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(54) Title: ELECTRONIC VAPOUR INHALERS

(57) Abstract: A cartridge (26) for an electronic vapour inhaler (10) comprises an elongate induction heatable element (28) and a flavour-release medium (30) adhered to the surface (32) of the elongate induction heatable element (28).
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ELECTRONIC VAPOUR INHALERS

Technical Field
The present disclosure relates generally to electronic vapour inhalers and more particularly to a cartridge having a flavour-release medium for use with an electronic vapour inhaler, in which the flavour-release medium can be heated to produce a vapour for inhalation by a user.

Technical Background
The use of electronic vapour inhalers (also known as electronic cigarettes, e-cigarettes and personal vaporisers), which can be used as an alternative to conventional smoking articles such as cigarettes, cigars, and pipes, is becoming increasingly popular and widespread. Electronic vapour inhalers, which are usually battery powered, heat and atomise a liquid containing nicotine, to produce a nicotine-containing vapour which can be inhaled by a user. The vapour is inhaled through a mouthpiece to deliver nicotine to the lungs, and vapour exhaled by the user generally mimics the appearance of smoke from a conventional smoking article. Although inhalation of the vapour creates a physical sensation which is similar to conventional smoking, harmful chemicals such as carbon monoxide and tar, are not produced or inhaled because there is no combustion.

Various electronic vapour inhalers are currently available but they all have drawbacks associated with them which the present disclosure seeks to overcome.

Summary of the Disclosure
According to a first aspect of the present disclosure, there is provided a cartridge for an electronic vapour inhaler, the cartridge comprising:

- an elongate induction heatable element; and
- a flavour-release medium adhered to the surface of the elongate induction heatable element.
The cartridge provides a convenient way for a user to load the flavour-release medium into the electronic vapour inhaler, thereby reducing the likelihood of spillage and waste. The integrity, safety and quality of the flavour-release medium can also be assured, because it is provided in the form of a pre-manufactured cartridge. Correct dosing of the flavour-release medium is also assured.

By arranging the induction heatable element in close proximity to the flavour-release medium and in contact with at least some of it, the flavour-release medium is heated rapidly and efficiently in the presence of an electromagnetic field and this gives a fast heating response with a relatively low power requirement. The cartridge does not have any moving parts and the heating element is disposed along with the cartridge. The heating element does not wear out and is not subject to a build-up of residue formed by deposits from the heated flavour-release medium because it is renewed each time the cartridge is replaced and there is, therefore, no reduction in performance or degradation in flavour or aroma over time. This is to be contrasted, for example, with existing electronic vapour inhalers which have a resistance heating element in the housing of the inhaler which wears out or fails after a certain amount of use and which is subject to the build-up of residue as the flavour-release medium is heated. In the event of failure, the electronic vapour inhaler may need to be discarded entirely and replaced with a new one.

The flavour-release medium may be any material or combination of materials which can be heated to release a vapour for inhalation by a user. The flavour-release medium may be tobacco or a tobacco material and may be impregnated with a vapour-forming medium such as propylene glycol or glycerol. The flavour-release medium is not, however, limited to tobacco and any flavour-release medium could be used.

The flavour-release medium may be adhered to an outer surface of the elongate induction heatable element. The flavour release medium may, for example, comprise a granulated material which may be adhered to the outer surface of the induction heatable element. The flavour-release medium can, therefore, be attached to the induction heatable element in a simple manner.
The elongate induction heatable element may comprise a rod or a wire which may have a solid cross-section.

The elongate induction heatable element may alternatively comprise a tube having a wall with an inner wall surface and an outer wall surface. The tube may, for example, be cylindrical or elliptical and the wall may be a circumferentially extending wall having an inner circumferential wall surface and an outer circumferential wall surface. The flavour release medium may be adhered to the inner wall surface and/or the outer wall surface. In arrangements where the flavour-release medium is adhered to both the inner and outer wall surfaces of the tubular induction heatable element, an increased amount of flavour and aroma may be released.

The tube may be adhered to one or both the inner and outer wall surfaces. The tube may further comprise one or more openings in the wall to allow air and gases to flow therethrough. For example, the tube may comprise a tubular mesh or a tubular perforated foil.

The cartridge may further comprise a thermally-insulating layer between the induction heatable element and the flavour-release medium. The thermally-insulating layer may usefully slow down the rate at which the flavour-release medium is heated.

