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(54) **SMOKING SUBSTITUTE CONSUMABLE**

(57) The present disclosure relates to an aerosol-forming article (1) (e.g. a heat-not-burn (HNB) consumable) comprising an aerosol-forming substrate (2) and a plurality of hollow bore filter elements (4, 5) having different internal bore diameters. There may be a terminal filter element at the downstream/mouth end of the article and an upstream filter element upstream of the terminal filter element where the internal bore diameter of the terminal hollow bore filter element is less than the internal bore diameter of the upstream hollow bore filter element.

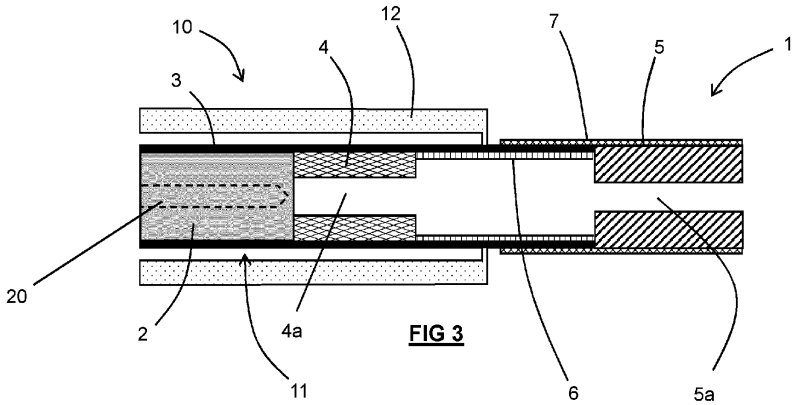

FIG 3

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Description

Field of the Disclosure

[0001] The present disclosure relates to a consumable for use in a smoking substitute system and particularly, although not exclusively, to a heat-not-burn (HNB) consumable.

Background

[0002] The smoking of tobacco is generally considered to expose a smoker to potentially harmful substances. It is generally thought that a significant amount of the potentially harmful substances are generated through the heat caused by the burning and/or combustion of the tobacco and the constituents of the burnt tobacco in the tobacco smoke itself.

[0003] Conventional combustible smoking articles, such as cigarettes, typically comprise a cylindrical rod of tobacco comprising shreds of tobacco which is surrounded by a wrapper, and usually also a cylindrical filter axially aligned in an abutting relationship with the wrapped tobacco rod. The filter typically comprises a filtration material which is circumscribed by a plug wrap. The wrapped tobacco rod and the filter are joined together by a wrapped band of tipping paper that circumscribes the entire length of the filter and an adjacent portion of the wrapped tobacco rod. A conventional cigarette of this type is used by lighting the end opposite to the filter, and burning the tobacco rod. The smoker receives mainstream smoke into their mouth by drawing on the mouth end or filter end of the cigarette.

[0004] Combustion of organic material such as tobacco is known to produce tar and other potentially harmful byproducts. There have been proposed various smoking substitute systems (or "substitute smoking systems") in order to avoid the smoking of tobacco.

[0005] Such smoking substitute systems can form part of nicotine replacement therapies aimed at people who wish to stop smoking and overcome a dependence on nicotine.

[0006] Smoking substitute systems include electronic systems that permit a user to simulate the act of smoking by producing an aerosol (also referred to as a "vapour") that 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.

[0007] In general, smoking substitute systems 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 with combustible tobacco products. Some smoking substitute systems use smoking substitute articles that are designed to resemble a traditional cigarette and are cylindrical in form with a mouthpiece at one end.

[0008] The popularity and use of smoking substitute systems 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 systems as desirable lifestyle accessories.

[0009] There are a number of different categories of smoking substitute systems, each utilising a different smoking substitute approach.

[0010] One approach for a smoking substitute system is the so-called "heat not burn" ("HNB") approach in which tobacco (rather than an "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. the tobacco does not undergo combustion.

[0011] A typical HNB smoking substitute system may include a device and a consumable. The consumable may include the tobacco material. The device and consumable may be configured to be physically coupled together. In use, heat may be imparted to the tobacco material by a heating element of the device, wherein airflow through the tobacco material causes moisture in the tobacco material to be released as vapour. A vapour may also be formed from a carrier in the tobacco material (this carrier may for example include propylene glycol and/or vegetable glycerine) and additionally volatile compounds released from the tobacco. The released vapour may be entrained in the airflow drawn through the tobacco.

