(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 811 789 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.04.2021 Bulletin 2021/17

(51) Int Cl.:
A24B 15/167 *(2020.01)* ***A24B 15/24*** *(2006.01)*
A24F 40/10 *(2020.01)*

(21) Application number: **19205019.3**

(22) Date of filing: **24.10.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **NERUDIA LIMITED**
Liverpool Merseyside L24 9HP (GB)

(72) Inventor: **The designation of the inventor has not yet been filed**

(74) Representative: **Mewburn Ellis LLP**
Aurora Building
Counterslip
Bristol BS1 6BX (GB)

(54) **SMOKING SUBSTITUTE SYSTEM**

(57) A consumable for a smoking substitute device contains a liquid aerosol-forming substrate, wherein the substrate comprises an infusion of solid tobacco-derived material in aerosol-former solution, and the infusion is combined with a nicotine formulation. The nicotine formulation may comprise a nicotine salt, particularly nicotine lactate. The substrate is obtained by macerating solid tobacco-derived material in aerosol-former liquid to form an infusion of solid tobacco-derived material and combining the infusion with a nicotine formulation. The tobacco-derived solids are macerated for a time period sufficient for the infusion to undergo a required change in physical characteristics (such as colour or viscosity) or a required change in chemical characteristics (such as amount of nicotine release). Tobacco-derived solid may be visible in the substrate as an indicator that it is not a pharmaceutical product.

EP 3 811 789 A1

Description

Field of the Invention

[0001] The present invention relates to smoking substitute systems, a consumable containing a liquid aerosol-forming substrate and methods for manufacture thereof.

Background

[0002] Smoking substitute devices, which may also be known as electronic nicotine delivery systems, may comprise electronic systems that permit a user to simulate the act of smoking by producing an aerosol, also referred to as a "vapour", which is drawn into the lungs through the mouth (inhaled) and then exhaled. The inhaled aerosol typically bears nicotine and/or flavourings without, or with fewer of, the odour and health risks associated with traditional smoking.

[0003] In general, smoking substitute devices are intended to provide a substitute for the rituals of smoking, whilst providing the user with a similar experience and satisfaction to those experienced with traditional smoking and tobacco products.

[0004] The popularity and use of smoking substitute devices has grown rapidly in the past few years. Although originally marketed as an aid to assist habitual smokers wishing to quit tobacco smoking, consumers are increasingly viewing smoking substitute devices as desirable lifestyle accessories. Some smoking substitute devices are designed to resemble a traditional cigarette and are cylindrical in form with a mouthpiece at one end. Other smoking substitute devices do not generally resemble a cigarette (for example, the smoking substitute device may have a generally box-like form).

[0005] There are a number of different categories of smoking substitute devices, each utilising a different smoking substitute approach.

[0006] One approach for a smoking substitute device is the so-called "vaping" approach, in which a vaporisable liquid, typically referred to as "e-liquid", is heated by a heating device to produce an aerosol vapour which is inhaled by a user. An e-liquid typically includes a base liquid as well as nicotine and/or flavourings. The resulting vapour therefore typically contains nicotine and/or flavourings. The base liquid may include propylene glycol and/or vegetable glycerine.

[0007] A typical vaping smoking substitute device includes a mouthpiece, a power source (typically a battery), a tank for containing e-liquid, as well as a heating device. In use, electrical energy is supplied from the power source to the heating device, which heats the e-liquid to produce an aerosol (or "vapour") which is inhaled by a user through the mouthpiece.

[0008] Vaping smoking substitute devices can be configured in a variety of ways. For example, there are "closed system" vaping smoking substitute devices which typically have a sealed tank and heating element which is pre-filled with e-liquid and is not intended to be refilled by an end user. One subset of closed system vaping smoking substitute devices include a main body which includes the power source, wherein the main body is configured to be physically and electrically coupled to a consumable including the tank and the heating element. In this way, when the tank of a consumable has been emptied, the main body can be reused by connecting it to a new consumable. Another subset of closed system vaping smoking substitute devices are completely disposable, and intended for one-use only.

[0009] There are also "open system" vaping smoking substitute devices which typically have a tank that is configured to be refilled by a user, so the device can be used multiple times.

[0010] An example vaping smoking substitute device is the myblu™ e-cigarette. The myblu™ e-cigarette is a closed system device which includes a main body and a consumable. The main body and consumable are physically and electrically coupled together by pushing the consumable into the main body. The main body includes a rechargeable battery. The consumable includes a mouthpiece, a sealed tank which contains e-liquid, as well as a heating device, which for this device is a heating filament coiled around a portion of a wick which is partially immersed in the e-liquid. The device is activated when a microprocessor on board the main body detects a user inhaling through the mouthpiece. When the device is activated, electrical energy is supplied from the power source to the heating device, which heats e-liquid from the tank to produce a vapour which is inhaled by a user through the mouthpiece.

[0011] Another example vaping smoking substitute device is the blu PRO™ e-cigarette. The blu PRO™ e-cigarette is an open system device which includes a main body, a (refillable) tank, and a mouthpiece. The main body and tank are physically and electrically coupled together by screwing one to the other. The mouthpiece and refillable tank are physically coupled together by screwing one into the other, and detaching the mouthpiece from the refillable tank allows the tank to be refilled with e-liquid. The device is activated by a button on the main body. When the device is activated, electrical energy is supplied from the power source to a heating device, which heats e-liquid from the tank to produce a vapour which is inhaled by a user through the mouthpiece.

[0012] WO2013/060827 proposes an apparatus for creating a liquid tobacco extract to be supplied to a refillable tank of an e-cigarette. The aim is to allow the user to make their own e-liquid from cut tobacco, to extract flavour and aroma compounds as close as possible in time to the moment the e-cigarette will be used, and without delivering cut tobacco particles to the cartridge which could otherwise be detrimental to performance of the e-cigarette.

[0013] Another different approach for a smoking substitute device is the so-called "heat not burn" ("HNB")

approach in which tobacco (rather than e-liquid) is heated or warmed to release vapour. The tobacco may be leaf tobacco or reconstituted tobacco. The vapour may contain nicotine and/or flavourings. In the HNB approach the intention is that the tobacco is heated but not burned, i.e. does not undergo combustion.

[0014] A host of e-liquid formulations are commercially available for use in vaping smoking substitute devices. The formulations are typically based on vegetable glycerine or propylene glycol in combination with various flavourings. E-liquids may optionally contain nicotine.

[0015] Nicotine contains two basic nitrogen atoms. If neither are protonated then the nicotine is referred to as the "free-base", whereas if one or two are protonated it may be referred to as "mono-protonated" or "di-protonated", respectively.

[0016] Nicotine may be synthetically produced or, more typically, isolated and purified from natural sources. In the leaves of the tobacco plant nicotine is present as a salt, which is not as readily bioavailable as the free base. For this reason, nicotine is typically isolated from a tobacco plant by methods involving reaction of the plant with a strong base in order to convert the salts to the free base.

[0017] During smoking of traditional cigarettes, nicotine is rapidly absorbed across the surface of the lungs owing to the large surface area of the alveoli and considerable capillary network. The nicotine salts that occur naturally in tobacco are not absorbed by the human body as readily as the free base form. The free base is also more lipid soluble which means that it crosses the blood-brain barrier more readily to trigger a dopamine response more effective that achieved by the naturally occurring nicotine salts.

[0018] Whilst free-base nicotine is absorbed in the mouth and upper respiratory tract, the rate of this absorption in the blood is slower than in the lungs. However, deposition of the free-base nicotine in the mouth has been found to lead to greater sensory effects, possibly due to activation of peripheral nerves. As free-base nicotine is acidic, it can produce a harsh response in the throat above certain concentrations.

[0019] On activation of an e-cigarette which includes a nicotine-containing e-liquid, nicotine may be volatized as gas-phase nicotine or released from the e-liquid on aerosol particles. Nicotine bound to particles can be deposited into the lungs where it can be rapidly absorbed into the pulmonary venous circulation. Alternatively or in addition it may evaporate from the particles on impact in the mouth and upper airways and be absorbed into the circulation via this route, albeit more slowly than via the lungs.

[0020] Numerous nicotine salts are known, notably nicotine monotartarate, nicotine bitartrate, nicotine citrate, nicotine malate and nicotine hydrochloride. Investigations have been made into nicotine salts that could show improved bioavailability when incorporated into e-liquids.

[0021] For example, WO2014/ 182736 Ploom Inc concerns nicotine salt formulations for aerosol devices and methods thereof. It proposes that certain nicotine salt formulations provide satisfaction in an individual superior to that of free-base nicotine, and more comparable to the satisfaction in an individual smoking a traditional cigarette. The satisfaction effect is stated to be consistent with an efficient transfer of nicotine to the lungs of an individual and a rapid rise of nicotine absorption in the plasma is shown.

[0022] Results are included which show differences in the rate of nicotine uptake in the blood for various nicotine salts formulations aerosolized in e-cigarettes, as compared to nicotine free-base formulations. The peak concentration of the nicotine in the blood and the total amount of nicotine delivered appeared to be comparable to a traditional cigarette and did not vary significantly between the various nicotine salt formulations.