According to a second aspect of the present disclosure, there is provided a cartridge for an electronic vapour inhaler, the cartridge comprising:

an elongate induction heatable element having a solid cross-section; and

a flavour-release medium surrounding the elongate induction heatable element.

The elongate induction heatable element may comprise a rod or may comprise one or more wires.

The cartridge may include a protective sleeve which surrounds the flavour-release medium. The use of a protective sleeve may be advantageous in arrangements where
the flavour-release medium comprises a fibrous material or is in the form of fine pieces or pellets or a granulated material, in order to hold the flavour-release medium in position around the elongate induction heatable element.

5 The protective sleeve may comprise a thermally-insulating material which may also be electrically-insulating and which may be non-magnetic. The protective sleeve could comprise a paper overwrap.

The protective sleeve may be tubular and may have open ends. The protective sleeve could, for example, be circular or elliptical in cross-section.

The elongate induction heatable element and the tubular protective sleeve may be concentric.

15 The cartridge may further comprise a thermally-insulating layer between the induction heatable element and the flavour-release medium.

According to a third aspect of the present disclosure, there is provided a cartridge for an electronic vapour inhaler, the cartridge comprising:

a tubular induction heatable element; and

a flavour-release medium provided exclusively to surround the tubular induction heatable element whereby the interior of the tubular induction heatable element is devoid of said flavour-release medium.

25 The tubular induction heatable element may comprise one or more openings in a wall thereof surrounded by the flavour-release medium to allow air and gases to flow through the wall. For example, the tubular induction heatable element could comprise a tubular mesh or a tubular perforated foil.

The cartridge may include a protective sleeve surrounding the flavour-release medium.
The protective sleeve may comprise a thermally-insulating material which may also be electrically-insulating and which may be non-magnetic. The protective sleeve could comprise a paper overwrap.

The protective sleeve may be tubular and may have open ends. The protective sleeve could, for example, be circular or elliptical in cross-section.

The tubular induction heatable element and the tubular protective sleeve may be concentric.

The cartridge may further comprise a thermally-insulating layer between the induction heatable element and the flavour-release medium.

According to a fourth aspect of the present disclosure, there is provided a cartridge for an electronic vapour inhaler, the cartridge comprising a flavour-release medium and an induction heatable material dispersed throughout the flavour-release medium.

The induction heatable material may be a particulate material. The particles are individually heated in the presence of an electromagnetic field and heat is transferred locally from the heated particles to the flavour-release medium. Rapid and effective heating of the flavour-release medium is, therefore, readily achieved.

The cartridge may include a protective sleeve surrounding the interspersed flavour-release medium and induction heatable material.

The protective sleeve may comprise a thermally-insulating material which may also be electrically-insulating and which may be non-magnetic. The protective sleeve could comprise a paper overwrap.

The protective sleeve may be tubular and may have open ends. The protective sleeve could, for example, be circular or elliptical in cross-section.
According to a fifth aspect of the present disclosure, there is provided an electronic vapour inhaler comprising:

- a housing having a proximal end and a distal end;
- a mouthpiece at the proximal end of the housing;
- a cartridge according to the present disclosure disposed in the housing; and
- an induction heating arrangement arranged to inductively heat the induction heatable element and thereby heat the flavour-release medium.

The housing may include a chamber in which the cartridge is removably disposed. The chamber may be thermally isolated from the external environment. The chamber could be located at any suitable position between the distal end and the proximal end of the housing. In some embodiments, the chamber could be located at the proximal end. In other embodiments, the chamber could be located at the distal end. In the latter case, even if there is a slight increase in temperature at the outer surface of the housing as the cartridge is heated during operation of the induction heating arrangement, this increase in temperature would not occur at the proximal end of the housing where the mouthpiece is located.

The induction heating arrangement may comprise an induction coil. The induction coil may extend around the chamber.

The housing may include an air inlet through which air can flow into the chamber. A plurality of air inlets could be provided.

The housing may be fitted with an airflow control mechanism to vary the airflow through the or each air inlet and, hence, through the cartridge. This might allow a user to influence the amount of flavour and aroma released from the heated flavour-release medium during inhalation through the mouthpiece.

