of the substrate 20 is in contact with the smokable material 10. However, as opposed to the arrangement shown in Figures 1 to 3, in this embodiment, the substrate 20 is not within the mass of smokable material 10. Instead, the mass of smokable material 10 is located on one face of the substrate 20. The article 2 may thus be manufactured in a process that does not involve enveloping the substrate 20 in the smokable material 10, which may simplify manufacture.

In this embodiment, the heating material of the substrate 20 extends to opposite longitudinal ends of the mass of smokable material 10. This can help provide more uniform heating of the smokable material 10 in use, and may aid manufacture of the article 2. For example, the article 2 may be formed by cutting the article 2 from an elongate or larger assembly comprising smokable material on substrate material. However, in some embodiments, a portion of the substrate 20 may protrude beyond an end, such as a longitudinal end, of the mass of smokable material 10 so as to form part of the exterior of the article 2. The protruding portion of the substrate 20 may be contactable by a temperature monitor of the apparatus with which the article 2 is usable, as discussed in more detail below. The protruding portion of the substrate 20 may comprise or consist of the heating material.

Referring to Figure 5 there is shown a schematic perspective view of an example of another article according to an embodiment of the invention. The article 3 of this embodiment is identical to the article 1 of Figures 1 to 3, except for the form of the exterior of the article 3 and the form of the substrate 20 relative to the mass of smokable material 10. Any of the herein-described possible variations to the articles 1, 2 of Figures 1 to 4 may be made to the article 3 of Figure 5 to form separate respective embodiments. The article 3 is for use with apparatus for heating the smokable material 10 to volatilise at least one component of the smokable material 10 without burning the smokable material 10, such as one of the example apparatus described below.

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In this embodiment, the exterior of the article 3 again has a length L, a width W, and a depth D. The width W is perpendicular to the length L, and the depth D is perpendicular to each of the length L and the width W. In this embodiment, the length L is greater than the width W, and the width W is greater than the depth D. In this embodiment, the exterior of the article 3 is a rectangular cuboid, except that the elongate edges of the article 3 running in the direction of the length L of the article 3 are rounded. The article 3 is thus elongate with a substantially rounded-rectangular cross-section. In variations to this embodiment, the curved edges may instead be bevelled or right-angled edges. In some embodiments, the length L may be equal or substantially equal to the width W, so that the article 3 is not elongate as such. In some embodiments, the article 3 may have other than a round-rectangular cross-section, such as a substantially rectangular cross-section or an elliptical cross-section.

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The mass of smokable material 10 is fixed relative to the exterior of the article 2. However, in contrast to the article 2 of Figure 4, in this embodiment the mass of smokable material 10 defines only a small proportion of the exterior of the article 3. Similarly, the substrate 20 defines only a small proportion of the exterior of the article 3. A majority of the exterior of the article 3 is instead defined by a cover 30 of the article 3. The cover 30 may be made of, for example, paper, card, cardboard, or a plastics material, or the like.

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In this embodiment, in contrast to the article 1 of Figures 1 to 3, a portion of the substrate 20 protrudes beyond an end of the mass of smokable material 10. In this

embodiment, the end is a longitudinal end of the mass of smokable material 10. In this embodiment, this portion of the substrate 20 forms part of the exterior of the article 3. The portion of the substrate 20 may be contactable by a temperature monitor of the apparatus with which the article 3 is usable, as discussed in more detail below. The
5 portion of the substrate 20 may comprise or consist of the heating material.

In this embodiment, the cover 30 encircles the smokable material 10 so that the smokable material 10 is within the cover 30. In some embodiments, the cover 30 may also cover the longitudinal end of the article 3 opposite from the protruding portion of
10 the substrate 20 discussed above. In this embodiment, most or all of the substrate 20 is kept out of contact with the cover 30. This can help avoid or reduce singeing of the cover 30 as the substrate 20 is heated in use. However, in other embodiments, the substrate 20 may be in contact with the cover 30.

In some embodiments, any one of the covers 30 discussed above may comprise
15 a thermal insulation. The thermal insulation may comprise one or more materials selected from the group consisting of: aerogel, vacuum insulation, wadding, fleece, non-woven material, non-woven fleece, woven material, knitted material, nylon, foam, polystyrene, polyester, polyester filament, polypropylene, a blend of polyester and
20 polypropylene, cellulose acetate, paper or card, and corrugated material such as corrugated paper or card. The thermal insulation may additionally or alternatively comprise an air gap. Such thermal insulation can help prevent heat loss to components of the apparatus, and provide more efficient heating of the smokable material 10 within the cover 30. In some embodiments, the insulation may have a thickness of up to one
25 millimetre, such as up to 0.5 millimetres.

In each of the articles 1, 2, 3 shown in Figures 1 to 5, the substrate 20 comprises heating material that is heatable by penetration with a varying magnetic field to heat the smokable material 10. In each of the illustrated embodiments, the substrate 20 consists
30 entirely, or substantially entirely, of the heating material. However, this need not be the case in other embodiments. In each of the embodiments discussed above, the heating material is aluminium. However, in other embodiments, the heating material may comprise one or more materials selected from the group consisting of: electrically-

conductive material, magnetic material, and magnetic electrically-conductive material. The heating material may comprise a metal or a metal alloy. The heating material may comprise one or more materials selected from the group consisting of: aluminium, gold, iron, nickel, cobalt, conductive carbon, graphite, plain-carbon steel, stainless steel, ferritic stainless steel, copper, and bronze. Other heating material(s) may be used in other embodiments. It has been found that, when magnetic electrically-conductive material is used as the heating material, magnetic coupling between the substrate 20 and an electromagnet of the apparatus in use may be enhanced. In addition to potentially enabling magnetic hysteresis heating, this can result in greater or improved Joule heating of the heating material, and thus greater or improved heating of the smokable material 10.

In each of the articles 1, 2, 3 shown in Figures 1 to 5, the heating material of the substrate 20 is in contact with the smokable material 10. Thus, when the heating material is heated by penetration with a varying magnetic field, heat may be transferred directly from the heating material to the smokable material 10. In other embodiments, the heating material may be kept out of contact with the smokable material 10. For example, in some embodiments, the article 1, 2, 3 may comprise a thermally-conductive barrier that is free of heating material and that spaces the substrate 20 from the smokable material 10. In some embodiments, the thermally-conductive barrier may be a coating on the substrate 20. The provision of such a barrier may be advantageous to help to dissipate heat to alleviate hot spots in the heating material.

In each of the articles 1, 2, 3 shown in Figures 1 to 5, the substrate 20 has a length SL, a width SW, and a depth SD. The width SW is perpendicular to the length SL. The depth SD is perpendicular to each of the length SL and the width SW. In the illustrated embodiments, the length SL is greater than the width SW, and the width SW is greater than the depth SD. However, in some embodiments, the length SL may be equal or substantially equal to the width SW.

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In each of the articles 1, 2, 3 shown in Figures 1 to 5, the substrate 20 thus has two opposing major surfaces joined by two minor surfaces. Therefore, the depth SD or thickness of the substrate 20 is relatively small as compared to the other dimensions of

the substrate 20. This may help to ensure that heat generated in the substrate 20 is efficiently transferred to the smokable material. In this embodiment, the substrate 20 has a rectangular, or substantially rectangular, cross section perpendicular to its length SL. However, in other embodiments, the substrate 20 may have a cross-section that is a shape other than rectangular, such as circular, elliptical, annular, polygonal, square, triangular, star-shaped, or radially-finned.

In each of the illustrated embodiments, the length SL, width SW and depth SD of the substrate 20 are substantially parallel to the length L, width W and depth D, respectively, of the exterior of the article 1, 2, 3. Moreover, in each of the illustrated embodiments, the substrate 20 extends along a longitudinal axis that is substantially aligned with a longitudinal axis of the article 1, 2, 3. This can help to provide more uniform heating of the smokable material 10 in use. In the articles 1, 3 of Figures 1 to 3 and 5, the aligned axes are coincident. In a variation to these embodiment, the aligned axes may be parallel to each other, as is the case in the article 2 of Figure 4. However, in other embodiments, the axes may be oblique to each other, or one or both of the substrate 20 and the article 1, 2, 3 may not have a longitudinal axis.

In some embodiments, the substrate 20 has a depth SD of less than five millimetres. In some embodiments, the substrate 20 has a depth SD of less than two millimetres. In some embodiments, the substrate 20 has a depth SD of between 0.1 and 0.6 millimetres, such as 0.3 millimetres.