[0023] Nicotine salt formulations are proposed for use in an electronic cigarette which comprise a nicotine salt in a biologically acceptable carrier, such as a PG/VG blend, wherein the acid used to form the salt has a vapour pressure above 20 mmHg at 200°C, and / or between 20 to 300 mmHg at 200°C and / or has a melting point below 160°C, a boiling point above 160°C and at least a 50°C difference between the melting and boiling points. Example acids meeting one or more of the above criteria are stated to be salicylic acid, sorbic acid, benzoic acid, pyruvic acid lauric acid and levulinic acid.

[0024] Nicotine salt formulations were prepared by combining nicotine and acid in a carrier mixture, such as PG and VG. Heart rate studies were performed using nicotine levulinate, nicotine benzoate, nicotine succinate, nicotine salicylate, nicotine malate, nicotine pyruvate, nicotine citrate and nicotine freebase. Nicotine levulinate, nicotine benzoate and nicotine salicylate are shown to cause a significant heart rate increase. Nicotine benzoate, nicotine salicylate and nicotine succinate also performed particularly well in user satisfaction tests. In addition, formulations containing nicotine benzoate, nicotine salicylate and nicotine citrate all exhibited high rates of nicotine uptake in blood within the initial 90 seconds of the test.

[0025] Although vaping smoking substitute devices are gaining popularity in many parts of the world, they are not universally acceptable for use and in a significant number of countries the sale or supply of nicotine-containing e-liquids is restricted. This may be due to the fact that in many countries purified nicotine is classified as a pharmaceutical product and for this reason the sale and use of nicotine-containing liquids is highly regulated. Such countries may in fact prohibit the sale of nicotine-containing e-liquids.

[0026] In some countries vaping smoking devices are considered to be drug delivery devices and consequently their use and / or sale may also be prohibited.

[0027] It would be desirable to provide a vaping smoking substitute device and system which can be used to deliver an aerosol containing a predetermined level of a

nicotine component and which would be acceptable for sale and use in countries which currently do not permit the sale and use of purified nicotine-containing e-liquids due to their classification as drugs or pharmaceutical products.

[0028] The present invention can provide a consumable which includes a nicotine-containing liquid aerosol-forming substrate (e-liquid) which includes tobacco-derived components and as such, although it contains nicotine, it would not be classified as a pharmaceutical product.

[0029] Accordingly, in a first aspect the invention provides a consumable for a smoking substitute device which contains a liquid aerosol-forming substrate, wherein the liquid aerosol-forming substrate comprises an infusion of solid tobacco-derived material in aerosol-former solution, and the infusion is combined with a nicotine formulation.

[0030] Preferably the infusion for the liquid aerosol-forming substrate comprises a suspension of solid tobacco-derived material saturated with aerosol-former(s).

[0031] Preferably the infusion contains nicotine-containing components released from the solid tobacco-derived material. Preferably the liquid aerosol-forming substrate contains naturally occurring nicotine-containing components released from the solid tobacco-derived material. The aerosol-former solution is substantially free of purified nicotine extracts.

[0032] In some embodiments the nicotine formulation contains free-base (unprotonated) nicotine.

[0033] Preferably the nicotine formulation contains a mono-protonated and / or di-protonated salt of an organic acid. Preferably the nicotine formulation contains a nicotine salt of an organic acid selected from lactic acid, benzoic acid, formic acid, acetic acid, butyric acid, citric acid, levulinic acid, oleic acid, oxalic acid, propionic acid, phenylacetic acid, pyruvic acid, salicylic acid, sorbic acid, succinic acid and tartaric acid and most preferably a salt of lactic acid. Mixtures of one or more acids may be employed.

[0034] Preferably the nicotine formulation provides at least 50 wt% of the nicotine content of the liquid aerosol-forming substrate.

[0035] Preferably the liquid aerosol-forming substrate contains at least 7.5 mg / ml of nicotine.

[0036] Preferred embodiments of the invention provide a consumable for a smoking substitute device which contains a liquid aerosol-forming substrate, wherein the liquid aerosol-forming substrate is a suspension of solid tobacco-derived material in a solution containing a nicotine extract, preferably a nicotine salt.

[0037] A second aspect of the present invention concerns the use of a liquid aerosol-forming substrate according to the first aspect in the manufacture of a consumable for a smoking substitute device configured for vaping e-liquid.

[0038] A third aspect concerns a method for manufacturing a consumable for a smoking substitute device which contains a liquid aerosol-forming substrate according to the first and / or second aspects, which method comprises combining solid tobacco-derived material with aerosol former liquid to form an infusion of solid tobacco-derived material in aerosol-former solution, combining the infusion with a nicotine formulation to form the liquid aerosol-forming substrate, and supplying the substrate to a consumable component of a smoking substitute device.

[0039] A fourth aspect concerns a vaping smoking substitute device configured for vaping a liquid aerosol-forming substrate as defined in relation to the other aspects of the invention.

[0040] Thus, the nicotine-containing liquid aerosol forming substrate (e-liquid) is unlikely be classified as a pharmaceutical product owing to the presence of tobacco-derived foreign matter. The presence of tobacco-derived components may be deduced by the appearance of solid material in the substrate and / or by the colour of the substrate.

[0041] The liquid aerosol-forming substrate comprises an infusion of solid tobacco-derived material in aerosol-former solution which has been combined with a nicotine formulation. The requirement for the infusion to be prepared in advance of addition of the nicotine formulation has been found to be significant in ensuring efficient release of nicotine from the tobacco-derived solids and efficient wetting of the solids.

[0042] This can be distinguished from other proposals for adding tobacco flavour to a nicotine-containing e-liquid, such as described in WO2017/001351, in which flakes of solid tobacco are added to the liquid component which comprises a mixture of a nicotine-containing material and an aerosol former (propylene glycol or glycerine).

[0043] Embodiments of the invention may involve any of the following features:

The liquid aerosol-forming substrate comprises an infusion of solid tobacco-derived material in aerosol-former solution which has been combined with a purified nicotine extract.

[0044] The tobacco-derived solids may float, sink or be suspended in the aerosol-forming substrate. Preferably the infusion for the liquid aerosol-forming substrate comprises a suspension of solid tobacco-derived material saturated with aerosol-former. Thus, it is preferred that the solids are infused in the aerosol-former solution for a period sufficient to allow the solids to soften and absorb liquid in order to reduce the amount of solid which is floating in the substrate.

[0045] Optionally the aerosol-former solution includes at least one of polypropylene glycol, glycerine and water. Such aerosol formers have been found to be advantageous in order to achieve good dispersion of solid material throughout the liquid component, together with a liquid component having a density which is less likely to result in leakages from the consumable. Combinations may be employed, as discussed below. The aerosol-

formers do not include nicotine-containing materials.

[0046] The solid tobacco-derived material may be visible in the substrate, such that this indicates that the nicotine is not of pharmaceutical grade and / or is from a tobacco source. Optionally the solid tobacco-derived material is visible in the consumable. Optionally the solid tobacco-derived material is visible in the smoking substitute device.

[0047] The infusion component of the liquid aerosol-forming substrate will generally contain nicotine released from the solid tobacco-derived material. Suitably the infusion component of the liquid aerosol-forming substrate may contain at least 1.0 mg / ml of nicotine. Often the infusion may contain at least 1.5mg / ml, preferably at least 1.8 mg / ml, more preferably at least 2.0 mg / ml. In some embodiments the infusion may contain at least 2.5 mg / ml, preferably at least 2.8 mg / ml of nicotine, more preferably at least 3.0 mg, most preferably at least 3.2 mg and especially at least 3.5 mg of nicotine per ml of total liquid. The amount of nicotine present in the liquid aerosol-forming substrate can be determined by HPLC methods as known in this technical field.

[0048] Typically the maximum amount of nicotine released from the tobacco-derived material into the infusion would be 7.0 mg / ml, preferably 6.5 mg / ml, more preferably 6.0 mg / ml, further preferably 5.5 mg / ml and especially 5.0 mg / ml or 4.5 mg / ml.

[0049] The infusion is prepared by macerating solid tobacco-derived material in aerosol former liquid in order to allow the solid to absorb liquid so that the solids soften and are sufficiently wetted such that it is possible to form a slurry or suspension of the wet solids.

[0050] Once the infusion has maturated for a selected period of time, the infusion can be combined with a nicotine formulation. In this regard, it has been found that enhanced results are obtainable by allowing the tobacco-derived material to infuse in aerosol former(s) prior to mixing with purified nicotine extracts. In particular, in experiments where the purified nicotine extracts and aerosol formers were all combined together with the tobacco material this was found to result in a reduced release of nicotine from the tobacco solids and a reduced overall content of nicotine in the aerosol-forming substrate.

[0051] The solid tobacco-derived material may be macerated in aerosol former(s) for a time period sufficient for the infusion to undergo a required change in physical and / or chemical characteristics. For example a time period sufficient to observe a certain change in viscosity or colour, or in chemical composition (such as amount of nicotine released) may be selected.

[0052] The infusion of solid tobacco-derived material is subsequently combined with a nicotine formulation. A nicotine formulation containing purified nicotine extracts can be distinguished from the nicotine released from the tobacco-derived solids in the infusion.

[0053] The nicotine in the formulation may be in the form of a free base and / or a mono-protonated salt and / or a di-protonated salt. The proportions of free base, mono-protonated salt and di-protonated salt will vary in dependence upon the acidity / alkalinity of the formulation. These proportions may be adjusted by addition of acid, for example. Thus, a formulation may comprise free-base nicotine. Alternatively, the formulation may be prepared from a combination of free base and acid, as discussed in more detail below.