The housing may include a conduit for delivering heated flavour-release medium to the mouthpiece. The conduit may include at least one first inlet for ambient air and at least one second inlet for heated air from the chamber. The conduit may be arranged
to provide a venturi effect, so that the heated air is sucked into the conduit from the
chamber by the venturi effect as ambient air flows through the conduit past the at least
one second inlet. With such an arrangement, relatively cool ambient air and relatively
hot air from the chamber are mixed together as they flow through the conduit and this
may provide a more gradual release of flavour and aroma during inhalation through
the mouthpiece. The housing may be fitted with an airflow control mechanism to vary
the flow through the at least one first inlet. The conduit is typically an annular conduit
which surrounds the chamber. The annular conduit may include a plurality of
circumferentially spaced first inlets formed in the housing and a plurality of
circumferentially spaced second inlets formed in a circumferential wall of the
chamber.

The electronic vapour inhaler may include one or more temperature sensors to
determine the cartridge temperature. Any suitable temperature sensor could be used,
for example a thermocouple, a resistance temperature detector, a thermistor or an
infra-red sensor. In one implementation, the temperature sensor(s) may determine the
cartridge temperature by direct measurement of the cartridge temperature. In another
implementation, the temperature sensor(s) may be used to determine the cartridge
temperature indirectly. For example, a temperature sensor could be used to measure
the temperature of the airflow into the chamber through the or each air inlet and the
cartridge temperature could then be determined mathematically as a function of the
measured air inlet temperature, the properties of the cartridge and the amount of
energy supplied by the induction heating arrangement.

The electronic vapour inhaler may include a control arrangement which may be
arranged to energise the induction heating arrangement to maintain the cartridge at a
substantially constant and predetermined temperature. The control arrangement could
be arranged to energise the induction heating arrangement based on the determined
temperature, thus creating a closed-loop feedback control arrangement. It should,
however, be understood that the temperature control could be effected without using a
temperature sensor.
According to a sixth aspect of the present disclosure, there is provided an electronic vapour inhaler comprising:

- a housing having a mouthpiece at one end;
- an induction heating arrangement arranged to inductively heat an induction heatable element of a cartridge or capsule inserted into the housing to heat a flavour-release medium within the cartridge or capsule;
- a control arrangement which is arranged to energise the induction heating arrangement to inductively heat the induction heatable element and thereby heat the flavour-release medium;
- the control arrangement being arranged to recognise an inserted capsule or cartridge by detecting a characteristic of the induction heatable element and to control the operation of the induction heating arrangement based on the detected characteristic.

The induction heatable element is effectively 'read' as a cartridge or capsule is inserted into the housing thereby providing automatic recognition of the cartridge or capsule.

The control arrangement may be arranged to control the operation of the induction heating arrangement, based on the detected characteristic, to provide a desired heating profile. The heating profile can, therefore, be set automatically upon recognition of a cartridge or capsule so that the flavour-release medium is heated in an optimum manner to release the flavour and aroma therefrom.

The control arrangement may be adapted to detect a change in the electromagnetic field generated by the interaction between the induction heatable element and the induction heating arrangement during insertion of a cartridge or capsule into the housing.

The cartridge may be as defined above. In this case, the characteristic to be detected, such as the change in the electromagnetic field, could be varied between different
cartridges for example by providing induction heatable elements of differing length, thickness or shape.

**Brief Description of the Drawings**

Figure 1 is diagrammatic cross-sectional view of an electronic vapour including a cartridge according to the present disclosure having an elongate rod-like induction heatable element with flavour-release medium adhered to its outer surface;

Figure 1a is a view similar to Figure 1, showing part of an alternative embodiment of an electronic vapour inhaler;

Figure 2 is a cross-sectional side view of the cartridge shown in Figures 1 and 2;

Figure 3 is a diagrammatic cross-sectional side view of a cartridge having a tubular induction heatable element with flavour-release medium adhered to inner and outer wall surfaces;

Figure 4a is a view of a cartridge similar to the cartridge shown in Figure 3 but having a perforated tubular induction heatable element and Figure 4b is a side view of the perforated tubular induction heatable element;

Figure 5 is a diagrammatic cross-sectional side view of a cartridge having an elongate rod-like induction heatable element with flavour-release medium surrounding it;

Figure 6 is a diagrammatic cross-sectional side view of a cartridge having a tubular induction heatable element with flavour-release medium surrounding it; and

Figure 7 is a diagrammatic cross-sectional side view of a cartridge in which particulate induction heatable material is dispersed throughout a flavour-release medium.

**Detailed Description of Embodiments**

Embodiments of the present disclosure will now be described by way of example only and with reference to the accompanying drawings.