In each of the illustrated embodiments, the substrate 20 is impermeable to air or volatilised material, and is substantially free of discontinuities. The substrate 20 may thus be relatively easy to manufacture. However, in variations to these embodiments, the substrate 20 may be permeable to air and/or permeable to volatilised material created when the smokable material 10 is heated. Such a permeable nature of the substrate 20 may help air passing through the article 1, 2, 3 to pick up the volatilised material created when the smokable material 10 is heated. In some embodiments, such a permeable nature of the substrate 20 may also act to impede an undesired thermal path to an end of the substrate 20, at which heat could leak from the article 1, 2, 3 without greatly heating the smokable material 10.

In each of the articles 1, 2, 3 shown in Figures 1 to 5, the cross section of the substrate 20 is constant along the length of the substrate 20. Moreover, in these embodiments, the substrate 20 is planar, or substantially planar. The substrate 20 of each of these embodiments could be considered a flat strip. However, in other embodiments, this may not be the case.

For example, in some embodiments, the substrate 20 may follow a wavelike or wavy path. The path may be a sinusoidal path. In some embodiments, the substrate 20 may be twisted. In some such embodiments, the substrate 20 may be considered to be twisted about a longitudinal axis that is coincident with the longitudinal axis of the article 1, 2, 3. In some embodiments, the substrate 20 may be corrugated. In some such embodiments, the substrate 20 may be considered to follow a longitudinal axis that is coincident with the longitudinal axis of the article 1, 2, 3.

Such non-planar shapes of the substrate 20 may help air passing through the article 1, 2, 3 to pick up the volatilised material created when the smokable material 10 is heated. Non-planar shapes can provide a tortuous path for air to follow, creating turbulence in the air and causing better heat transfer from the heating material to the smokable material 10. The non-planar shapes can also increase the surface area of the substrate 20 per unit length of the substrate 20. This can result in greater or improved Joule heating of the substrate 20, and thus greater or improved heating of the smokable material 10.

Non-planar substrates 20 of other embodiments may have shapes other than those discussed above. For example, in some embodiments the substrate 20 may be helical, a spiral shape, comprise a plate or strip or ribbon having protrusions thereon and/or indentations therein, comprise a mesh, comprise expanded metal, or have a non-uniform non-planar shape.

In each of the above-described embodiments, the mass of smokable material 10 is said to be fixed relative to the exterior of the article 1, 2, 3. However, in other

embodiments, the mass of smokable material 10 may be movable, at least to a degree, relative to the exterior of the article 1, 2, 3.

In each of the articles 1, 2, 3 shown in Figures 1 to 5, the mass of smokable material 10 comprises first, second and third regions 10a, 10b, 10c (not expressly shown in Figure 5 or Figures 2 and 3). The smokable material 10 in at least one of these regions 10a, 10b, 10c has a form or chemical composition that differs from the form or chemical composition, respectively, of the smokable material 10 of at least one other of these regions 10a, 10b, 10c. In some embodiments, the smokable material of at least one of these regions 10a, 10b, 10c has a form or chemical composition so as to be heatable more quickly than the smokable material of at least one other of these regions 10a, 10b, 10c. For example, the regions 10a, 10b, 10c may have different respective mean sizes of particles of the smokable material. In some embodiments, the difference in chemical composition may comprise a difference in quantities by weight of moisture, a vapour forming agent, such as glycerol, or a smoke modifying substance, such as a flavourant. By providing the different regions 10a, 10b, 10c with different quantities of moisture, smoke modifying agents or flavourants, in some embodiments a change in flavour of generated vapour for user inhalation is achievable. This effect may be enabled or enhanced by the apparatus with which the article 1, 2, 3 is used being capable of heating the different regions 10a, 10b, 10c separately and/or independently.

Although, in the illustrated articles 1, 2, 3, the regions 10a, 10b, 10c are relatively located in the length L direction of the article 1, 2, 3, in other embodiments the regions 10a, 10b, 10c may be relatively located along the width W or depth D direction of the article 1, 2, 3. Although three regions 10a, 10b, 10c are shown in each of Figures 1, 4 and 5, in other embodiments there may be two or more than three such regions. In some embodiments, all of the mass of smokable material 10 is of substantially constant form and/or chemical composition.

In some embodiments, the depth D of the exterior of the article 1, 2, 3 may be less than a half of the width W of the exterior of the article 1, 2, 3. In each of the articles 1, 2, 3 shown in Figures 1 to 5, the depth D of the exterior of the article 1, 2, 3 is less than a quarter of the width W of the exterior of the article 1, 2, 3. However, in other

embodiments, the depth D may be greater than half the width W. The smaller the depth D relative to the width W, the greater the surface area of the exterior of the article 1, 2, 3 for a given volume of the article 1, 2, 3. This can result in greater or improved heating of the smokable material 10 in use, and/or greater, easier or improved release from the article 1, 2, 3 of volatilised material created when the smokable material 10 is heated.

In some embodiments, which may be respective variations to the embodiments discussed above, a first portion of the substrate 20 may be more susceptible to eddy currents being induced therein by penetration with a varying magnetic field than a second portion of the substrate 20. The first portion of the substrate 20 may be more susceptible as a result of the first portion of the substrate 20 being made of a first material, the second portion of the substrate 20 being made of a different second material, and the first material being of a higher susceptibility to eddy currents being induced therein than the second material. For example, one of the first and second portions may be made of iron, and the other of the first and second portions may be made of graphite. Alternatively or additionally, the first portion of the substrate 20 may be more susceptible as a result of the first portion of the substrate 20 having a different thickness to the second portion of the substrate 20. In some embodiments, such first and second portions are located adjacent each other in the longitudinal direction of the article 1, 2, 3 or of the substrate 20, but in other embodiments this need not be the case. For example, in some embodiments the first and second portions may be disposed adjacent each other in a direction perpendicular to the longitudinal direction of the article 1, 2, 3 or of the substrate 20.

Such varying susceptibility of the substrate 20 to eddy currents being induced therein can help achieve progressive heating of the smokable material 10, and thereby progressive generation of vapour. For example, the higher susceptibility portion may be able to heat a first region of the smokable material 10 relatively quickly to initialise volatilisation of at least one component of the smokable material 10 and formation of vapour in the first region of the smokable material 10. The lower susceptibility portion may be able to heat a second region of the smokable material 10 relatively slowly to initialise volatilisation of at least one component of the smokable material 10 and formation of vapour in the second region of the smokable material 10. Accordingly,

vapour is able to be formed relatively rapidly for inhalation by a user, and vapour can continue to be formed thereafter for subsequent inhalation by the user even after the first region of the smokable material 10 may have ceased generating vapour. The first region of the smokable material 10 may cease generating the vapour when it becomes
5 exhausted of volatilisable components of the smokable material 10.

In other embodiments, all of the substrate 20 may be equally, or substantially equally, susceptible to eddy currents being induced therein by penetration with a varying magnetic field. In some embodiments, the substrate 20 may not be susceptible
10 to such eddy currents. In such embodiments, the heating material may be a magnetic material that is non-electrically-conductive, and thus may be heatable by the magnetic hysteresis process discussed above.

In some embodiments, which may be respective variations to the embodiments
15 discussed above, a plurality of the articles 1, 2, 3 may be arranged in a stack. The articles may be adhered to one another in the stack. Each of the articles 1, 2, 3 in the stack may be identical to each other of the articles 1, 2, 3 in the stack. Alternatively, one or more of the articles 1, 2, 3 in the stack may differ in construction from one or more other of the articles 1, 2, 3 in the stack. For example, any one or more of the
20 articles in the stack may be one of the articles 1, 2, 3 discussed above, and one or more other of the articles in the stack may be a different one of the articles 1, 2, 3 discussed above. Smokable material may then be sandwiched between two bodies of heating material.

In some embodiments, which may be respective variations to the embodiments
25 discussed above, the article 1, 2, 3 may comprise a plurality of substrates 20 within the mass of smokable material 10, wherein each of the substrates 20 comprises heating material that is heatable by penetration with a varying magnetic field. At least one of the plurality of substrates 20 may be more susceptible to eddy currents being induced
30 therein by penetration with a varying magnetic field than at least one of the other of the plurality of substrates 20. This may be effected by the substrates 20 being made of different heating materials and/or having different thicknesses, for example, as discussed above. Again, such varying susceptibility of the substrates 20 can help

achieve progressive heating of the smokable material 10, and thereby progressive generation of vapour, in a manner corresponding to that described above. The plurality of substrates 20 may be coplanar.