[0054] Likewise, the nicotine in the liquid aerosol-forming substrate may be in the form of the free base and / or a mono-protonated salt and / or di-protonated salt. The nicotine may be in salt form when it is combined with the infusion or a nicotine salt may be formed in-situ by combining free-base nicotine with acid.

[0055] Preferably the nicotine formulation contains a nicotine salt of an organic acid that is non-toxic to humans and more preferably an organic acid selected from one or more of lactic acid, benzoic acid, formic acid, acetic acid, butyric acid, citric acid, levulinic acid, oleic acid, oxalic acid, propionic acid, phenylacetic acid, pyruvic acid, salicylic acid, sorbic acid, succininc acid and tartaric acid. In some embodiments the formulation contains a nicotine salt of an organic acid other than salicylic acid or tartaric acid. In some embodiments it may be preferable for the nicotine salt to be of an organic acid other than benzoic acid or levulinic acid. Further preferably the formulation contains a nicotine salt that is miscible with at least one of propylene glycol, glycerine and water at a temperature below 100°C and more especially at ambient temperature (20 to 25°C). In some embodiments the formulation contains a nicotine salt of an organic acid that is liquid at ambient temperature.

[0056] In particularly preferred embodiments the nicotine formulation (and the liquid aerosol-forming substrate) contain a nicotine salt of lactic acid.

[0057] The nicotine formulation may optionally contain at least 2.0 mg / ml of nicotine. Often the formulation may contain at least 2.5mg / ml, preferably at least 3.0 mg / ml, more preferably at least 3.5 mg / ml. In some embodiments the formulation may contain at least 4.0 mg / ml, preferably at least 4.5 mg / ml of nicotine, more preferably at least 5.0 mg, most preferably at least 5.5 mg and especially at least 6.0 mg of nicotine per ml of liquid.

[0058] Preferably the nicotine formulation provides at least 50 wt% of the nicotine content of the liquid aerosol-forming substrate, preferably at least 55 wt%, more preferably at least 60 wt%, especially at least 65 wt%.

[0059] Suitably the liquid aerosol-forming substrate will have a total nicotine content of at least 7.5 mg / ml, especially at least 8.0 mg/ ml, more especially at least 8.5 mg / ml, particularly at least 9.0 mg / ml. In some jurisdictions a maximum dose of up to 9 mg / ml of nicotine is appropriate.

[0060] In some embodiments for other jurisdictions the liquid aerosol-forming substrate may contain a total nicotine content of at least 10.0 mg / ml or 11. 0 mg / ml, especially at least 12.0 mg / ml or 13.0 mg / ml, particularly at least 14.0 mg / ml, typically at least 15.0 mg / ml, especially at least 16.0 mg / ml, more especially at least

17.0 mg / ml. Examples maximum doses of nicotine include 20.0 mg / ml, 19.0 mg/ ml and 18.0 mg / ml.

[0061] The liquid aerosol-forming substrate optionally comprises one or more flavourings. In embodiments of the invention it is preferred that flavourings are in liquid form.

[0062] Preferred aerosol formers include polyols or polyhydric alcohols, optionally together with water. Preferred liquid components of an aerosol-former solution include one or more selected from propylene glycol, glycerine and water.

[0063] A combination of aerosol formers may be adopted. In such embodiments the liquid component may comprise propylene glycol and glycerine in a ratio within the range of 10:90 to 90:10 by volume, preferably 20:80 to 80:20, more preferably 25:75 to 75: 25, more preferably 30:70 to 70:30, and most preferably 40:60 to 60:40 by volume.

[0064] Suitably the liquid component comprises propylene glycol and glycerine in a ratio within the range of 10:90 to 90:10 by weight, preferably 20:80 to 80:20, more preferably 25:75 to 75: 25, more preferably 30:70 to 70:30, and most preferably 40:60 to 60:40 by weight.

[0065] The liquid component may optionally contain water or it may be essentially free of water. In cases where water is included, it is preferred that the substrate contains 0.1 to 10%, preferably 0.1 to 7%, more preferably up to 6%, further preferably up to 5%, more preferably up to 4% and especially up to 3% water, by volume and / or by weight. Water may be introduced as part of a flavouring component.

[0066] Some example aerosol-forming substrates contain up to 70% by weight, more preferably up to 65% and especially up to 60% by weight of propylene glycol. Preferably the substrates contain at least 25% and more preferably at least 30% by weight of propylene glycol.

[0067] Some example aerosol-forming substrates contain up to 70% by weight, more preferably up to 65% and especially up to 60% by weight of glycerine. Preferably the substrates contain at least 25% and more preferably at least 30% by weight of glycerine.

[0068] Preferably a glycerine component is vegetable glycerine.

[0069] The tobacco-derived material can take various forms. It may optionally be in the form of tobacco leaf, tobacco stem, tobacco powder and tobacco dust, for example. The tobacco-derived material may be treated to various process conditions prior to being combined with base liquids. For example it may be washed and dehydrated, optionally by freeze drying.

[0070] It is advantageous to select tobacco-derived material from a tobacco plant which has a naturally occurring high nicotine level in order to produce a liquid aerosol-forming substrate which has an effective concentration of nicotine. Preferably the liquid aerosol-forming substrate comprises a tobacco-infused liquid which contains solid tobacco-derived material obtained from a tobacco plant having a nicotine content of at least 3%, especially 3.5 or 4% by weight, preferably at least 4.5%, more preferably at least 5% by weight, still more preferably at least 5.5% by weight and most preferably at least 6% by weight. Conveniently the tobacco plant may have a nicotine content of up to 8 wt %, especially up to 7.5 wt %.

[0071] Preferably the tobacco-derived material is finely ground or milled to form a dust or powder. Preferably the tobacco-derived material has a maximum dimension of less than 2000μm such that the material will pass through a sieve having a mesh opening of 2000μm. This may provide an efficient ratio of surface area to liquid in order to achieve effective release of nicotine. Preferably the material has a maximum dimension of no more than 1500μm, more preferably no more than 1200μm.

[0072] Preferably very small tobacco-derived solids are avoided as they are more likely to cause problems with clogging of the wick to the heating device or even be small enough to be released with the vapour when the consumable is in use. Conveniently the tobacco-derived material may be larger than 20μm, preferably larger than 30μm, more preferably larger than 40μm, even more preferably larger than 50μm, further preferably larger than 60μm and especially larger than 70μm.

[0073] Preferably the solid tobacco-derived material corresponds to the sieve fraction of between 100 to 1000μm, such that the fraction of solids passing through a sieve of mesh size 100μm is discarded, along with the fraction that will not pass through a sieve of mesh size 1000μm. Employing tobacco-derived material in the form of a powder or dust increases the surface area of the solid material which enhances the release of nicotine from the solid into a solution.

[0074] Typically the liquid aerosol-forming substrate may contain at least 20 mg of solid tobacco-derived material per ml of total liquid components. The total amount of solid may be adjusted in dependence upon the concentration of nicotine required in the substrate. Preferably the liquid aerosol-forming substrate contains at least 25 mg, more preferably at least 30 mg, still more preferably 35 mg and especially at least 40 mg of solid tobacco-derived material per ml of total liquid. Optionally this may correspond to the total amount of solid in the aerosol-forming substrate, such that the substrate is substantially free of solid materials which are not derived from tobacco, such as solids intended solely for flavouring.

[0075] Conveniently the liquid aerosol-forming substrate may contain up to 130 mg or up to 125 mg of solid tobacco-derived material per ml of total liquid. Preferably the liquid aerosol-forming substrate contains up to 120 mg or 115 mg, more preferably at up to 110 mg, further preferably up 105 mg and especially up to 100 mg of solid tobacco-derived material per ml of total liquid.

[0076] Preferably the liquid aerosol-forming substrate may contain 0.1 to 20% by weight of solid material, especially of the tobacco-derived solid material. Often the liquid aerosol-forming substrate may contain at least 1% by weight, preferably at least 2% by weight, more pref-

erably at least 3% and especially at least 4% by weight. In some embodiments the aerosol-forming substrate may contain up to 19% or 18% by weight of solid material, preferably up to 17 % or 16% and more preferably up to 15% by weight of solid material.

[0077] The release of nicotine from the tobacco-derived material to form the infusion may also be enhanced by subjecting the tobacco-derived material and aerosol former (s) to elevated conditions of temperature.

[0078] An aerosol-forming substrate according to embodiments of the invention may comprise an infusion of solid tobacco-derived material in aerosol-former solution obtained by extracting nicotine from the solid tobacco-derived material under conditions of elevated temperature and / or agitation.

[0079] Optionally an aerosol-forming substrate may obtained by exposing a suspension of tobacco-derived material and base liquid to a temperature of at least 30°C, more preferably at least 35°C, further preferably at least 40°C, most preferably at least 45°C, and especially at least 50 °C, with or without agitation. Preferably the substrate is obtained by exposing a suspension of the tobacco-derive material and base liquid to a temperature up to 60°C, with or without agitation.

[0080] In embodiments agitation may be employed, at room temperature of 21°C, or at an elevated temperature such as any of those described above. Agitation may involve rotating or shaking the mixture of tobacco-derived solid and base liquid at a speed in a range of 50 to 500 rpm, preferably at least 100rpm, more preferably at least 200rpm up to 500 rpm or up to 400 rpm, for example.