Referring initially to Figure 1, an electronic vapour inhaler 10 comprises a generally elongate housing 12 having a proximal end 14 and a distal end 16. The electronic vapour inhaler 10 includes a mouthpiece 18 at the proximal end 14 through which a user can inhale vapour generated by heating a flavour-release medium 30. The
electronic vapour inhaler 10 includes a control arrangement 20, e.g. in the form of a microprocessor, and a power source 22 in the form of one or more batteries which could, for example, be inductively rechargeable.

The housing 12 includes a chamber 24 into which a cartridge 26 can be removably inserted. The chamber 24 is located at the proximal end 16 of the housing 12 adjacent to the mouthpiece 18, but this is not strictly necessary and it could be located at any suitable position between the proximal end 14 and the distal end 16. In the illustrated embodiment, the chamber 24 is formed in the housing 12 and is accessed by removing a cover 25, with which the mouthpiece 18 is integrally formed, from the proximal end 14 of the housing 12. In alternative embodiments, the chamber 24 could itself be formed as a removable component and could be accessed by removing the component from the housing 12. Either way, a cartridge 26 can be easily inserted into, or removed from, the chamber 24.

The cartridge 26, which is shown separately in Figure 2 for clarity purposes, comprises an elongate induction heatable element 28 in the form of a rod which is typically, but not exclusively, circular in cross-section. The cartridge 26 further comprises a flavour-release medium 30 which is adhered, e.g. as a coating, to the surface 32 of the induction heatable element 28. The flavour-release medium 30 is a granulated or particulate material which may be treated or processed to enable it to adhere to the induction heatable element 28. The flavour-release medium 30 typically comprises tobacco or a tobacco material which may be impregnated with a vapour-forming medium, such as propylene glycol or glycerol, so that it can be heated to produce a vapour for inhalation by a user through the mouthpiece 18 of the electronic vapour inhaler 10. When tobacco or a tobacco material is used, the electronic vapour inhaler 10 can be used as an electronic cigarette. Materials other than tobacco can, however, be used as explained earlier in this specification.

The induction heatable element 28 is in intimate contact with the flavour-release medium 30 due to the fact that the flavour-release medium 30 is adhered to it. As a
result, when the induction heatable element 28 is heated in the presence of an electromagnetic field, the flavour-release medium 30 is heated rapidly and uniformly.

Referring again to Figure 1, the electronic vapour inhaler 10 includes an induction heating arrangement 34 comprising an induction coil 36 which can be energised by the power source 22. As will be understood by those skilled in the art, when the induction coil 36 is energised, an electromagnetic field is produced which generates eddy currents in the induction heatable element 28 causing it to heat up. The heat is then transferred from the induction heatable element 28 to the flavour-release medium 30, for example by conduction, radiation and convection.

The operation of the induction heating arrangement 34 is controlled by the control arrangement 20 typically in order to maintain the flavour-release medium 30 at a temperature which is optimised for the release of flavour and aroma therefrom.

Although not shown in Figure 1, the electronic vapour inhaler 10 can include a temperature sensor to measure the temperature inside the chamber 24 and in this case the control arrangement 20 can be arranged to control the operation of the induction heating arrangement 34 based on the temperature measured by the temperature sensor. Other arrangements for determining the temperature inside the chamber 24 are, however, possible as described earlier in this specification.

When a user wishes to use the electronic vapour inhaler 10 to inhale vapour, the user may initially need to gain access to the chamber 24, for example by removing the cover 25 from the proximal end 14 of the housing 12 (e.g. by unscrewing it). The user then places a pre-manufactured cartridge 26 into the chamber 24. Pre-manufactured cartridges 26 are typically supplied in a pack which can be purchased separately. Loading the cartridge 26 into the chamber 24 is, therefore, a very simple procedure for the user.

The user then closes the chamber 24, for example by re-attaching the cover 25 to the proximal end 14 of the housing 12 (e.g. by screwing it back on to the housing 12).
The electronic vapour inhaler 10 can then be switched on by the user ready for use, thereby energising the induction coil 36 and heating the induction heatable element 28 and the flavour-release medium 30 as described above such that the flavour-release medium 30 is heated without being combusted.

When a user places their mouth over the mouthpiece 18 and inhales, ambient air is drawn through air inlets 38 into the chamber 24, as denoted by the arrows 40. The air is heated as it flows through the granulated or particulate flavour-release medium 30 in the chamber 24 and heated air with a suitable aroma and flavour flows out of the chamber 24. The heated air then flows through the mouthpiece 18 and, in doing so, it cools and condenses to form a vapour or aerosol which can be inhaled by a user through the mouthpiece 18, as denoted by the arrow 42. The control arrangement 20 could include a temperature selector to allow a user to select the desired vapour inhalation temperature to select the desired user experience, since the optimum inhalation temperature may be a matter of personal choice.