[0012] As the vapour passes through the consumable (entrained in the airflow) from an inlet to a mouthpiece (outlet), the vapour cools and condenses to form an aerosol for inhalation by the user. The aerosol will normally contain the volatile compounds.

[0013] In HNB smoking substitute systems, heating as opposed to burning the tobacco material is believed to cause fewer, or smaller quantities, of the more harmful compounds ordinarily produced during smoking. Consequently, the HNB approach may reduce the odour and/or health risks that can arise through the burning, combustion and pyrolytic degradation of tobacco.

[0014] In some cases, the aerosol passing from the mouthpiece (i.e. being inhaled by a user) may not be in a desirable state. Thus, it may be desirable to alter one or more characteristics of the aerosol before it is inhaled by the user.

[0015] There is a need for an improved design of HNB consumables to enhance the user experience and improve the function of the HNB smoking substitute system.

[0016] The present disclosure has been devised in the light of the above considerations.

Summary of the Disclosure

[0017] At its most general, the present disclosure relates to an aerosol-forming article e.g. a smoking substitute article such as an HNB consumable having hollow

bore filter elements of different bore diameters.

[0018] According to a first aspect, there is provided an aerosol-forming article (e.g. a smoking substitute article such as an HNB consumable) comprising an aerosol-forming substrate and a plurality of hollow bore filter elements having different internal bore diameters.

[0019] By providing a plurality of hollow bore filter elements having different internal bore diameters, the vapour filtering and mixing performance can be tailored during manufacture to enhance the user's experience.

[0020] Optional features will now be set out. These are applicable singly or in any combination with any aspect.

[0021] The aerosol-forming article is preferably a heat-not-burn (HNB) consumable.

[0022] The aerosol-forming substrate is capable of being heated to release at least one volatile compound that can form an aerosol. The aerosol-forming substrate may be located at the upstream end of the article/consumable.

[0023] As used herein, the terms "upstream" and "downstream" are intended to refer to the flow direction of the vapour/aerosol i.e. with the downstream end of the article/consumable being the mouth end or outlet where the aerosol exits the article/consumable for inhalation by the user. The upstream end of the article/consumable is the opposing end to the downstream end.

[0024] In order to generate an aerosol, the aerosol-forming substrate comprises at least one volatile compound that is intended to be vaporised/aerosolised and that may provide the user with a recreational and/or medicinal effect when inhaled. Suitable chemical and/or physiologically active volatile compounds include the group consisting of: nicotine, cocaine, caffeine, opiates and opoids, cathine and cathinone, kavalactones, mysticin, beta-carboline alkaloids, salvinorin A together with any combinations, functional equivalents to, and/or synthetic alternatives of the foregoing.

[0025] The aerosol-forming substrate may comprise plant material. The plant material may comprise least one plant material selected from the list including *Amaranthus dubius, Arctostaphylos uva-ursi* (Bearberry), *Argemone mexicana, Amica, Artemisia vulgaris,* Yellow Tees, *Galea zacatechichi, Canavalia maritima* (Baybean), *Cecropia mexicana* (Guamura), *Cestrum noctumum, Cynoglossum virginianum* (wild comfrey), *Cytisus scoparius, Damiana, Entada rheedii, Eschscholzia califomica* (California Poppy), *Fittonia albivenis, Hippobroma longiflora, Humulus japonica* (Japanese Hops), *Humulus lupulus* (Hops), *Lactuca virosa* (Lettuce Opium), *Laggera alata, Leonotis leonurus, Leonurus cardiaca* (Motherwort), *Leonurus sibiricus* (Honeyweed), *Lobelia cardinalis, Lobelia inflata* (Indian-tobacco), *Lobelia siphilitica, Nepeta cataria* (Catnip), *Nicotiana species* (Tobacco), *Nymphaea alba* (White Lily), *Nymphaea caerulea* (Blue Lily), Opium poppy, *Passiflora incamata* (Passionflower), *Pedicularis densiflora* (Indian Warrior), *Pedicularis groenlandica* (Elephant's Head), *Salvia divinorum, Salvia dorrii* (Tobacco Sage), Salvia species (Sage), *Scutellaria galericulata, Scutellaria lateriflora, Scutellaria nana, Scutellaria* species (Skullcap), *Sida acuta* (Wireweed), *Sida rhombifolia, Silene capensis, Syzygium aromaticum* (Clove), *Tagetes lucida* (Mexican Tarragon), *Tarchonanthus camphoratus, Tumera diffusa* (Damiana), *Verbascum* (Mullein), *Zamia latifolia* (Maconha Brava) together with any combinations, functional equivalents to, and/or synthetic alternatives of the foregoing.