[0081] The aerosol-forming substrate may be exposed to such conditions of elevated temperature and / or agitation before it is supplied to the consumable, or indeed while it is present in the consumable as part of the manufacturing process. This process aspect of the invention takes place as part of the manufacturing process and it therefore distinguished from any heating step as part of the vaping process.

[0082] The liquid aerosol-forming substrate may optionally be visible to the user when it is in the consumable. This helps to confirm that the nicotine in the solution is a tobacco-derived product and as such would not generally be classified as a pharmaceutical product.

[0083] According to some preferred embodiments the consumable forms part of a closed system device. In this regard the liquid aerosol-forming substrate may be stored in sealed tank which is provided with at least part of a vaporization mechanism, for example a heating element. The consumable may be disposable, such that the tank is not intended to be refilled or replaced after use.

[0084] Preferably the consumable is a cartomizer. Within the broad class of cartomizers, the consumable may be described as a clearomizer if the liquid storage tank includes a window such that the liquid aerosol-forming substrate is visible to the consumer.

[0085] In other embodiments the consumable may be a component of an open system device. For example the liquid aerosol-forming substrate may be stored in a refillable cartridge or in another liquid storage container for supply to a refillable cartridge.

[0086] In a second aspect the invention concerns the use of a liquid aerosol-forming substrate as defined in the first aspect in the manufacture of a consumable for a smoking substitute device for vaping e-liquid. Preferably this concerns the use of the substrate in a cartomizer which comprises a storage tank for a liquid substrate and at least part of a mechanism for forming an aerosol from the liquid substrate.

[0087] The invention also provides a method for manufacturing a consumable for a smoking substitute device which contains a liquid aerosol-forming substrate as described in relation to the first or second aspect of the present invention.

[0088] A method for manufacturing such a consumable which contains a liquid aerosol-forming substrate may include the steps of combining solid tobacco-derived material and aerosol-former liquid, subjecting the mixture to process conditions which promote release of nicotine from the tobacco-derived solid into the aerosol-former liquid to form an infusion, combining the infusion with a purified nicotine extract to form a liquid aerosol-forming substrate and supplying the aerosol-forming substrate to a consumable component of a smoking substitute device, such as a cartomizer. The aerosol-former liquid for the infusion is preferably substantially nicotine-free.

[0089] The method preferably includes a step of macerating the solid tobacco-derived material in aerosol-former liquid for a time period sufficient for the infusion to undergo a required change in physical and / or chemical characteristics. Preferably the method includes a step of determining the nicotine content of the infusion and adding a nicotine formulation in order to bring the total nicotine content of the liquid aerosol-forming substrate to a predetermined required level. Thus the method may also include the steps of calculating the amount of nicotine formulation required in order to bring the total nicotine content of the substrate up to a required level and adding the nicotine formulation in the required amount.

[0090] Features of the liquid aerosol-forming substrate as described above may be adopted in such methods. In particular, features of the tobacco-derived solid material, the aerosol former liquid and the process conditions as described above in relation to the other aspects of the invention may be employed.

[0091] Further apparatus aspects of the invention concern a consumable for a smoking substitute device adapted for vaping a liquid aerosol-forming substrate as defined in any aspect of the present invention and a vaping smoking substitute device configured for vaping a liquid aerosol-forming substrate as defined in any aspect of the present invention.

[0092] In this regard, difficulties may arise when utilizing vaporisable liquids which comprise a suspension of solid material as clogging of the solids can occur around

the wick which can reduce or even cut off contact of the wick with the vaporisable liquid. This may occur when the user inhales from a device in which a coil and wick assembly is at a lowermost point of the tank.

[0093] In such a further aspect, the invention may provide a consumable for a smoking substitute device, the consumable comprising: a tank containing a liquid aerosol-forming substrate as defined in any aspect of the present invention; and a coil and wick assembly, having a cavity, and an aperture which fluidly connects the cavity to the tank; wherein the coil and wick assembly comprises: a coil, within the cavity; and a wick, which extends from the coil through the aperture and into the tank.

[0094] By providing a wick which extends in this manner, the likelihood of it becoming clogged or blocked with the solid tobacco-derived material is significantly reduced.

[0095] Optional features of this apparatus aspect of the invention will now be set out. These are applicable singly or in any combination with any aspect of the invention. An example of this apparatus aspect is illustrated in the accompanying drawings and discussed in more detail below.

[0096] The wick may extend from the aperture by a distance of at least 5mm. The wick may extend from the aperture by a distance of at least 6mm. The wick may extend from the aperture by a distance of at least 7mm. The wick may extend from the aperture by a distance of at least 8mm. The wick may extend from the aperture by a distance of at least 9mm. The wick may extend from the aperture by a distance of at least 10mm.

[0097] The wick may have a length, from one end to the other, of more than 2 cm. The wick may have a length of more than 2.5 cm, or more than 3 cm. The wick may have a length of more than 4 cm.

[0098] The consumable may include a mouthpiece, and the wick may extend from the aperture in a direction substantially towards the mouthpiece. The mouthpiece may be located at or towards an opposite end of the consumable to the coil and wick assembly. Advantageously, as the mouthpiece is generally the highest point of the consumable, when the consumable is in use, by extending the wick towards it this can help ensure that solid matter settling at the bottom of the consumable does so as away from at least some of the wick.

[0099] The consumable may include a clip, which fixes a portion of the wick not contained within the coil and wick assembly to or near an exterior part of the coil and wick assembly. By providing such a clip, it can be ensured that the wick is held away from a bottommost part of the coil and wick assembly, and so away from an area where solid matter is likely to settle.

[0100] The consumable may include an outlet, which is fluidly connected to the coil and wick assembly, and a seal, which seals the outlet to the oil and wick assembly, and to which the clip is attached. The outlet may be referred to as a chimney or airway tube, and acts to draw the vaporised liquid from the coil towards the mouthpiece.

[0101] The coil and wick assembly may have a second aperture, which fluidly connects the cavity to the tank, and the wick may extend from the coil through both the first aperture and the second aperture into the tank. The second aperture may be on an opposite side of the coil and wick assembly to the first aperture. Such a second aperture, with a corresponding second wick portion, may help ensure that even if the first aperture and first wick portion become clogged some portion of the wick is still exposed to the liquid in the tank.

[0102] The clip may fix a second portion of the wick, which extends through the second aperture, to or near a second exterior part of the coil and wick assembly on the opposing side of the coil and wick assembly. Any feature of one aspect of the invention may be applied to other aspects of the invention, in any appropriate combination.

[0103] The liquid-aerosol forming substrate contains a purified nicotine extracts provided by the nicotine formualtion. In embodiments of the invention where this is in the form of a free nicotine salt, it is preferably other than a salt selected from: nicotine hydrochloride; nicotine dihydrochloride; nicotine monotartrate; nicotine bitartrate; nicotine bitartrate dihydrate; nicotine sulphate; nicotine zinc chloride monohydrate; and nicotine salicylate, for example. Preferably the substrate is substantially free from a salt selected from: nicotine hydrochloride; nicotine dihydrochloride; nicotine monotartrate; nicotine bitartrate; nicotine bitartrate dihydrate; nicotine sulphate; nicotine zinc chloride monohydrate; and nicotine salicylate, for example.

Brief Description of the Drawings

[0104] Embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1(a) shows a cross-sectional view of a coil and wick assembly;
Figure 1(b) shows a coil and wick assembly installed in a reservoir;
Figure 2(a) shows an example smoking substitute device;
Figure 2(b) shows the main body of the smoking substitute device of Figure 2(a);
Figure 2(c) shows the consumable of the smoking substitute device of Figure 2(a) without the main body;
Figure 3(a) is a schematic view of the main body of the smoking substitute device of Figure 2(a); and
Figure 3(b) is a cross-sectional view of a further coil and wick assembly;

Detailed Description and Further Optional Features

[0105] Aspects and embodiments of the present invention will now be discussed with reference to the accompanying figures. Further aspects and embodiments will

be apparent to those skilled in the art. All documents mentioned in this text are incorporated herein by reference

[0106] Figure 2(a) shows an example smoking substitute device 110. In this example, the smoking substitute device 110 includes a main body 120 and a consumable 150. The consumable 150 may alternatively be referred to as a "pod". The consumable may also be referred to as a cartridge or cartomizer.

[0107] In this example, the smoking substitute device 110 is a closed system vaping device, wherein the consumable 150 includes a sealed tank or liquid reservoir 156 and is intended for one-use only.

[0108] Figure 2(a) shows the smoking substitute device 110 with the main body 120 physically coupled to the consumable 150. Figure 2(b) shows the main body 120 of the smoking substitute device 110 without the consumable 150. Figure 2(c) shows the consumable 150 of the smoking substitute device 110 without the main body 120.

[0109] The main body 120 and the consumable 150 are configured to be physically coupled together, in this example by pushing the consumable 150 into an aperture in a top end 122 of the main body 120. In other examples, the main body 120 and the consumable could be physically coupled together by screwing one onto the other, or through a bayonet fitting, for example. An optional light 126, e.g. an LED located behind a small translucent cover, is located a bottom end 124 of the main body 120. The light 126 may be configured to illuminate when the smoking substitute device 110 is activated.