During inhalation, and as air flows into and through the chamber 24, it will be understood that the induction coil 36 can be energised as necessary to maintain a predetermined, e.g. substantially constant, temperature inside the chamber 24. This in turn ensures that the temperature of the vapour inhaled by the user through the mouthpiece 18 is optimised, e.g. substantially constant. However, in order to preserve the flavour-release medium 30, the control arrangement 20 can be arranged to control the induction heating arrangement 34 so that the induction coil 36 is energised in such a way that the temperature inside the chamber 24 decreases between inhalation cycles and increases immediately before, or at the start of, the next inhalation cycle.

When the flavour and aroma of the vapour supplied to the mouthpiece 18 has reached a level which is considered by a user to be unacceptable, the chamber 24 can be accessed, for example by removing the cover 25 from the proximal end 14 of the housing 12. The used cartridge 26 can then be removed and discarded, and a new cartridge 26 can be placed in the chamber 24 before the cover 25 is replaced as described above to ready the electronic vapour inhaler 10 for use.
It will be appreciated that the contents of the cartridge 26, and in particular the constituents of the flavour-release medium, may vary and that the operation of the induction heating arrangement 34 may ideally need to be varied to optimise the release of flavour and aroma from the flavour-release medium. For example, the contents of certain cartridges 26 may favour a heating profile with a relatively slow heating rate whereas the contents of other cartridges 26 may favour a heating profile with a relatively rapid heating rate. In order to accommodate this, in one embodiment the control arrangement 20 is arranged to recognise an inserted cartridge 26 by detecting a characteristic of the induction heatable element 28 and to control the operation of the induction heating arrangement 34, e.g. to provide a desired heating profile, based on the detected characteristic. In one possible implementation, as a cartridge 26 is inserted into the chamber 24, the control arrangement 20 detects a change in the electromagnetic field generated by the interaction between the induction heatable element 28 and the induction coil 36. In practice, different electromagnetic field signatures can be provided for different cartridges 26 by providing one or more induction heatable elements 28 of different length, thickness or shape.

Figure 1a shows an alternative embodiment of part of an electronic vapour inhaler 110. The electronic vapour inhaler 110 shares many features in common with the electronic vapour inhaler 10 shown in Figure 1 and corresponding features are, therefore, designated with corresponding reference numerals.

The electronic vapour inhaler 110 has an annular conduit 112 which surrounds the chamber 24. The annular conduit 112 is formed between a circumferential wall of the housing 12 in which the induction coil 36 is embedded and a circumferential wall 114 of the chamber 24. The annular conduit 112 includes a plurality of circumferentially spaced first inlets 116 formed in the housing 12 at the distal end of the annular conduit 112 to enable ambient air to flow into the annular conduit 112. The annular conduit 112 also includes a plurality of circumferentially spaced second inlets 118 which are formed in the circumferential wall 114 of the chamber 24 to enable heated air to flow from the chamber 24 into the annular conduit 112. The second inlets 118
are formed in the circumferential wall 114 roughly at the midpoint of the annular conduit 112, between the distal and proximal ends thereof, but other positions are of course entirely feasible and within the scope of the present disclosure. Circumferentially spaced passages 120, 122 are also provided in the housing 12 to direct a proportion of ambient air from the first inlets 116 along passage 124 and into the chamber 24.

During inhalation through the mouthpiece 18, ambient air is drawn through the circumferentially spaced first inlets 116 into the annular conduit 112, as shown by the arrows 140. The ambient air flows along the annular conduit 112, from the distal end towards the proximal end, towards the mouthpiece 18 as shown by the arrows 142. As the air flows past the circumferentially spaced second inlets 118 in the chamber wall 114, a venturi effect occurs. This causes ambient air to be drawn through the passages 120, 122, 124 into the chamber 24 and to be sucked out of the chamber 24 through the second inlets 118, as shown by the dotted arrows. As will be understood, the air entering the chamber through the passages 120, 122, 124 is heated as it flows through the granulated or particulate flavour-release medium 30 in the chamber 24 and, accordingly, heated air with a suitable aroma and flavour is sucked out of the chamber 24 through the second inlets 118. The heated air mixes with the ambient air flowing through the annular conduit 112 and this tends to reduce the temperature of the heated air to a more acceptable level. The heated air then cools further and condenses to form a vapour or aerosol which can be inhaled by a user through the mouthpiece 18, as denoted by the arrow 42.