5 In some embodiments in which the substrate 20 comprises heating material, the article 1, 2, 3 may comprise a catalytic material on at least a portion of the substrate 20. The catalytic material may take the form of a coating on the substrate 20. The catalytic material may be provided on all surface(s) of the substrate 20, or on only some of the surface(s) of the substrate 20. The provision of such a catalytic material on the substrate
10 20 means that, in use, the article 1, 2, 3 may have a heated, chemically active surface. In use, the catalytic material may act to convert, or increase the rate of conversion of, a potential irritant to something that is less of an irritant.

 In some embodiments, which may be respective variations to the embodiments
15 discussed above, the substrate 20 may be free of heating material. For example, in some embodiments, the entire article 1, 2, 3 may be free of heating material. Some such articles may be usable with apparatus for heating the smokable material 10 to volatilise at least one component of the smokable material 10 without burning the smokable material 10, wherein the apparatus itself comprises heating material that is heatable by
20 penetration with a varying magnetic field. Preferably, the substrate 20 comprises one or more materials that give the article 1, 2, 3 a sufficient degree of structure and/or robustness.

 In some embodiments, the substrate 20 may comprise smokable material, such
25 as tobacco. In some embodiments, the substrate 20 may comprise or consist entirely, or substantially entirely, of smokable material, e.g. tobacco, such as reconstituted smokable material, e.g. reconstituted tobacco. The latter is sometimes referred to as “tobacco recon”. Depending on the thickness and constitution of the reconstituted smokable material, the majority or all of the whole article 1, 2, 3 may consist entirely,
30 or substantially entirely, of smokable material.

 In some embodiments, which may be respective variations to the embodiments discussed above, the substrate 20 may be omitted. That is, the article 1, 2, 3 may be

free of a substrate. In some such embodiments, the article 1, 2, 3 may consist entirely, or substantially entirely, of the mass of smokable material 10. However, an appropriate binder might be required in order for the mass of smokable material 10 to retain its shape. The mass of smokable material 10 may be formed, for example, by a process
5 involving compacting the smokable material 10 until it assumes the desired final shape.

In some embodiments, which may be respective variations to the embodiments discussed above, the article 1, 2, 3 may comprise a mouthpiece defining a passageway that is in fluid communication with the mass of smokable material 10. The mouthpiece
10 may be made of any suitable material, such as a plastics material, cardboard, cellulose acetate, paper, metal, glass, ceramic, or rubber. In use, when the smokable material 10 is heated, volatilised components of the smokable material 10 can be readily inhaled by a user. In embodiments in which the article is a consumable article, once all or substantially all of the volatilisable component(s) of the smokable material 10 in the
15 article has/have been spent, the user may dispose of the mouthpiece together with the rest of the article. This can be more hygienic than using the same mouthpiece with multiple articles, can help ensure that the mouthpiece is correctly aligned with the smokable material, and presents a user with a clean, fresh mouthpiece each time they wish to use another article. The mouthpiece, when provided, may comprise or be
20 impregnated with a flavourant. The flavourant may be arranged so as to be picked up by heated vapour as the vapour passes through the passageway of the mouthpiece in use.

Each of the above-described articles 1, 2, 3 and described variants thereof may
25 provide significant manufacturing advantages, at least due to the proportions of the exterior of the article, which may be considered “flat”. For example, the proportions may lend themselves to the use of a wide variety of available materials, with a respective wide variety of thicknesses, thickness tolerances, and thermal, chemical and mechanical characteristics. Moreover, the proportions may help to ensure that the smokable
30 material is located close to, or in contact with, the heating material, so that thermal conductivity is relatively large. This can help to decrease temperature rise time and increase temperature control responsiveness.

Each of the above-described articles 1, 2, 3 and described variants thereof may be used with an apparatus for heating the smokable material 10 to volatilise at least one component of the smokable material 10. The apparatus may be to heat the smokable material 10 to volatilise the at least one component of the smokable material 10 without
5 burning the smokable material 10. Any one of the article(s) 1, 2, 3 and such apparatus may be provided together as a system. The system may take the form of a kit, in which the article 1, 2, 3 is separate from the apparatus. Alternatively, the system may take the form of an assembly, in which the article 1, 2, 3 is combined with the apparatus. Example such apparatus will now be described with reference to Figures 6 to 8.

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Referring to Figure 6 there is shown a schematic cross-sectional view of an example of apparatus for heating smokable material to volatilise at least one component of the smokable material, according to an embodiment of the invention. The apparatus 100 of this embodiment is usable with the articles 1, 2, 3 and variants thereof discussed
15 above with reference to Figures 1 to 5. Broadly speaking, the apparatus 100 comprises a first body 111, a second body 112, and a heating zone 114 between the first and second bodies 111, 112 for receiving at least a portion of an article 1, 2, 3 comprising smokable material 10.

20 The first body 111 is movable relative to the second body 112 to compress the heating zone 114. That is, such movement varies a volume of the heating zone 114. In this embodiment, the first body 111 is rotatable relative to the second body 112. However, in other embodiments the movement could be a translation, a combination of a translation and a rotation, an irregular movement, or the like. In this embodiment,
25 movement of the first body 111 relative to the second body 112 in a first direction reduces the volume of the heating zone 114, whereas movement of the first body 111 relative to the second body 112 in a second direction increases the volume of the heating zone 114.

30 In some embodiments, when the article 1, 2, 3 is located in the heating zone 114, such movement of the first body 111 relative to the second body 112 compresses the article 1, 2, 3. Such compression of the article 1, 2, 3 may compress the smokable material 10, so as to increase the thermal conductivity of the smokable material 10. In

other words, compression of the smokable material 10 can provide for higher heat transfer through the article 1, 2, 3. Such compression should not be so great as to break the article 1, 2, 3 or to prevent a user to be able to draw volatilised material from the article 1, 2, 3.

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In this embodiment, the apparatus 100 comprises a magnetic field generator 120, which is for generating varying magnetic fields to be used in heating the smokable material of the article 1, 2, 3 when the article 1, 2, 3 is located in the heating zone 114. In this embodiment, the magnetic field generator 120 comprises an electrical power
10 source 121, two electrically-conductive coils 122a, 122b, a device 123 for passing a varying electrical current, such as an alternating current, through each of the coils 122a, 122b, a controller 124, and a user interface 125 for user-operation of the controller 124.

The first body 111 comprises a first coil 122a of the two electrically-conductive
15 coils, a first support 130a on which the first electrically-conductive coil 122a is supported, a first non-electrically-conductive member 140a defining one or more air flow channels 142a, and a first heater 110a. The first member 140a is located between the first electrically-conductive coil 122a and the first heater 110a. Similarly, the second body 112 comprises a second coil 122b of the two electrically-conductive coils,
20 a second support 130b on which the second electrically-conductive coil 122b is supported, a second non-electrically-conductive member 140b defining one or more air flow channels 142b, and a second heater 110b. The second member 140b is located between the second electrically-conductive coil 122b and the second heater 110b. In this embodiment, the first and second heaters 110a, 110b define the heating zone 114.
25 However, in other embodiments, other parts of the apparatus 100 may instead or additionally define the heating zone 114.

In this embodiment, each of the first and second heaters 110a, 110b comprises heating material that is heatable by penetration with a varying magnetic field. The
30 heating material may comprise one or more of the heating materials discussed above. More specifically, although not shown in Figure 6, in this embodiment, each of the first and second heaters 110a, 110b defines a plurality of closed circuits of heating material. The closed circuits are heatable in use to heat the heating zone 114. It has been found

that the use of closed circuits provides enhanced magnetic coupling between the first and second heaters 110a, 110b and the first and second coils 122a, 122b, respectively in use, which may in turn provide greater or improved Joule heating of the first and second heaters 110a, 110b. In some embodiments, one or each of the first and second
5 heaters 110a, 110b may define only one closed circuit of heating material. In other embodiments, such as those in which each of the first and second heaters 110a, 110b is made of a magnetic non-electrically conductive material, the first and second heaters 110a, 110b may not define any number of closed circuits. In some embodiments, one or each of the first and second heaters 110a, 110b may comprise a plate of heating
10 material or a plurality of discrete regions of heating material.

In some embodiments, an impedance of the coil 122a of one of the first and second bodies 111, 112 is equal, or substantially equal, to an impedance of the heater 110a, 110b of that one of the first and second bodies 111, 112. Matching the impedances
15 may help to balance the voltage and current to maximise the heating power generated at the heaters 110a, 110b when heated in use.