[0110] The consumable 150 includes a mouthpiece (not shown) at a top end 152 of the consumable 150, as well as one or more air inlets (not shown in Fig. 2) so that air can be drawn into the smoking substitute device 110 when a user inhales through the mouthpiece. At a bottom end 154 of the consumable 150, there is located a tank 156 that contains e-liquid. The tank 156 may be a translucent body, for example.

[0111] The tank 156 preferably includes a window 158, so that the amount of e-liquid in the tank 156 can be visually assessed. The main body 120 includes a slot 128' so that the window 158 of the consumable 150 can be seen whilst the rest of the tank 156 is obscured from view when the consumable 150 is inserted into the aperture in the top end 122 of the main body 120.

[0112] The tank 156 may be referred to as a "clearomizer" if it includes a window 158, or more generally a "cartomizer".

[0113] The consumable 150 may identify itself to the main body 120, via an electrical interface, RFID chip, or barcode.

[0114] Tank 156 contains a liquid aerosol-forming substrate. The substrate comprises an infusion of solid tobacco-derived material in aerosol-former solution and a nicotine formulation. The infusion is obtained by macerating solid tobacco material in one or more aerosol-formers in order to saturate the solids so that they can form a suspension or slurry with aerosol-former liquid and release components which provide flavour and aroma associated with the tobacco. As the infusion proceeds, the colour and viscosity of the composition changes. The maceration process may also result in the release nicotine from the solid tobacco material. The process can be conducted for a time period sufficient to achieve a certain selected viscosity or level of nicotine release, for example. As an example a suitable time period could be at least 24 hours, preferably at least 48 hours, more preferably at least 72 hours and most preferably at least 96 hours.

[0115] The amount of nicotine contained in the infusion is determined. The infusion of tobacco-derived material in aerosol-former solution is subsequently combined with a nicotine formulation in order to bring the total nicotine content in the liquid aerosol-forming substrate up to a required level. Additional flavours can also be added at this stage.

[0116] Experiments have found that it is preferable to macerate the tobacco-derived solids in an aerosol-former in advance of adding purified nicotine extracts as this results in improved release of nicotine from the tobacco and improved wetting of tobacco solids, as compared to the case where the tobacco-derived solids are combined with a nicotine-containing liquid and aerosol-former solution and the combination allowed to mature to allow nicotine to be released from the tobacco.

[0117] The nicotine formulation may contain free-base nicotine and / or a mono-protonated nicotine salt and / or a di-protonated nicotine salt. Enhanced user satisfaction has been observed for substrates containing nicotine lactate.

[0118] The substrate is in the form of a suspension of solid material in a solution which comprises aerosol-former (s), soluble components released from the tobacco-derived material (including naturally occurring nicotine salts), together with purified nicotine extracts. The solids can identify the substrate as a nicotine-containing solution which is derived from tobacco material.

[0119] The liquid components include aerosol formers such as glycerine and / or propylene glycol. A combination of both glycerine and propylene glycol has been found to achieve good dispersion of solid particles in a liquid of an appropriate viscosity to show resistance to leakage from the tank 156. Water may also be included as this has been found to enhance release of nicotine from the tobacco solid. In this respect, water may be incorporated as part of a raw material flavouring formulation or it may be added as a separate raw material. The appropriate amount of water, or any aerosol former, may be adjusted as appropriate for compatibility with different flavour combinations.

[0120] The tobacco material is derived from a tobacco plant. It may be prepared from leaf or stem, for example. The tobacco plant is usually ground or powdered to reduce its size so as to increase the surface area available for infusion with liquid and therefore improve the amount

of nicotine extracted therefrom. Very small particles are best avoided as they can become entrained with the vapour and be inhaled by the user and this is regarded as unpleasant. Large particle sizes are also more likely to cause problems with clogging of the wick. Tobacco solids having particle sizes in a range of 50 to 2000μm, particularly 100 to 1000μm and especially 250 to 500 μm have provided an excellent combination of efficient release of nicotine together with resistance to clogging of the wick of the consumable.

[0121] The tobacco is preferably derived from a plant which inherently has a high nicotine content, in order to maximise the amount of nicotine which can be released in to the solution. A high nicotine content could correspond to at least 4% by weight of the dry plant material. An example of a tobacco product with a high nicotine content is grown in the Philippines and has a dry content in the leaf of about 7% by weight. The nicotine content can be determined by HPLC methods as known in this technical field.

[0122] The liquid components preferably include propylene glycol and glycerine in a ratio in a range of 90:10 to 10:90 by volume. Example liquid components typically contain 0.1 to 50% by volume of propylene glycol and 0.1 to 50% by volume of glycerine. Generally the liquid components would also contain up to 5% or more usually up to 3% by volume of water. Example formulations could comprise 45% PG, 45% VG with 10% of water and flavourings; and 50% PG, 45% VG with the balance water and flavourings. Different water contents may be required for compatibility with different flavouring formulations.

[0123] The mixture of liquid components and ground tobacco may be subjected to heating and / or agitation in order to enhance release of nicotine as part of the process for manufacturing the e-liquid. This preferably involves heating the mixture at a temperature above room temperature and up to 60°c. In experiments elevation of temperature alone from 21° C to 60 °C has been found to result in about a 50% increase in the release of nicotine from the tobacco solid. This heating step is part of the process for manufacturing the liquid aerosol-forming substrate and can therefore be distinguished from a step of heating the liquid as part of the vaping process. The mixture of tobacco-derived solids and base liquids can be heated prior to supply to the tank 156, or a filled tank 156 could be heated in this way.

[0124] Agitation of the mixture at a speed of at least 100 rpm has also been found to be effective to enhance extraction of nicotine from the tobacco-derived solid. Agitation at 400 rpm for 3 hours has been found to result in an increase in the amount of nicotine released by a factor of over 100%, as compared to simply allowing a corresponding mixture to stand for the same period in order to allow nicotine to infuse into the base liquids, for example. The mixture may be heated and / or agitated prior to supply to the storage tank 156 of the consumable. Alternatively or additionally a storage tank 156 containing a mixture may be heated and / or agitated in order to enhance release of nicotine into the liquid stored in the consumable.

[0125] Features of an example smoking substitute device will now be described in more detail. Figure 3(a) is a schematic view of the main body 120 of the smoking substitute device 110. Figure 3(b) is a schematic view of the consumable 150 of the smoking substitute device 110.

[0126] As shown in Figure 3(a), the main body 120 includes a power source 128, a control unit 130, a memory 132, a wireless interface 134, an electrical interface 136, and, optionally, one or more additional components 138. The power source 128 is preferably a battery, more preferably a rechargeable battery. The control unit 130 may include a microprocessor, for example.

[0127] The memory 132 is preferably includes non-volatile memory. The memory may include instructions which, when implemented, cause the control unit 130 to perform certain tasks or steps of a method.

[0128] The wireless interface 134 is preferably configured to communicate wirelessly with the mobile device 2, e.g. via Bluetooth®. To this end, the wireless interface 134 could include a Bluetooth® antenna. Other wireless communication interfaces, e.g. WiFi®, are also possible.

[0129] The electrical interface 136 of the main body 120 may include one or more electrical contacts. The electrical interface 136 may be located in, and preferably at the bottom of, the aperture in the top end 122 of the main body 120. When the main body 120 is physically coupled to the consumable 150, the electrical interface 136 may be configured to pass electrical power from the power source 128 to (e.g. a heating device of) the consumable 150 when the smoking substitute device 110 is activated, e.g. via the electrical interface 160 of the consumable 150 (discussed below). When the main body 120 is not physically coupled to the consumable 150, the electrical interface may be configured to receive power from the charging station 6. The electrical interface 136 may also be used to identify the consumable 150 from a list of known consumables. For example, the consumable may be a particular flavour and/or have a certain concentration of nicotine. This can be identified to the control unit 130 of the main body 120 when the consumable is connected to the main body. Additionally, or alternatively, there may be a separate communication interface provided in the main body 120 and a corresponding communication interface in the consumable 150 such that, when connected, the consumable can identify itself to the main body 120.

[0130] The additional components 138 of the main body 120 may include the optional light 126 discussed above.

[0131] The additional components 138 of the main body 120 may, if the power source 128 is a rechargeable battery, include a charging port configured to receive power from the charging station. This may be located at the bottom end 124 of the main body 120. Alternatively, the electrical interface 136 discussed above is configured

to act as a charging port configured to receive power from the charging station 6 such that a separate charging port is not required.

[0132] The additional components 138 of the main body 120 may, if the power source 128 is a rechargeable battery, include a battery charging control circuit, for controlling the charging of the rechargeable battery. However, a battery charging control circuit could equally be located in the charging station (if present).

[0133] The additional components 138 of the main body 120 may include an airflow sensor for detecting airflow in the smoking substitute device 110, e.g. caused by a user inhaling through a mouthpiece 166 (discussed below) of the smoking substitute device 110. The smoking substitute device 110 may be configured to be activated when airflow is detected by the airflow sensor. This optional sensor could alternatively be included in the consumable 150 (though this is less preferred where the consumable 150 is intended to be disposed of after use, as in this example). The airflow sensor can be used to determine, for example, how heavily a user draws on the mouthpiece or how many times a user draws on the mouthpiece in a particular time period.