Alternative cartridges can be used with the electronic vapour inhalers 10, 110, or indeed other suitably configured electronic vapour inhalers, as will now be described.

Referring to Figure 3, there is shown a cartridge 44 comprising a tubular (possibly cylindrical) induction heatable element 46. The tubular induction heatable element 46 has a wall 48 with inner and outer wall surfaces 50, 52 and flavour-release medium 54 is adhered to both the inner and outer wall surfaces 50, 52. In other embodiments, the
flavour-release medium 54 could be adhered to just one of the inner and outer wall surfaces 50, 52.

Figures 4a and 4b show a cartridge 56 similar to the cartridge 44 of Figure 3 and in which corresponding components are identified using corresponding reference numerals. In the cartridge 56 of Figures 4a and 4b, the tubular induction heatable element 46 (which is cylindrical in the illustrated embodiment) includes perforations 58 so that air can flow through the wall 48 between the inner and outer wall surfaces 50, 52.

Referring now to Figure 5, there is shown a cartridge 60 comprising an elongate induction heatable element 62 in the form of a rod which is typically, but not exclusively, circular in cross-section. The cartridge 60 further comprises a flavour-release medium 64 which surrounds the induction heatable element 62. A thermally-insulating, electrically-insulating and non-magnetic protective sleeve 66, for example in the form of a paper overwrap having open ends, surrounds the flavour-release medium 64 and may advantageously hold it in position, in particular if the flavour-release medium 64 comprises fine pieces or particles of material. In other embodiments, the flavour-release medium 64 can comprise interwoven fibres and this may be sufficient to retain the fibrous flavour-release medium 64 in position around the induction heatable element 62 without a protective sleeve 66 being needed.

Figure 6 shows a cartridge 68 comprising a tubular (possibly cylindrical) induction heatable element 70. The tubular induction heatable element 70 comprises a wall 72 with inner and outer wall surfaces 74, 76 and flavour-release medium 78 is provided exclusively around the outer wall surface 76 to surround the induction heatable element 70. Thus, the interior 80 of the tubular induction heatable element 70 is devoid of flavour-release medium 78.

A thermally-insulating, electrically-insulating and non-magnetic protective sleeve 82, for example in the form of a paper overwrap, surrounds the flavour-release medium 78 and may advantageously hold it in position, in particular if the flavour-release
medium 78 comprises fine pieces or particles of material. In other embodiments, the flavour-release medium 78 can comprise interwoven fibres and this may be sufficient to retain the fibrous flavour-release medium 78 in position around the induction heatable element 70 without a protective sleeve 82 being needed.

In a modified implementation of the cartridge 68 (not illustrated), the tubular induction heatable element 70 includes perforations so that air can flow through the wall 72 between the inner and outer wall surfaces 74, 76.

Referring now to Figure 7, there is shown a cartridge 84 comprising a flavour-release medium 86 in the form of fine pieces or pellets, particles, flakes or a fibrous form. In the illustrated embodiment, a paper overwrap is provided to act as a protective sleeve 88 but, as described with respect to earlier embodiments, this may be omitted if, for example, the flavour-release medium 86 comprises interwoven fibres or the like which enable it to retain its shape in the absence of the support structure provided by the protective sleeve 88.

The cartridge 84 further comprises an induction heatable material 90 in the form of particles of material which are individually inductively heated in the presence of an electromagnetic field. The particles of the induction heatable material 90 are dispersed throughout the flavour-release medium, typically but not exclusively in a uniform manner.

Although exemplary embodiments have been described in the preceding paragraphs, it should be understood that various modifications may be made to those embodiments without departing from the scope of the appended claims. Thus, the breadth and scope of the claims should not be limited to the above-described exemplary embodiments. Each feature disclosed in the specification, including the claims and drawings, may be replaced by alternative features serving the same, equivalent or similar purposes, unless expressly stated otherwise.
Although the cartridges 26, 44, 56, 60, 68, 84, have been described for use with the electronic vapour inhalers 10, 110, it will be understood that they can be used with electronic vapour inhalers having alternative configurations.

Although not illustrated, either of the electronic vapour inhalers 10, 110 could be provided with an airflow control mechanism to enable a user to control the airflow through the inlets 38, 116. For example, the airflow control mechanism could comprise means for varying the aperture size of the inlets 38, 116 to restrict the flow of air into the inlets 38, 116.