[0026] Preferably, the plant material is tobacco. Any type of tobacco may be used. This includes, but is not limited to, flue-cured tobacco, burley tobacco, Maryland Tobacco, dark-air cured tobacco, oriental tobacco, dark-fired tobacco, perique tobacco and rustica tobacco. This also includes blends of the above mentioned tobaccos.

[0027] Any suitable parts of the tobacco plant may be used. This includes leaves, stems, roots, bark, seeds and flowers.

[0028] The tobacco may comprise one or more of leaf tobacco, stem tobacco, tobacco powder, tobacco dust, tobacco derivatives, expanded tobacco, homogenised tobacco, shredded tobacco, extruded tobacco, cut rag tobacco and/or reconstituted tobacco (e.g. slurry recon or paper recon).

[0029] The aerosol-forming substrate may comprise a gathered sheet of homogenised (e.g. paper/slurry recon) tobacco or gathered shreds/strips formed from such a sheet.

[0030] In some embodiments, the sheet used to form the aerosol-forming substrate has a grammage greater than or equal to 100 g/m^2, e.g. greater than or equal to 110 g/m^2 such as greater than or equal to 120 g/m^2.

[0031] The sheet may have a grammage of less than or equal to 300 g/m^2 e.g. less than or equal to 250 g/m^2 or less than or equal to 200 g/m^2.

[0032] The sheet may have a grammage of between 120 and 190 g/m^2.

[0033] The aerosol-forming substrate may comprise at least 50 wt% plant material, e.g. at least 60 wt% plant material e.g. around 65 wt% plant material. The aerosol-forming substrate may comprise 80 wt% or less plant material e.g. 75 or 70 wt% or less plant material.

[0034] The aerosol-forming substrate may comprise one or more additives selected from humectants, flavourants, fillers, aqueous/non-aqueous solvents and binders.

[0035] Humectants are provided as vapour generators - the resulting vapour helps carry the volatile active compounds and increases visible vapour. Suitable humectants include polyhydric alcohols (e.g. propylene glycol (PG), triethylene glycol, 1 ,2-butane diol and vegetable glycerine (VG)) and their esters (e.g. glycerol mono-, di- or tri-acetate). They may be present in the aerosol-forming substrate in an amount between 1 and 50 wt%.

[0036] The humectant content of the aerosol-forming substrate may have a lower limit of at least 1 % by weight of the plant material, such as at least 2 wt %, such as at least 5 wt %, such as at least 10 wt %, such as at least 20 wt %, such as at least 30 wt %, or such as least 40 wt %.

[0037] The humectant content of the aerosol-forming substrate may have an upper limit of at most 50 % by

weight of the plant material, such as at most 40 wt %, such as at most 30 wt %, or such as at most 20 wt %.

[0038] Preferably, the humectant content is 1 to 40 wt % of the aerosol-forming substrate, such as 1 to 20 wt % Suitable binders are known in the art and may act to bind together the components forming the aerosol-forming substrate. Binders may comprise starches and/or cellulosic binders such as methyl cellulose, ethyl cellulose, hydroxypropyl cellulose, hydroxyethyl cellulose and methyl cellulose, gums such as xanthan, guar, arabic and/or locust bean gum, organic acids and their salts such as alginic acid/ sodium alginate, agar and pectins.

[0039] Preferably the binder content is 5 to 10 wt% of the aerosol-forming substrate e.g. around 6 to 8 wt%.

[0040] Suitable fillers are known in the art and may act to strengthen the aerosol-forming substrate. Fillers may comprise fibrous (non-tobacco) fillers such as cellulose fibres, lignocellulose fibres (e.g. wood fibres), jute fibres and combinations thereof.

[0041] Preferably, the filler content is 5 to 10 wt% of the aerosol-forming substrate e.g. around 6 to 9 wt%.

[0042] The aerosol-forming substrate may comprise an aqueous and/or non-aqueous solvent. In some embodiments, the aerosol forming substrate has a water content of between 5 and 10 wt% e.g. between 6-9 wt% such as between 7-9 wt%.

[0043] The flavourant may be provided in solid or liquid form. It may include menthol, liquorice, chocolate, fruit flavour (including e.g. citrus, cherry etc.), vanilla, spice (e.g. ginger, cinnamon) and tobacco flavour. The flavourant may be evenly dispersed throughout the aerosol-forming substrate or may be provided in isolated locations and/or varying concentrations throughout the aerosol-forming substrate.