[0134] The additional components 138 of the main body 120 may include an actuator, e.g. a button. The smoking substitute device 110 may be configured to be activated when the actuator is actuated. This provides an alternative to the airflow sensor noted, as a mechanism for activating the smoking substitute device 110.

[0135] As shown in Figure 3(b), the consumable 150 includes the tank 156 for the liquid aerosol-forming substrate (e-liquid), an electrical interface 160, a heating device 162, one or more air inlets 164, a mouthpiece 166, and, optionally, one or more additional components 168.

[0136] The electrical interface 160 of the consumable 150 may include one or more electrical contacts. The electrical interface 136 of the main body 120 and an electrical interface 160 of the consumable 150 are preferably configured to contact each other and therefore electrically couple the main body 120 to the consumable 150 when the main body 120 is physically coupled to the consumable 150. In this way, electrical energy (e.g. in the form of an electrical current) is able to be supplied from the power source 140 in the main body 120 to the heating device 162 in the consumable 150.

[0137] The heating device 162 is preferably configured to heat e-liquid contained in the tank 156, e.g. using electrical energy supplied from the power source 140. In one example, the heating device 162 may include a heating filament and a wick, wherein a first portion of the wick extends into the tank 156 in order to draw e-liquid out from the tank 156, and wherein the heating filament coils around a second portion of the wick located outside the tank 156. In this example, the heating filament is configured to heat up e-liquid drawn out of the tank 156 by the wick to produce an aerosol vapour.

[0138] The one or more air inlets 164 are preferably configured to allow air to be drawn into the smoking substitute device 110, when a user inhales through the mouthpiece 166.

[0139] In use, a user activates the smoking substitute device 110, e.g. through actuating an actuator included in the main body 120 or by inhaling through the mouthpiece 166 as described above. Upon activation, the control unit 130 may supply electrical energy from the power source 128 to the heating device 162 (via electrical interfaces 136, 166), which may cause the heating device 162 to heat e-liquid drawn from the tank 156 to produce a vapour which is inhaled by a user through the mouthpiece 166.

[0140] As an example of one of the one or more additional components 168, an interface for obtaining an identifier of the consumable may be provided. As discussed above, this interface may be, for example, an RFID reader, a barcode or QR code reader, or an electronic interface which is able to identify the consumable to the main body. The consumable may, therefore include any one or more of an RFID chip, a barcode or QR code, or memory within which is an identifier and which can be interrogated via the electronic interface in the main body.

[0141] Of course, a skilled reader would readily appreciate that the smoking substitute device 110 shown in Figs. 2 and 3 shows just one example implementation of a smoking substitute device, and that other forms of smoking substitute device could be used.

[0142] As another example, an open system vaping device which includes a main body, a refillable tank, and a mouthpiece could be used, instead of the smoking substitute device 110. One such open system vaping device is the blu PRO™ e-cigarette discussed above.

[0143] As another example, an entirely disposable (one use) smoking substitute device could be used as the smoking substitute device.

[0144] Figure 1(a) shows a cross-sectional view of a coil and wick assembly 302. The coil and wick assembly may form the heater of any of the preceding consumables 150. The coil and wick assembly is disposed within the tank 156, at a bottom end thereof opposite to the mouthpiece 166. The coil and wick assembly is connected to the mouthpiece via an outlet, or chimney. The coil and wick assembly may form a lower wall of the tank, i.e. it may at least partially define the interior volume of the tank. Broadly, the coil and wick assembly is formed from a housing 304, in which are first 305a and second 305b apertures or wick apertures. Within a cavity 310, provided by the housing, is a coil 306 e.g. coil of electrical wire, connected to first 308a and second 308b electrical contacts. These contacts are connectable to the battery of the main device 110, and so provide power to the coil.

[0145] An outlet aperture 309 is located proximal to the coil 306. When installed within the consumable, the outlet aperture is sealed from the liquid containing volume of the tank and is fluidly connected to an outlet. The outlet fluidly connects the cavity 310 of the coil and wick assembly to the mouthpiece. A wick 307 is provided through the coil, and through each of the first and second aper-

tures. The wick acts to substantially seal the cavity 310 of the coil and wick assembly from free flowing liquid in the tank. Thus, liquid can only enter the cavity 310 by capillary action i.e. by being wicked in via the wick.

[0146] The wick extends from the apertures, in a direction away from the electrical contacts to leave exposed regions 307a and 307b respectively.

[0147] The coil and wick assembly has an outlet aperture 309, which is positioned above the coil i.e. on an opposing side of the coil to the electrical contacts, in an uppermost surface of the coil and wick assembly. This outlet aperture is connected to the outlet discussed previously, which allows vaporised liquid to travel to the mouthpiece. The wick may have a length, as measured from one end to an opposing end, of more than 2 cm. For example, the wick may have a length of around 3 cm.

[0148] At a lower end of the consumable, i.e. one nearest the electrical contacts, is an air inlet 164. In use, the user draws on the mouthpiece which causes air to flow in through air inlet 164. This airflow draws with it vaporised liquid from the wick contained within the coil 306 (which is heated); and the airflow, now containing vaporised liquid, travels up an outlet and into the mouthpiece whereby it is inhaled. Whist the air inlet in this example is shown as a single air inlet disposed between the electrical contacts, instead there may be plural air inlets disposed between respective electrical contacts and an edge region of the coil and wick assembly. Further alternatively, there may be a single air inlet which extends across a width of the device thereby defining a channel. The channel may be bridged, across its width, by the first and second electrodes.

[0149] Figure 1(b) shows the coil and wick assembly of Figure 1(a), as installed in the consumable 150. As can be seen, the coil and wick assembly 302 forms a lower wall of the tank 156 and so at least partially defines the liquid containing volume thereof. The tank 156 in this example is filled with an aerosol-forming substrate in the form of a vaporisable liquid which contains a solid suspension. As a result, when the consumable 150 is orientated such that the mouthpiece is higher than the coil and wick assembly (as is the case in Figure 1(b)) solid tobacco-derived sediment 602 may accumulate around the coil and wick assembly. The portions of the wick 307a and 307b extend above where this sediment may accumulate, and so will generally be exposed to the liquid within the tank 156. As shown in the figure, an outlet 604 is provided which is sealed to the coil and wick assembly via a seal (omitted for clarity). Arrows 606 and 608 indicate the air flow through the consumable.

List of Features

[0150]

110	Smoking substitute device
120	Main body
122	Top end of main body
124	Bottom end of main body
126	Light
128	Power source; 128' Slot
130	Control unit
132	Memory
134	Wireless interface
136	Electrical interface
138	Additional component
150	Consumable
152	Top end of consumable
154	Bottom end of consumable
156	Tank
158	Window
160	Electrical interface
162	Heating device
164	Air inlets
166	Mouthpiece
168	Additional components
302	Coil and wick assembly
304	Housing
305a,b	Apertures
306	Coil
307a,b	Wick
308a,b	Electrical contacts
310	Cavity
400	Seal
402a,b	Clip
502	Clip main body
602	Sediment
604	Outlet
606, 608	Air flow

[0151] While the invention has been described in conjunction with the exemplary embodiments described above, many equivalent modifications and variations will be apparent to those skilled in the art when given this disclosure. Accordingly, the exemplary embodiments of the invention set forth above are considered to be illustrative and not limiting. Various changes to the described embodiments may be made without departing from the spirit and scope of the invention.

[0152] For the avoidance of any doubt, any theoretical explanations provided herein are provided for the purposes of improving the understanding of a reader. The inventors do not wish to be bound by any of these theoretical explanations. Any section headings used herein are for organizational purposes only and are not to be construed as limiting the subject matter described.

[0153] Throughout this specification, including the claims which follow, unless the context requires otherwise, the words "have", "comprise", and "include", and variations such as "having", "comprises", "comprising", and "including" will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

[0154] It must be noted that, as used in the specification and the appended claims, the singular forms "a," "an,"

and "the" include plural referents unless the context clearly dictates otherwise. Ranges may be expressed herein as from "about" one particular value, and/or to "about" another particular value. When such a range is expressed, another embodiment includes from the one particular value and/or to the other particular value. Similarly, when values are expressed as approximations, by the use of the antecedent "about," it will be understood that the particular value forms another embodiment. The term "about" in relation to a numerical value is optional and means, for example, +/- 10%.

[0155] The words "preferred" and "preferably" are used herein refer to embodiments of the invention that may provide certain benefits under some circumstances. It is to be appreciated, however, that other embodiments may also be preferred under the same or different circumstances. The recitation of one or more preferred embodiments therefore does not mean or imply that other embodiments are not useful, and is not intended to exclude other embodiments from the scope of the disclosure, or from the scope of the claims.

Claims

1. A consumable for a smoking substitute device containing a liquid aerosol-forming substrate, wherein the liquid aerosol-forming substrate comprises an infusion of solid tobacco-derived material in aerosol-former solution, and the infusion is combined with a nicotine formulation.

2. A consumable according to claim 1, wherein the infusion for the liquid aerosol-forming substrate comprises a suspension of solid tobacco-derived material saturated with aerosol-former.

3. A consumable according to any preceding claim, wherein the infusion for the liquid aerosol-forming substrate contains nicotine-containing components released from the solid tobacco-derived material.