It may be desirable in any of the aforementioned embodiments to provide a thermally-insulating material between the induction heatable element and the flavour-release medium to reduce the rate of heat transfer to the flavour-release medium.

Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise", "comprising", and the like, are to be construed in an inclusive as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to".

Any combination of the above-described features in all possible variations thereof is encompassed by the present invention unless otherwise indicated herein or otherwise clearly contradicted by context.
Claims

1. A cartridge for an electronic vapour inhaler, the cartridge comprising:
   an elongate induction heatable element; and
   a flavour-release medium adhered to the surface of the elongate induction heatable element.

2. A cartridge according to claim 1, wherein the flavour-release medium is adhered to an outer surface of the elongate induction heatable element.

3. A cartridge according to claim 1 or claim 2, wherein the elongate induction heatable element comprises a rod or a wire having a solid cross-section.

4. A cartridge according to claim 1, wherein the elongate induction heatable element comprises a tube having a wall with inner and outer wall surfaces.

5. A cartridge according to claim 4, wherein the flavour release medium is adhered to the inner wall surface.

6. A cartridge according to claim 4 or claim 5, wherein the flavour release medium is adhered to the outer wall surface.

7. A cartridge according to claim any of claims 4 to 6, wherein the tubular induction heatable element comprises one or more openings in the wall to allow air to flow therethrough.

8. A cartridge according to any preceding claim, further comprising a thermally-insulating layer between the induction heatable element and the flavour-release medium.

9. A cartridge for an electronic vapour inhaler, the cartridge comprising:
   an elongate induction heatable element having a solid cross-section; and
a flavour-release medium surrounding the elongate induction heatable element.

10. A cartridge according to claim 9, wherein the elongate induction heatable element comprises a rod or a wire.

11. A cartridge according to claim 9 or claim 10, wherein the cartridge comprises a protective sleeve surrounding the flavour-release medium.

12. A cartridge according to claim 11, wherein the protective sleeve comprises a thermally-insulating material which is also electrically-insulating and non-magnetic.

13. A cartridge according to claim 11 or claim 12, wherein the protective sleeve is tubular and has open ends.

14. A cartridge according to claim 13, wherein the elongate induction heatable element and the tubular protective sleeve are concentric.

15. A cartridge according to any of claims 9 to 14, further comprising a thermally-insulating layer between the induction heatable element and the flavour-release medium.

16. A cartridge for an electronic vapour inhaler, the cartridge comprising:
   a tubular induction heatable element; and
   a flavour-release medium provided exclusively to surround the tubular induction heatable element whereby the interior of the tubular induction heatable element is devoid of said flavour-release medium.

17. A cartridge according to claim 16, wherein the tubular induction heatable element comprises one or more openings in a wall thereof surrounded by the flavour-release medium to allow air to flow through the wall.
18. A cartridge according to claim 16 or claim 17, wherein the cartridge comprises a protective sleeve surrounding the flavour-release medium.

19. A cartridge according to claim 18, wherein the protective sleeve comprises a thermally-insulating material which is also electrically-insulating and non-magnetic.

20. A cartridge according to claim 18 or claim 19, wherein the protective sleeve is tubular and has open ends.

21. A cartridge according to claim 20, wherein the tubular induction heatable element and the tubular protective sleeve are concentric.

22. A cartridge according to any of claims 16 to 21, further comprising a thermally-insulating layer between the induction heatable element and the flavour-release medium.

23. A cartridge for an electronic vapour inhaler, the cartridge comprising a flavour-release medium and an induction heatable material dispersed throughout the flavour-release medium.

24. A cartridge according to claim 23, wherein the induction heatable material is a particulate material.

25. A cartridge according to claim 23 or claim 24, wherein the cartridge comprises a protective sleeve surrounding the flavour-release medium and induction heatable material dispersed therein.

26. A cartridge according to claim 25, wherein the protective sleeve comprises a thermally-insulating material which is also electrically-insulating and non-magnetic.

27. A cartridge according to claim 25 or claim 26, wherein the protective sleeve is tubular and has open ends.
28. An electronic vapour inhaler comprising:
   a housing having a proximal end and a distal end;
   a mouthpiece at the proximal end of the housing;
   a cartridge according to any preceding claim disposed in the housing; and
   an induction heating arrangement arranged to inductively heat the induction
   heatable element and thereby heat the flavour-release medium.