In this embodiment, the device 123 for passing an alternating or varying electrical current through each of the coils 122a, 122b is electrically connected between
20 the electrical power source 121 and each of the coils 122a, 122b (although only the electrical connection with the coil 122a of the first body 111 is shown in Figure 6, for clarity). In this embodiment, the controller 124 also is electrically connected to the electrical power source 121, and is communicatively connected to the device 123. The controller 124 is for causing and controlling heating by the apparatus 100. More
25 specifically, in this embodiment, the controller 124 is for controlling the device 123, so as to control the supply of electrical power from the electrical power source 121 to the coils 122a, 122b. In this embodiment, the controller 124 comprises an integrated circuit (IC), such as an IC on a printed circuit board (PCB). In other embodiments, the controller 124 may take a different form. In some embodiments, the apparatus may
30 have a single electrical or electronic component comprising the device 123 and the controller 124. The controller 124 is operated in this embodiment by user-operation of the user interface 125. In this embodiment, the user interface 125 is located at the exterior of the apparatus 100. The user interface 125 may comprise a push-button, a

toggle switch, a dial, a touchscreen, or the like. In other embodiments, the user interface 125 may be remote and connected to the rest of the apparatus wirelessly, such as via Bluetooth.

5 In this embodiment, operation of the user interface 125 by a user causes the controller 124 to cause the device 123 to apply an alternating electric current across each of the coils 122a, 122b, so as to cause the coils 122a, 122b to generate respective alternating magnetic fields. The first coil 122a and the first heater 110a are suitably relatively positioned so that the alternating magnetic field produced by the first coil
10 122a penetrates the first heater 110a. When the heating material of the first heater 110a is an electrically-conductive material, this may cause the generation of one or more eddy currents in the first heater 110a. The flow of eddy currents in the first heater 110a against the electrical resistance of the first heater 110a causes the first heater 110a to be heated by Joule heating. As mentioned above, when the first heater 110a is made of a
15 magnetic material, the orientation of magnetic dipoles in the first heater 110a changes with the changing applied magnetic field, which causes heat to be generated in the first heater 110a. Similarly, in this embodiment, the second coil 122b and the second heater 110b are suitably relatively positioned so that the alternating magnetic field produced by the second coil 122b penetrates the second heater 110b.

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 In some embodiments, one or both of the first and second heaters 110a, 110b comprising heating material may be omitted from the apparatus 100. In such embodiments, the apparatus 100 still comprises a magnetic field generator for generating a varying magnetic field. Such apparatus 100 may be usable with an article,
25 such as one of articles 1, 2, 3 and variants thereof discussed above with reference to Figures 1 to 5, which itself comprises heating material that can act in use as a heater to heat the smokable material 10 therein. In such embodiments, the heating zone 114 would be defined by other parts of the first and second bodies 111, 112. In such embodiments, the heating zone 114 and the coils 122a, 122b may be relatively
30 positioned so that the varying magnetic fields produced by the coils 122a, 122b in use penetrate the heating zone 114 at location(s) where the heating material of the article 1, 2, 3 would be located when the article 1, 2, 3 is located in the heating zone 114. When the heating material of the article 1, 2, 3 is an electrically-conductive material, this may

cause the generation of eddy currents in the heating material of the article 1, 2, 3. The flow of such eddy currents against the electrical resistance of the heating material causes the heating material to be heated by Joule heating. When the heating material of the article 1, 2, 3 is made of a magnetic material, the orientation of magnetic dipoles in the heating material changes with the changing applied magnetic field, which causes heat to be generated in the heating material.

In some embodiments, the heating material of the heater(s) 110a, 110b of the apparatus 100 or the heating material of the article 1, 2, 3 may comprise discontinuities or holes therein. Such discontinuities or holes may act as thermal breaks to control the degree to which different regions of the smokable material are heated in use. Areas of the heating material with discontinuities or holes therein may be heated to a lesser extent than areas without discontinuities or holes. This may help progressive heating of the smokable material, and thus progressive generation of vapour, to be achieved.

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Referring to Figures 7 and 8 there are shown schematic perspective views of respective portions of an example of apparatus for heating smokable material to volatilise at least one component of the smokable material, according to another embodiment of the invention. The apparatus 200 of this embodiment is usable with the articles 1, 2, 3 and variants thereof discussed above with reference to Figures 1 to 5. Broadly speaking, the apparatus 200 comprises a heating zone 114 for receiving at least a portion of an article 1, 2, 3 comprising smokable material 10, and a magnetic field generator 120 for generating a varying magnetic field to be used in heating the smokable material 10 when the portion of the article 1, 2, 3 is located in the heating zone 114. In Figure 8, the article 3 of Figure 5 is shown being inserted into the heating zone 114 of the apparatus 200. However, in other embodiments, a different article, such as one of the articles 1, 2 shown in Figures 1 to 4, may be used with the apparatus 200.

The heating zone 114 of the apparatus 200 has a length HL, a width HW perpendicular to the length HL, and a depth HD perpendicular to each of the length HL and the width HW. In this embodiment, the length HL is greater than the width HW, and the width HW is greater than the depth HD, so that the heating one 114 is elongate. However, in other embodiments, the length HL may be equal or substantially equal to

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the width HW, so that the heating zone 114 is not elongate as such. In any event, by providing that the heating zone 114 is similarly sized and proportioned relative to the article 1, 2, 3 with which the apparatus 200 is to be used, a close or snug fit may be provided between the article 1, 2, 3 and the apparatus 200. This may help to protect the
5 article 1, 2, 3 from being damaged by movement relative to the apparatus 200 if the apparatus 200 is knocked. It may also help to ensure that the article 1, 2, 3, and thus the heating material of the article 1, 2, 3, is well-placed relative to the magnetic field generator 120.

10 In this embodiment, as best shown in Figure 7, the apparatus 200 comprises first, second and third bodies 111, 112, 113. A first side 112a of the second body 112 is attached to the first body 111 via a pair of first elements 151. A second side 112b of the second body 112 is attached to the third body 113 via a pair of second elements 152. Accordingly, the second body 112 is between the first and third bodies 111, 113. In
15 other embodiments, only one of each of the first and second elements 151, 152 may be provided. In this embodiment, the first and second elements 151, 152 are flexible and so the first, second and third bodies 111, 112, 113 are moveable relative to one another due to the flexible nature of the elements 151, 152 connecting them together. The first and second elements 151, 152 are foldable to effect rotation of the second body 112
20 relative to each of the first and third bodies 111, 113. In this embodiment, the first and third bodies 111, 113 are movable relative to the second body 112 so that the second body 112 becomes sandwiched between the first and third bodies 111, 113, as shown in Figure 8. In this embodiment, in such a state, the first to third bodies 111, 112, 113 are substantially parallel to one another. In other embodiments, the first and second
25 elements 151, 152 may be distortable and other than flexible. For example, in some embodiments, each of the first and second elements 151, 152 may comprise a hinge. In some embodiments, each of the first and second elements 151, 152 may be relatively non-distortable.

30 In this embodiment, the magnetic field generator 120 comprises an electrical power source 121, two electrically-conductive coils 122a, 122b, a device 123 for passing a varying electrical current, such as an alternating current, through each of the

coils 122a, 122b, a controller 124, and a user interface (not shown) for user-operation of the controller 124.

5 In this embodiment, each of the first and second bodies 111, 112 comprises a respective one of the electrically-conductive coils 122a, 122b. In this embodiment, each of the coils 122a, 122b is a two-dimensional electrically-conductive coil, but in other embodiments one or each of the coils 122a, 122b could take a different form.

10 In this embodiment, the third body 113 comprises the device 123 and the controller 124. The device 123 and the controller 124 may take any of the forms discussed above for the device 123 and the controller 124 of the apparatus 100 of Figure 6. The third body may comprise at least a portion of an electrical circuit, which electrical circuit may be part of the device 123 and/or part of the controller 124.

15 Similarly to the embodiment of Figure 6, in this embodiment the device 123 for passing an alternating or varying electrical current through each of the coils 122a, 122b is electrically connected between the electrical power source 121 and each of the coils 122a, 122b. Moreover, the controller 124 also is electrically connected to the electrical power source 121, and is communicatively connected to the device 123. The electrical
20 connections between the components of the magnetic field generator 120 on the first to third bodies 111, 112, 113 may be via one or more of the first and second elements 151, 152. The controller 124 is for causing and controlling heating by the apparatus 200. The controller 124 may take any of the forms discussed above for the controller 124 of the apparatus 100 of Figure 6. In some embodiments, the apparatus 200 may have a
25 single electrical or electronic component comprising the device 123 and the controller 124. The user interface may take any of the forms discussed above for the user interface 125 of the apparatus 100 of Figure 6.