4. A consumable according to any preceding claim, wherein the infusion for the liquid aerosol-forming substrate is obtainable by macerating solid tobacco-derived material in aerosol-former solution.

5. A consumable according to any preceding claim, wherein the nicotine formulation contains free-base nicotine.

6. A consumable according to any preceding claim, wherein the nicotine formulation contains a nicotine salt.

7. A consumable according to any preceding claim, wherein the nicotine formulation contains (i) a nicotine salt of an organic acid and / or (ii) a mono-protonated nicotine salt.

8. A consumable according to any preceding claim, wherein the nicotine formulation contains a nicotine salt of an organic acid selected from one or more of lactic acid, benzoic acid, formic acid, acetic acid, butyric acid, citric acid, levulinic acid, oleic acid, oxalic acid, propionic acid, phenylacetic acid, pyruvic acid, salicylic acid, sorbic acid, succinic acid and tartaric acid.

9. A consumable according to claim 8, wherein the nicotine formulation contains a nicotine salt of lactic acid.

10. A consumable according to any preceding claim, wherein (i) the nicotine formulation provides at least 50wt% of the total nicotine content of the liquid aerosol-forming substrate and / or (ii) the liquid aerosol-forming substrate contains at least 7.5 mg/ml of nicotine.

11. A consumable according to any preceding claim, wherein the liquid-aerosol forming substrate comprises solid tobacco-derived material corresponding to the sieve fraction of between 100 to 1000μm.

12. Use of a liquid aerosol-forming substrate as defined in any one of claims 1 to 11 in the manufacture of a consumable for a smoking substitute device for vaping e-liquid.

13. A method for manufacturing a consumable for a smoking substitute device which contains a liquid aerosol-forming substrate as defined in any one of claims 1 to 11, which method comprises combining solid tobacco-derived material and aerosol former liquid to form an infusion of solid tobacco-derived material in aerosol-former solution, and combining the infusion with a nicotine formulation.

14. A method according to claim 13, which comprises macerating solid tobacco-derived material in aerosol-former solution for a time period sufficient for the infusion to undergo a required change in physical and / or chemical characteristics.

15. A method according to claim 13 or 14, which comprises a step of determining the nicotine content of the infusion and subsequently combining the infusion with a nicotine formulation in an amount appropriate to provide a liquid aerosol-forming substrate having a predetermined nicotine content.

16. A vaping smoking substitute device configured for vaping a liquid aerosol-forming substrate as defined in any one of claims 1 to 11.

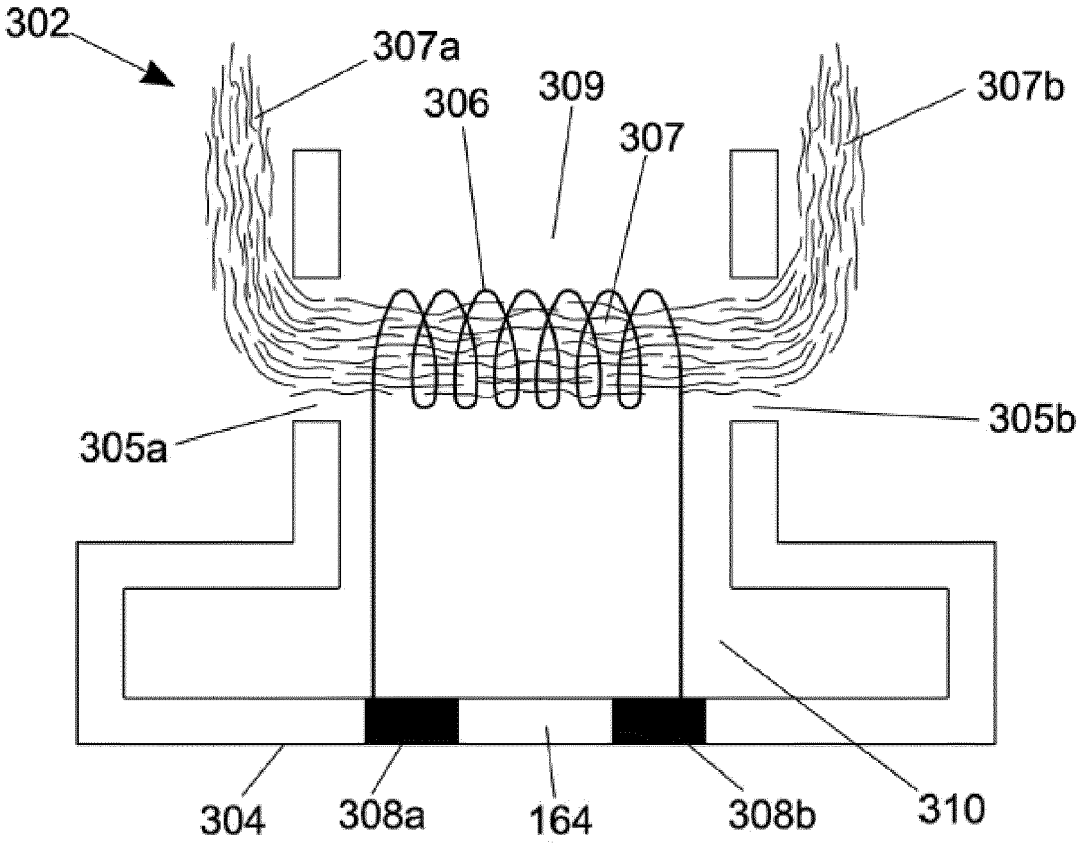

Fig. 1(a)

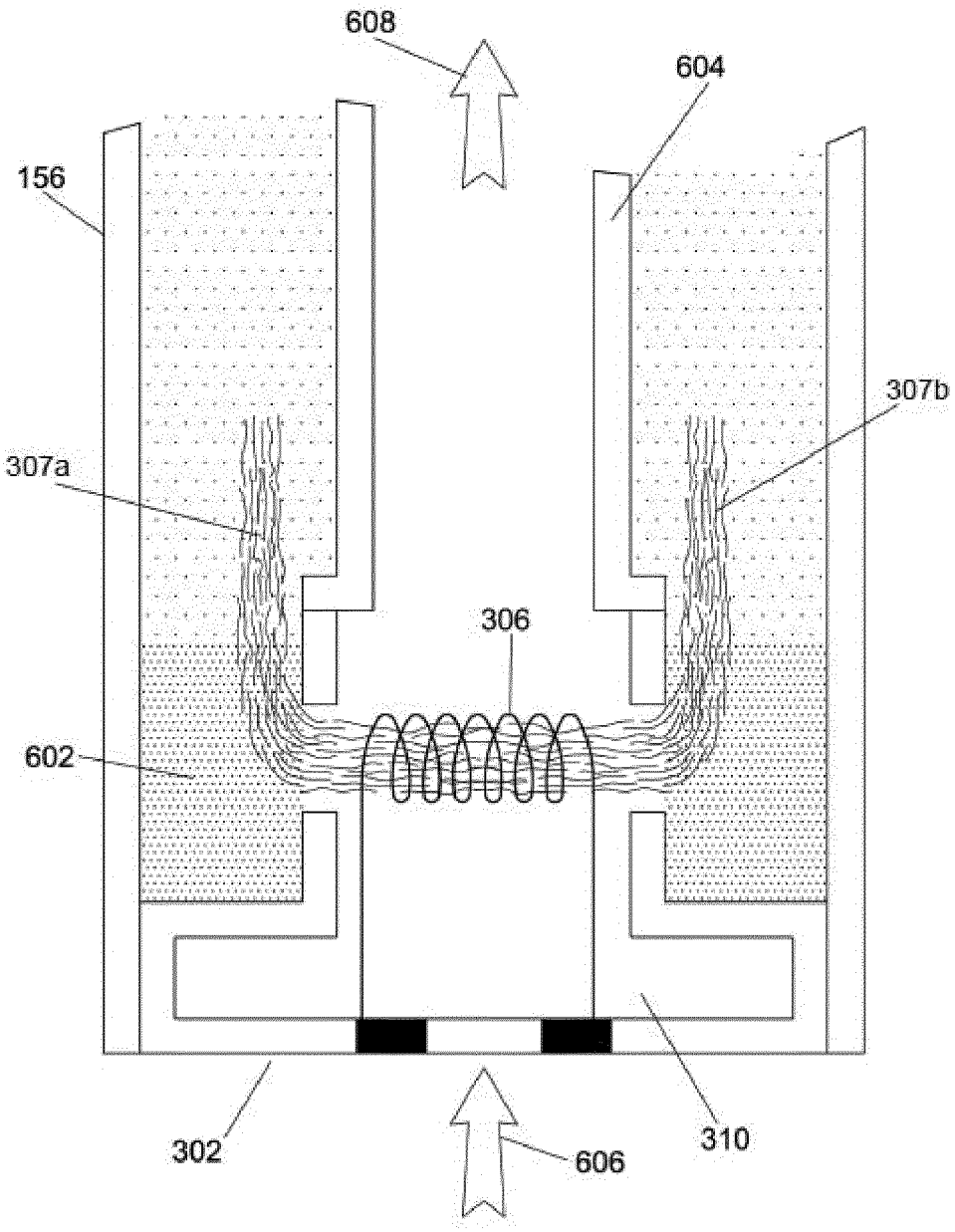

Fig. 1(b)