29. An electronic vapour inhaler according to claim 28, wherein the induction
    heating arrangement comprises an induction coil.

30. An electronic vapour inhaler according to claim 28 or claim 29, wherein the
    housing includes a chamber in which the cartridge is disposed.

31. An electronic vapour inhaler according to any of claims 28 to 30, further
    including a control arrangement which is adapted to energise the induction heating
    arrangement to maintain the cartridge substantially at a predetermined temperature.

32. An electronic vapour inhaler according to claim 31, further including a
    temperature sensor for determining the cartridge temperature, wherein the control
    arrangement is adapted to energise the induction heating arrangement based on the
    determined temperature.

33. An electronic vapour inhaler according to any of claims 30 to 32, wherein the
    housing includes a conduit for delivering heated air to the mouthpiece, the conduit
    includes at least one first inlet for ambient air and at least one second inlet for heated
    air from the chamber, the conduit being arranged to provide a venturi effect whereby,
    in use, the heated air is sucked into the conduit from the chamber by the venturi effect
    as ambient air flows through the conduit past the at least one second inlet.

34. An electronic vapour inhaler according to claim 33, wherein the conduit is an
    annular conduit which surrounds the chamber.
35. An electronic vapour inhaler according to claim 34, wherein the annular conduit includes a plurality of circumferentially spaced first inlets formed in the housing and a plurality of circumferentially spaced second inlets formed in a circumferential wall of the chamber.

36. An electronic vapour inhaler comprising:
   a housing having a mouthpiece at one end;
   an induction heating arrangement arranged to inductively heat an induction heatable element of a cartridge or capsule inserted into the housing to heat a flavour-release medium within the cartridge or capsule;
   a control arrangement which is arranged to energise the induction heating arrangement to inductively heat the induction heatable element and thereby heat the flavour-release medium;
   the control arrangement being further arranged to recognise an inserted capsule or cartridge by detecting a characteristic of the induction heatable element and to control the operation of the induction heating arrangement based on the detected characteristic.

37. An electronic vapour inhaler according to claim 36, wherein the control arrangement is arranged to control the operation of the induction heating arrangement to provide a predetermined heating profile.

38. An electronic vapour inhaler according to claim 36 or claim 37, wherein the control arrangement is arranged to detect a change in the electromagnetic field generated by the interaction between the induction heatable element and the induction heating arrangement during insertion of a capsule or cartridge into the housing.

39. An electronic vapour inhaler according to any of claims 36 to 38, wherein the induction heating arrangement comprises an induction coil.
40. An electronic vapour inhaler according to any of claims 36 to 39, wherein the housing includes a chamber in which the cartridge is disposed.

41. An electronic vapour inhaler according to any of claims 36 to 40, wherein the cartridge is as defined in any of claims 1 to 27.

42. A cartridge for an electronic vapour inhaler substantially as hereinbefore described and/or as shown in any one or more of the accompanying drawings.

43. An electronic vapour inhaler substantially as hereinbefore described and/or as shown in Figure 1 or Figure 1a of the accompanying drawings.
Fig. 7
## Classification of Subject Matter

### ADD.

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

### INV.

A24F

## Fields Searched

Minimum documentation searched (classification system followed by classification symbols)

A24F

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

## Field Documentation Consulted during the International Search

(EPO-Internal, WPI Data)

## Documents Considered to Be Relevant

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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) one of which is cited to establish the publication date of another citation or other special reason (as specified)

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

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**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

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**A** document member of the same patent family

### Date of the actual completion of the international search

4 February 2016

### Name and mailing address of the ISA

European Patent Office
P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel.: (+31-70) 340-2040, Fax: (+31-70) 340-3016

### Authorized officer

Marzano Monterosso
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**INTERNATIONAL SEARCH REPORT**

**Box No. II**  
Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III**  
Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

- see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ❌ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

- No protest accompanied the payment of additional search fees.

Form PCT/ISA/21 0 (continuation of first sheet (2)) (April 2005)
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-43

Cartridge for electronic vapour inhaler with elongate inductor on heatable element.
Cartridge with flavour release medium and inductor on heatable material dispersed throughout the medium. Electronic vapour inhaler with control arrangements to recognise an inserted capsule.

1.1. claims: 23-27

Cartridge with flavour release medium and inductor on heatable material dispersed throughout the medium.

1.2. claims: 36-41

Electronic vapour inhaler with control arrangements to recognise an inserted capsule.

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