30 In this embodiment, the heating zone 114 is defined by and is arranged between the first and second bodies 111, 112 when the apparatus 200 is in the state shown in Figure 8. In this embodiment, thermal insulation 115 is located between the second and third bodies 112, 113 when the apparatus 200 is in the state shown in Figure 8. The thermal insulation 115 may comprise one or more materials selected from the group

consisting of: aerogel, vacuum insulation, wadding, fleece, non-woven material, non-woven fleece, woven material, knitted material, nylon, foam, polystyrene, polyester, polyester filament, polypropylene, a blend of polyester and polypropylene, cellulose acetate, paper or card, and corrugated material such as corrugated paper or card. The thermal insulation 115 may additionally or alternatively comprise an air gap. Such thermal insulation 115 can help prevent heat loss from the heating zone 114 to electrical components of the apparatus 200, such as the device 123 and/or the controller 124, and provide more efficient heating of the smokable material 10 within the heating zone 114. In some embodiments, the thermal insulation 115 may be omitted.

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In this embodiment, all of the components discussed above of the apparatus 200 are packaged in an outer housing 150 of the apparatus 200, so as to maintain the relative relationship of all the components.

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In this embodiment, the electrical power source 121 is offset from the heating zone 114 in a direction parallel to the depth HD of the heating zone 114. This can allow the exterior dimensions of the housing 150 or apparatus 200 to be relatively compact, as compared to an alternative construction in which the electrical power source 121 is offset from the heating zone 114 in a direction parallel to the length HL or width HW of the heating zone 114. In this embodiment, the electrical power source 121 has a length EL, a width EW perpendicular to the length EL, and a depth ED perpendicular to each of the length EL and the width EW. The length EL is greater than the width EW, and the width EW is greater than the depth ED. Furthermore, the length EL, width EW and depth ED of the electrical power source 121 are substantially parallel to the length HL, width HW and depth HD, respectively, of the heating zone 114. Accordingly, the exterior dimensions of the housing 150 or apparatus 200 can be further compact, as compared to an alternative construction in which the electrical power source 121 is proportioned differently relative to the heating zone 114. However, in other embodiments, the electrical power source 121 may take a different form to that illustrated, and/or may be located elsewhere to the location illustrated.

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In some embodiments, the third body 113 may be omitted. In some such embodiments, the device 123 and the controller 124 would be located elsewhere in the

apparatus 200, such as on the major surface of the second body 112 opposite from the major surface that carries the second coil 122b.

In this embodiment, the heating zone 114 and the coils 122a, 122b are relatively
5 positioned so that the varying magnetic fields produced by the coils 122a, 122b in use penetrate the heating zone 114 at location(s) where the heating material of the article 1, 2, 3 would be located, when the article 1, 2, 3 is located in the heating zone 114. When the heating material of the article 1, 2, 3 is an electrically-conductive material, this may cause the generation of eddy currents in the heating material of the article 1, 2, 3. The
10 flow of such eddy currents against the electrical resistance of the heating material causes the heating material to be heated by Joule heating. When the heating material of the article 1, 2, 3 is made of a magnetic material, the orientation of magnetic dipoles in the heating material changes with the changing applied magnetic field, which causes heat to be generated in the heating material.

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In each of the embodiments discussed above, each of the coils 122a, 122b may take any suitable form. In the illustrated embodiments, each of the coils 122a, 122b comprises a two-dimensional spiral of electrically-conductive material, such as copper. In some embodiments, the magnetic field generator 120 may comprise one or more
20 magnetically permeable cores around which the coils 122a, 122b are respectively wound. This can help concentrate the magnetic flux produced by the respective coils 122a, 122b to make more powerful magnetic fields. The, or each, magnetically permeable core may be made of iron, for example. In some embodiments, the magnetically permeable core may extend only partially along the length of its associated
25 coil 122a, 122b, so as to concentrate the magnetic flux only in certain regions.

Although, in each of the embodiments discussed above, each of the first and second bodies 111, 112 comprises an electrically-conductive coil 122a, 122b of the magnetic field generator 120, in other embodiments, only one of the first and second
30 bodies 111, 112 may comprise such a coil 122a, 112b. In some embodiments, the magnetic field generator 120 may comprise only one coil 122a, 122b.

In each of the embodiments discussed above, the electrical power source 121 is a rechargeable battery. In other embodiments, the electrical power source 121 may be other than a rechargeable battery, such as a non-rechargeable battery, a capacitor, a battery-capacitor hybrid, or a connection to a mains electricity supply.

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In each of the embodiments discussed above, the apparatus 100, 200 includes a temperature sensor 126 for sensing a temperature of the heating zone 114. The temperature sensor 126 is communicatively connected to the controller 124, so that the controller 124 is able to monitor the temperature of the heating zone 114. In some
10 embodiments, the temperature sensor 126 may be arranged to take an optical temperature measurement of the heating zone 114 or article 1, 2, 3. In some embodiments, the article 1, 2, 3 may comprise a temperature detector, such as a resistance temperature detector (RTD), for detecting a temperature of the article 1, 2, 3. The article 1, 2, 3 may further comprise one or more terminals connected, such as
15 electrically-connected, to the temperature detector. The terminal(s) may be for making connection, such as electrical connection, with a temperature monitor of the apparatus 100 when the article 1, 2, 3 is in the heating zone 114. The controller 124 may comprise the temperature monitor. The temperature monitor of the apparatus 100 may thus be able to determine a temperature of the article 1, 2, 3 during use of the article 1, 2, 3 with
20 the apparatus 100.

In some embodiments, by providing that the heating material of the article 1, 2, 3 has a suitable resistance, the response of the heating material to a change in temperature could be sufficient to give information regarding temperature inside the
25 article 1, 2, 3. The temperature sensor of the apparatus 100 may then comprise a probe for analysing the heating material of the article 1, 2, 3.

In some embodiments, the temperature sensor 126 of the apparatus 100, 200 may be for contacting the heating material of the article when the article is located in
30 the heating zone 114. For example, in some embodiments, the temperature sensor 126 of the apparatus 100, 200 may comprise a thermocouple that contacts the protruding portion of the substrate 20 of the article 3 of Figure 5. The thermocouple may be biased into contact with the article by a resilient element, such as a leaf spring.

In each of the embodiments discussed above, on the basis of one or more signals received from the temperature sensor 126 or temperature detector, the controller 124 may cause the device 123 to adjust a characteristic of the varying or alternating current passed through the first coil 122a and/or the second coil 122b as necessary, in order to ensure that the temperature of the heating zone 114 remains within a predetermined temperature range. The characteristic may be, for example, amplitude or frequency. Within the predetermined temperature range, in use the smokable material 10 of the article 1, 2, 3 located in the heating zone 114 in use is heated sufficiently to volatilise at least one component of the smokable material 10 without combusting the smokable material 10. Accordingly, the controller 124, and the apparatus 100, 200 as a whole, is arranged to heat the smokable material 10 to volatilise the at least one component of the smokable material 10 without combusting the smokable material 10. In some embodiments, the temperature range is about 50°C to about 300°C, such as between about 50°C and about 250°C, between about 50°C and about 150°C, between about 50°C and about 120°C, between about 50°C and about 100°C, between about 50°C and about 80°C, or between about 60°C and about 70°C. In some embodiments, the temperature range is between about 170°C and about 220°C. In other embodiments, the temperature range may be other than this range. In some embodiments, the temperature sensor 126 may be omitted.

In some embodiments, the apparatus 100, 200 or the article 1, 2, 3 may comprise a mouthpiece. In such embodiments, when the article 1, 2, 3 is located in the heating zone 114, a user may be able to inhale the volatilised component(s) of the smokable material 10 by drawing the volatilised component(s) through a channel in the mouthpiece that is in fluid communication with the heating zone 114. In the apparatus 100 of Figure 6, as the volatilised component(s) are removed from the article 1, 2, 3, air may be drawn into the heating zone 114 from the exterior of the apparatus 100 via the air flow channels 142a, 142b. This air may then permeate the article 1, 2, 3 and exit the heating zone 114 via the channel of the mouthpiece when the user takes another draw. Such passage of air through the air flow channels 142a, 142b may help to remove heat generated by the first and second heaters 110a, 100b away from the first and second coils 122a, 122b and the rest of the magnetic field generator 120. In other embodiments,

the air flow channels 142a, 142b may be omitted, and air may be drawn into the heating zone 114 via a different path.