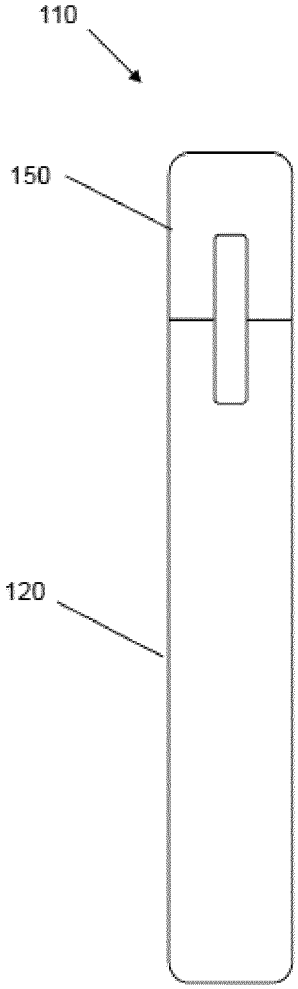

Fig. 2(a)

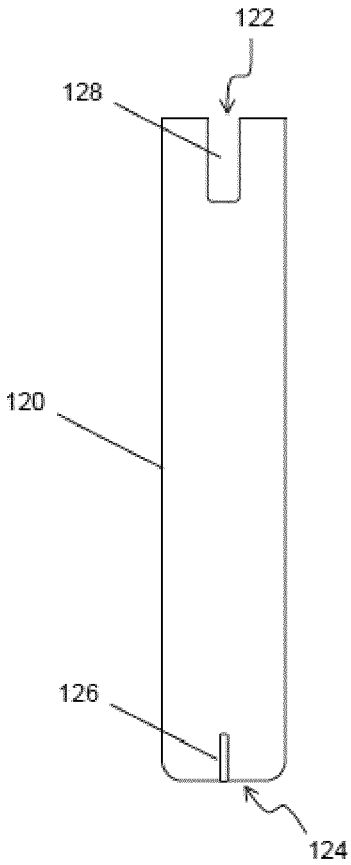

Fig. 2(b)

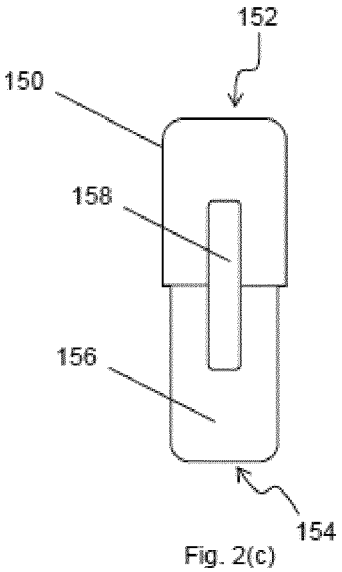

Fig. 2(c)

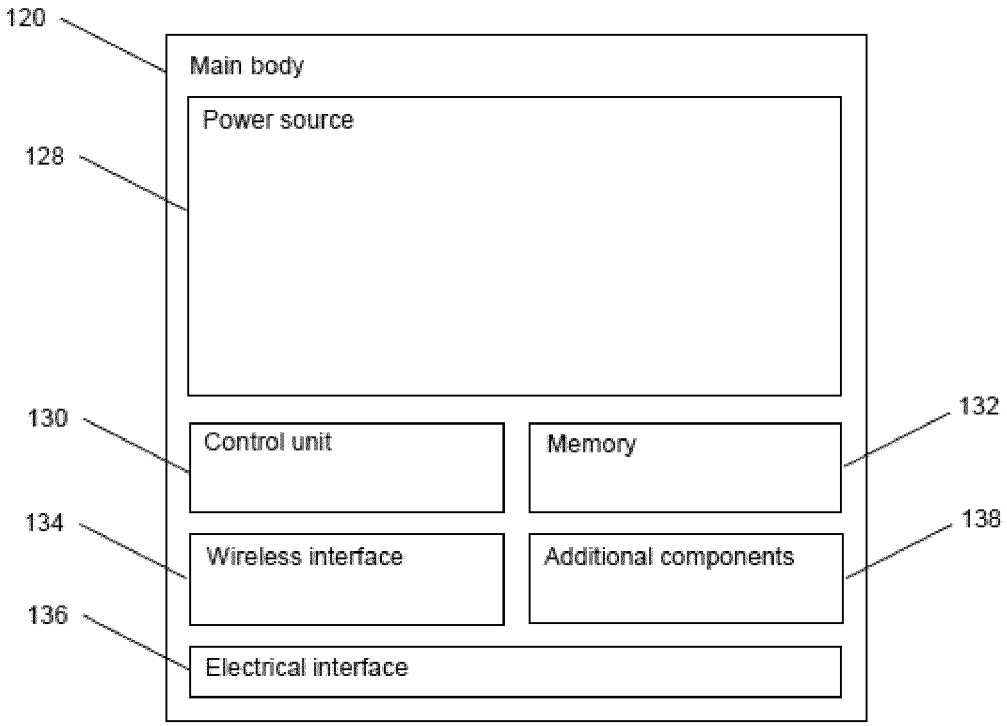
120
Main body
Power source
128
130
Control unit
Memory
132
134
Wireless interface
Additional components
138
136
Electrical interface

Fig. 3(a)

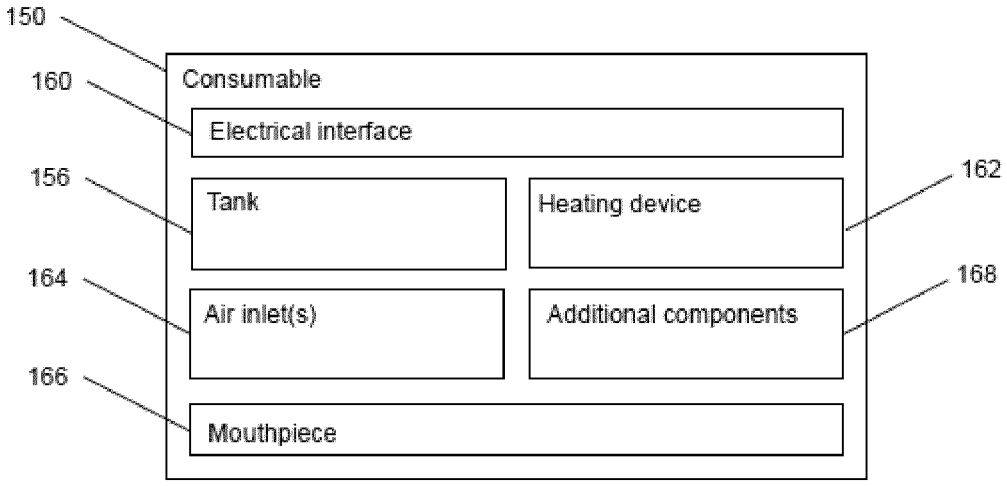
150
Consumable
160
Electrical interface
156
Tank
Heating device
162
164
Air inlet(s)
Additional components
168
166
Mouthpiece

Fig. 3(b)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 20 5019

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X,D	WO 2017/001351 A2 (PHILIP MORRIS PRODUCTS SA [CH]) 5 January 2017 (2017-01-05) * page 2, line 14 - page 3, line 35 * * page 13, line 33 - page 14, line 30 * * figure 1 * -----	1-16	INV. A24B15/167 A24B15/24 A24F40/10
X,D A	WO 2013/060827 A1 (JT INT SA [CH]) 2 May 2013 (2013-05-02) * claims 1-3 * * page 3, line 19 - page 4, line 19 * -----	1,16 2-15	
A	WO 2018/210681 A2 (BRITISH AMERICAN TOBACCO INVESTMENTS LTD [GB]) 22 November 2018 (2018-11-22) * the whole document * -----	1-16	

TECHNICAL FIELDS SEARCHED (IPC)

A24B
A24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 March 2020	Dimoula, Kerasina

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 20 5019

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

25-03-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2017001351 A2	05-01-2017	CN 107920587 A	17-04-2018
		EP 3313215 A2	02-05-2018
		ES 2734804 T3	12-12-2019
		JP 2018523985 A	30-08-2018
		KR 20180023899 A	07-03-2018
		PL 3313215 T3	31-12-2019
		PT 3313215 T	30-09-2019
		RU 2017143473 A	29-07-2019
		TR 201910636 T4	21-08-2019
		US 2018295882 A1	18-10-2018
		WO 2017001351 A2	05-01-2017
WO 2013060827 A1	02-05-2013	CN 103929985 A	16-07-2014
		EA 201490609 A1	30-09-2014
		EP 2770856 A1	03-09-2014
		EP 3578063 A1	11-12-2019
		JP 5908099 B2	26-04-2016
		JP 2014530633 A	20-11-2014
		KR 20140097254 A	06-08-2014
		US 2014261483 A1	18-09-2014
		WO 2013060827 A1	02-05-2013
WO 2018210681 A2	22-11-2018	AR 111796 A1	21-08-2019
		AU 2018267919 A1	14-11-2019
		CA 3062987 A1	22-11-2018
		CN 110650641 A	03-01-2020
		EP 3624619 A2	25-03-2020
		KR 20190134789 A	04-12-2019
		TW 201900042 A	01-01-2019
		WO 2018210681 A2	22-11-2018

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2013060827 A **[0012]**
- WO 2014182736 A **[0021]**
- WO 2017001351 A **[0042]**