The apparatus 100, 200 may provide haptic feedback to a user. The feedback
5 could indicate that heating is taking place, or be triggered by a timer to indicate that greater than a predetermined proportion of the original quantity of volatilisable component(s) of the smokable material 10 in the article 1, 2, 3 has/have been spent, or the like. The haptic feedback could be created by interaction of heating material with one or both of the coils 122a, 122b (i.e. magnetic response), by interaction of an
10 electrically-conductive element with one or both of the coils 122a, 122b, by rotating an unbalanced motor, by repeatedly applying and removing a current across a piezoelectric element, or the like.

In embodiments in which the apparatus 100, 200 comprises more than one coil
15 122a, 122b, such as that illustrated, the plurality of coils 122a, 122b could be operated to provide progressive heating of the smokable material 10 in an article 1, 2, 3, and thereby progressive generation of vapour. For example, one coil 122a may be able to heat a first region of the heating material relatively quickly to initialise volatilisation of at least one component of the smokable material 10 and formation of vapour in a first
20 region of the smokable material 10. Another coil 122b may be able to heat a second region of the heating material relatively slowly to initialise volatilisation of at least one component of the smokable material 10 and formation of vapour in a second region of the smokable material 10. Accordingly, vapour is able to be formed relatively rapidly for inhalation by a user, and vapour can continue to be formed thereafter for subsequent
25 inhalation by the user even after the first region of the smokable material 10 may have ceased generating vapour. The initially-unheated second region of smokable material 10 could act as a heat sink, to reduce the temperature of created vapour or make the created vapour mild, during heating of the first region of smokable material 10.

30 The heating material used in embodiments of the invention may have a skin depth, which is an exterior zone within which most of an induced electrical current and/or induced reorientation of magnetic dipoles occurs. By providing that the component comprising the heating material has a relatively small thickness, a greater

proportion of the heating material may be heatable by a given varying magnetic field, as compared to heating material in a component having a depth or thickness that is relatively large as compared to the other dimensions of the component. Thus, a more efficient use of material is achieved. In turn, costs are reduced.

5

In some embodiments, the heating material may comprise discontinuities or holes therein. Such discontinuities or holes may act as thermal breaks to control the degree to which different regions of the smokable material 10 are heated in use. Areas of the heating material with discontinuities or holes therein may be heated to a lesser extent than areas without discontinuities or holes. This may help progressive heating of the smokable material 10, and thus progressive generation of vapour, to be achieved. Such discontinuities or holes may, on the other hand, be used to optimise the creation of complex eddy currents in use.

15 In each of the above described embodiments, the smokable material 10 comprises tobacco. However, in respective variations to each of these embodiments, the smokable material 10 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
20 embodiments, the smokable material 10 may comprise a vapour or aerosol forming agent or a humectant, such as glycerol, propylene glycol, triacetin, or diethylene glycol.

An article embodying the present invention may be a cartridge, for example.

25 In each of the above described embodiments, the article 1, 2, 3 is a consumable article. Once all, or substantially all, of the volatilisable component(s) of the smokable material 10 in the article 1, 2, 3 has/have been spent, the user may remove the article 1, 2, 3 from the apparatus and dispose of the article 1, 2, 3. The user may subsequently re-use the apparatus with another of the articles 1, 2, 3. However, in other respective
30 embodiments, the article 1, 2, 3 may be non-consumable, and the apparatus and the article 1, 2, 3 may be disposed of together once the volatilisable component(s) of the smokable material 10 has/have been spent.

In some embodiments, the apparatus discussed above is sold, supplied or otherwise provided separately from the articles 1, 2, 3 with which the apparatus is usable. However, in some embodiments, the apparatus and one or more of the articles 1, 2, 3 may be provided together as a system, such as a kit or an assembly, possibly with
5 additional components, such as cleaning utensils.

The invention could be implemented in a system comprising any one of the articles discussed herein, and any one of the apparatuses discussed herein, wherein the apparatus itself has heating material, such as in a susceptor, for heating by penetration
10 with the varying magnetic field generated by the magnetic field generator. Heat generated in the heating material of the apparatus could be transferred to the article to heat, or further heat, the smokable material therein. In some such embodiments, the article may be free of heating material, so that the smokable material of the article is heated only by the heat transferred to the article from the heating material of the
15 apparatus.

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
20 heating smokable material to volatilise at least one component of the smokable material, superior articles for use with such apparatus, and superior systems comprising such apparatus and such articles. 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
25 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
30 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. An article for use with apparatus for heating smokable material to volatilise at least one component of the smokable material, wherein the article comprises a mass of smokable material, and wherein an exterior of the article has a length, a width perpendicular to the length, and a depth perpendicular to each of the length and the width, wherein the length is greater than or equal to the width, and wherein the width is greater than the depth.
2. The article of claim 1, wherein the mass of smokable material is fixed relative to the exterior of the article.
3. The article of claim 1, comprising a substrate, wherein the mass of smokable material is on the substrate.
4. The article of claim 3, wherein the substrate has a length, a width perpendicular to the length of the substrate, and a depth perpendicular to each of the length and the width of the substrate, wherein the length of the substrate is greater than or equal to the width of the substrate, and wherein the width of the substrate is greater than the depth of the substrate; and
wherein the length, width and depth of the substrate are substantially parallel to the length, width and depth, respectively, of the exterior of the article.
5. The article of claim 3, wherein the substrate comprises heating material that is heatable by penetration with a varying magnetic field to heat the smokable material.
6. The article of claim 5, wherein the heating material comprises one or more materials selected from the group consisting of: an electrically-conductive material, a magnetic material, and a magnetic electrically-conductive material.
7. The article of claim 5, wherein the heating material comprises a metal or a metal alloy.

8. The article of claim 5, wherein the heating material comprises one or more materials selected from the group consisting of: aluminium, gold, iron, nickel, cobalt, conductive carbon, graphite, plain-carbon steel, stainless steel, ferritic stainless steel, copper, and bronze.
- 5
9. The article of claim 5, wherein the heating material is in contact with the smokable material.
10. The article of claim 5, wherein the heating material extends to opposite
10 longitudinal ends of the mass of smokable material.
11. The article of claim 3, wherein a portion of the substrate protrudes beyond an end of the mass of smokable material.
- 15 12. The article of claim 3, wherein the substrate is within the mass of smokable material.
13. The article of claim 3, wherein the substrate comprises smokable material.
- 20 14. The article of claim 1, wherein the mass of smokable material defines at least a portion of the exterior of the article.
15. The article of claim 1, comprising a cover around the mass of smokable material, wherein the cover defines at least a portion of the exterior of the article.
- 25
16. The article of claim 1, wherein the smokable material comprises tobacco and/or one or more humectants.
17. The article of claim 1, wherein the smokable material comprises reconstituted
30 smokable material or is in the form of one of a gel, agglomerates, compressed material, or bound material.

18. Apparatus for heating smokable material to volatilise at least one component of the smokable material, the apparatus comprising:
first and second bodies with a heating zone arranged therebetween, wherein the first body is movable relative to the second body to compress the heating zone, wherein
5 the heating zone is for receiving at least a portion of an article comprising smokable material; and
wherein one or each of the first and second bodies comprises at least a portion of a magnetic field generator for generating a varying magnetic field to be used in heating the smokable material when the portion of the article is located in the heating
10 zone.
19. The apparatus of claim 18, wherein the first body is rotatable relative to the second body to compress the heating zone.
- 15 20. The apparatus of claim 18, wherein the portion of a magnetic field generator comprises an electrically-conductive coil.
21. The apparatus of claim 18, wherein the, or each, magnetic field generator is for generating a varying magnetic field that penetrates the heating zone.
20
22. The apparatus of claim 18, wherein one or each of the first and second bodies comprises heating material that is heatable by penetration with a varying magnetic field to heat the heating zone.
- 25 23. Apparatus for heating smokable material to volatilise at least one component of the smokable material, the apparatus comprising:
a heating zone for receiving at least a portion of an article comprising smokable material, wherein the heating zone has a length, a width perpendicular to the length, and a depth perpendicular to each of the length and the width, wherein the length is greater
30 than or equal to the width, and wherein the width is greater than the depth; and
a magnetic field generator for generating a varying magnetic field to be used in heating the smokable material when the portion of the article is located in the heating zone.

24. The apparatus of claim 23, wherein the magnetic field generator comprises an electrical power source that is offset from the heating zone in a direction parallel to the depth of the heating zone.

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25. The apparatus of claim 24, wherein the electrical power source has a length, a width perpendicular to the length of the electrical power source, and a depth perpendicular to each of the length and the width of the electrical power source, wherein the length of the electrical power source is greater than or equal to the width of the electrical power source, and wherein the width of the electrical power source is greater than the depth of the electrical power source; and

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wherein the length, width and depth of the electrical power source are substantially parallel to the length, width and depth, respectively, of the heating zone.

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26. The apparatus of claim 23, comprising first and second bodies, wherein the heating zone is defined by and is arranged between the first and second bodies, and wherein one or each of the first and second bodies comprises at least a portion of a magnetic field generator for generating a varying magnetic field to be used in heating the smokable material when the portion of the article is located in the heating zone.

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27. The apparatus of claim 26, wherein the portion of a magnetic field generator comprises a two-dimensional electrically-conductive coil.

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28. The apparatus of claim 26, comprising a third body comprising at least a portion of an electrical circuit;

wherein a first side of the second body is attached to the first body via a first element, and a second side of the second body is attached to the third body via a second element; and

30

wherein the second body is between the first and third bodies.

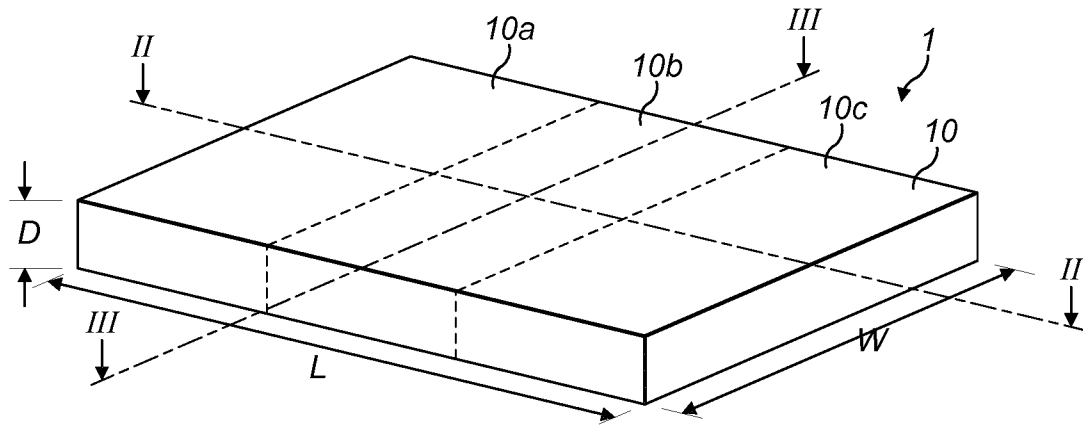


FIG. 1

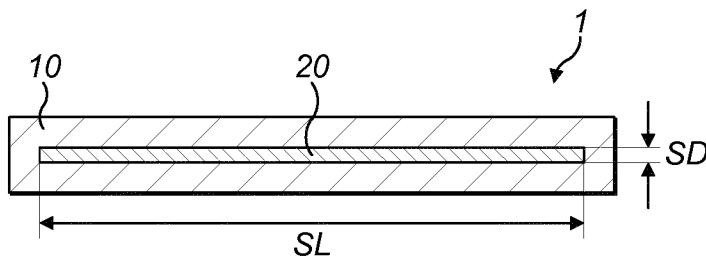


FIG. 2

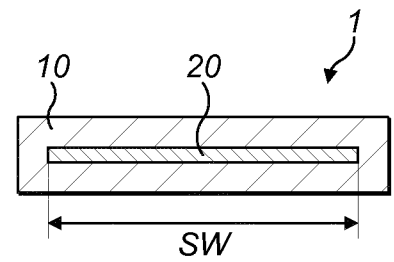


FIG. 3

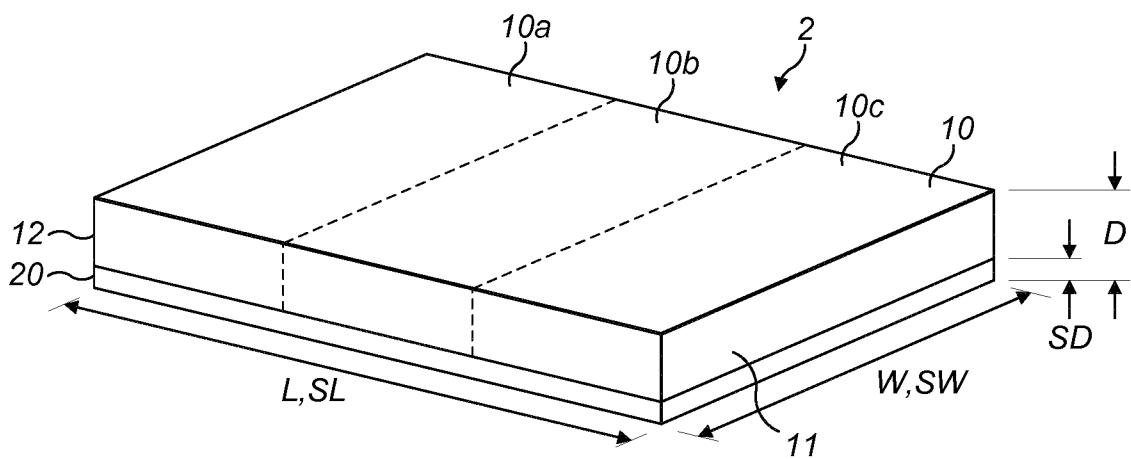


FIG. 4

2 / 3

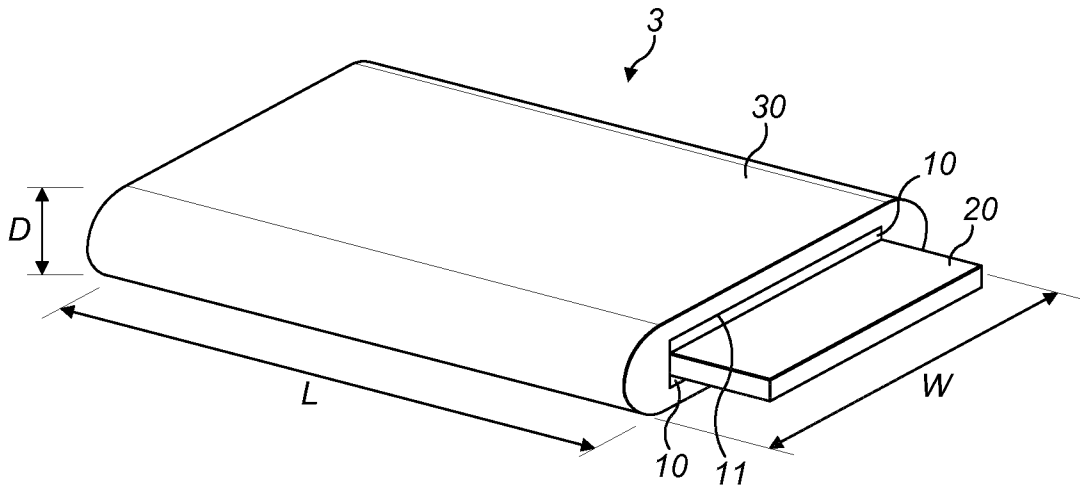


FIG. 5

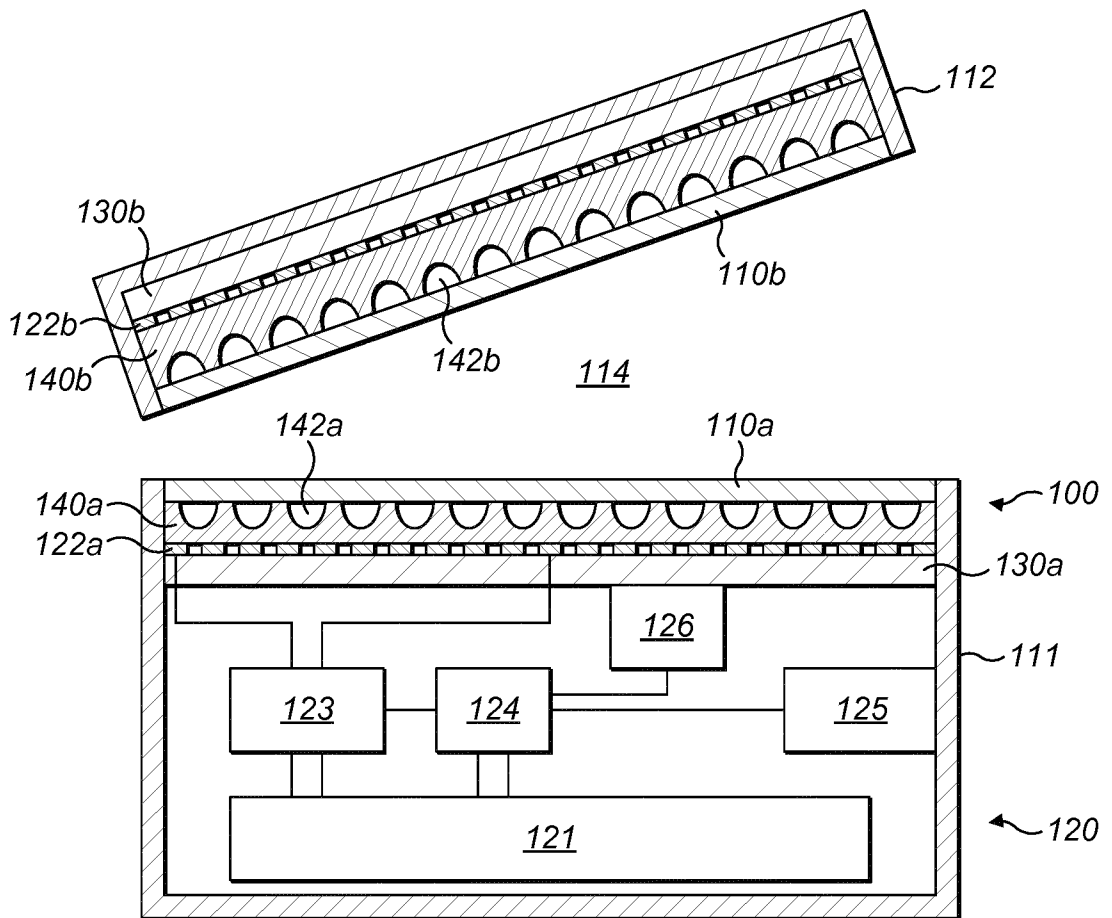


FIG. 6

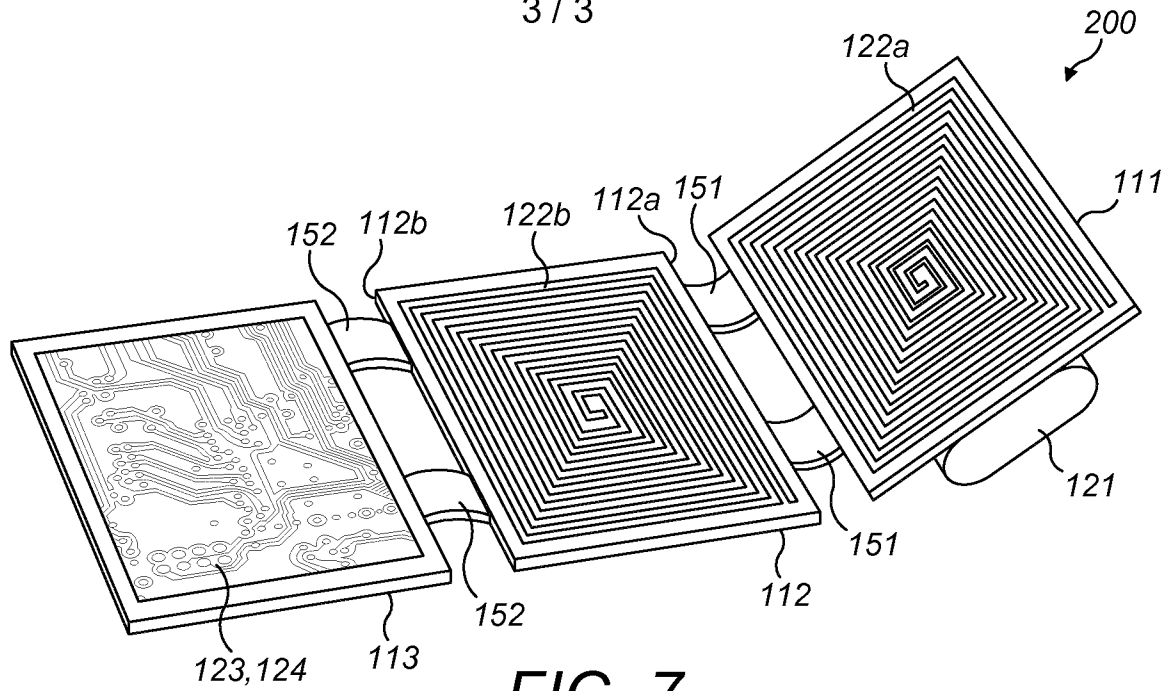


FIG. 7

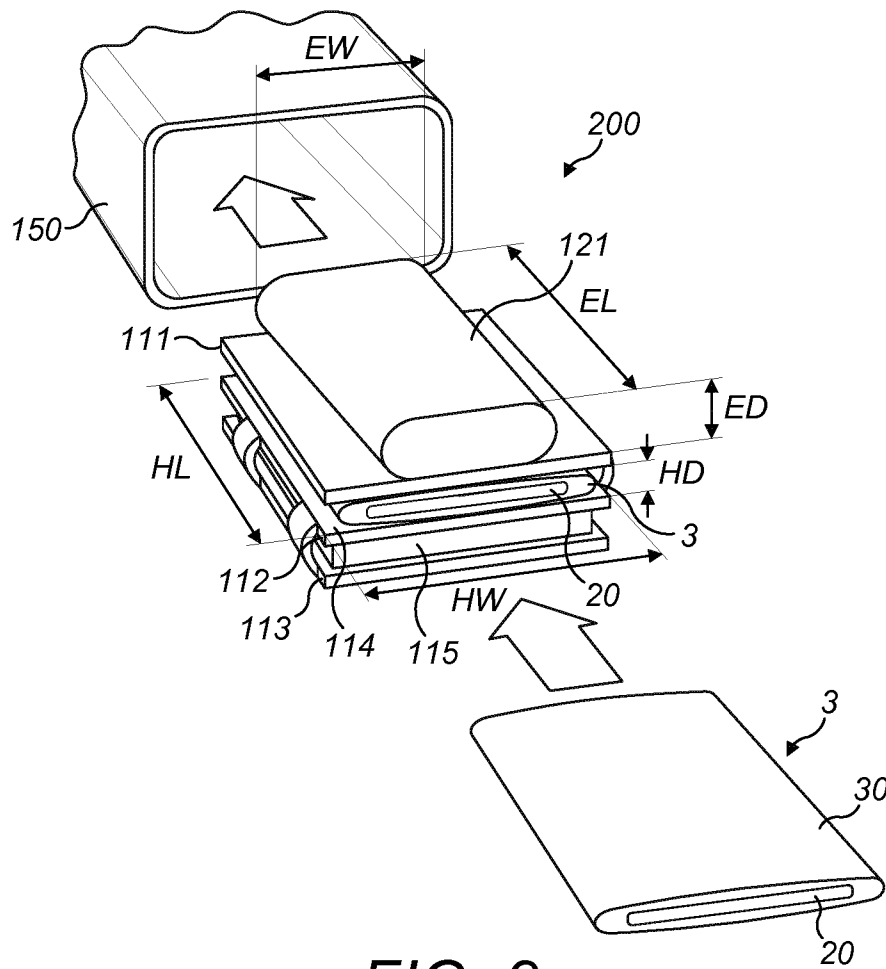


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/075736

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 A24B

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	EP 2 907 397 A1 (JAPAN TOBACCO INC [JP]) 19 August 2015 (2015-08-19) the whole document	1-11, 14-17
A	WO 2011/130414 A1 (ALTRIA CLIENT SERVICES INC [US]; CARROLL ANDREW NATHAN [US]; BLACK SHA) 20 October 2011 (2011-10-20) the whole document	1-28

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 6 February 2017	Date of mailing of the international search report 14/02/2017
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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 MacCormick, Duncan
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/EP2016/075736

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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			WO 2011130414 A1 20-10-2011

摘要: 公开了一种与用于加热可抽吸材料以使可抽吸材料的至少一种成分挥发的设备(100、200)一起使用的制品(1、2、3)。制品(1、2、3)包括可抽吸材料块(10)。制品(1、2、3)的外部具有长度(L)、垂直于长度(L)的宽度(W), 以及垂直于长度(L)和宽度(W)中的每者的深度(D)。长度(L)大于或等于宽度(W), 并且宽度(W)大于深度(D)。