[0044] The aerosol-forming substrate may be formed in a substantially cylindrical shape such that the article/consumable resembles a conventional cigarette. It may have a diameter of between 5 and 10mm e.g. between 6 and 9mm or 6 and 8mm e.g. around 7 mm. It may have an axial length of between 10 and 15mm e.g. between 11 and 14mm such as around 12 or 13mm.

[0045] The aerosol-forming substrate may be at least partly circumscribed by a wrapping layer e.g. a paper wrapping layer. The wrapping layer may overlie an inner foil layer or may comprise a paper/foil laminate (with the foil innermost).

[0046] The article/consumable comprises at least two hollow bore filter elements having a different internal axial bore diameters. There may be a terminal hollow bore filter element at the downstream/mouth end of the article/consumable. There may be an upstream hollow bore filter element upstream of the terminal filter element but downstream of the aerosol-forming substrate.

[0047] The terminal filter element and upstream filter element may be axially adjacent one another or may be spaced apart. The upstream filter element may be at least partly (e.g. entirely) circumscribed by the (paper) wrapping layer.

[0048] At least one of the filter elements (e.g. the terminal filter element and/or upstream filter element) may be comprised of cellulose acetate or polypropylene tow. At least one of the filter elements (e.g. the terminal filter element and/or upstream filter element) may be comprised of activated charcoal. At least one of the filter elements (e.g. the terminal filter element and/or upstream filter element) may be comprised of paper. At least one of the filter elements (e.g. the terminal filter element and/or upstream filter element) may be comprised of extruded plant material. The or each filter element may be circumscribed with a plug wrap e.g. a paper plug wrap.

[0049] Each filter element may have a substantially cylindrical shape with a diameter substantially matching the diameter of the aerosol-forming substrate (with or without its associated wrapping layer).

[0050] In some embodiments, the axial length of the terminal filter element is greater than the axial length of the upstream filter element. For example, the axial length of the terminal filter element may be 1 mm or more greater than the axial length of the upstream filter element. The axial length of the terminal filter element may be 2 mm or 3 mm or 4 mm or 5 mm or more greater than the axial length of the upstream filter element.

[0051] The axial length of the terminal filter element may be less than 20 mm, e.g. between 8 and 15 mm, for example between 9 and 13 mm e.g. between 10 and 12 mm such as around 12 mm.

[0052] In some embodiments, the upstream filter element may have an axial length of 10 mm or less and the terminal filter element has an axial length greater than 10mm e.g. around 12mm.

[0053] Each hollow bore filter element may have a bore diameter of between 1 and 5 mm, e.g. between 2 and 4 mm or between 2 and 3 mm. The upstream hollow bore filter element preferably has a larger bore diameter than the terminal hollow bore filter element. For example, the upstream hollow bore filter element may have a bore diameter that is 1mm or more greater than the bore diameter of the terminal filter element. For example, the upstream hollow bore filter element may have a bore diameter of 3 or 3.5 mm whilst the terminal filter element may have a bore diameter of around 2mm.

[0054] By providing a terminal filter element with a reduced bore diameter (compared to the upstream hollow bore filter element), a greater mixing effect is achieved within the terminal hollow bore filter element as all of the components of the vapour/aerosol are forced to co-locate within the more restricted hollow bore. The increased length of the terminal hollow bore filter in preferred embodiments also provides for good mixing (within the bore) of the vapour components.

[0055] The terminal hollow bore filter element may have an increased density or increased hardness than the upstream filter element i.e. the upstream filter element may have an increased porosity than the terminal filter element. This is to increase the flow and mixing of the vapour/aerosol within the hollow bore of the terminal

filter element.

[0056] The terminal filter element (at the downstream end of the article/consumable) may be joined to the upstream elements forming the article/consumable by a circumscribing tipping layer e.g. a tipping paper layer. The tipping paper may have an axial length longer than the axial length of the terminal filter element such that the tipping paper completely circumscribes the terminal filter element plus the wrapping layer surrounding any adjacent upstream element.

[0057] In some embodiments, the article/consumable may comprise an aerosol-cooling element which is adapted to cool the aerosol generated from the aerosol-forming substrate (by heat exchange) before being inhaled by the user.

[0058] The aerosol-cooling element will be downstream from the aerosol-forming substrate. For example, it may be between the aerosol-forming substrate and the upstream filter element and/or between the two filter elements. The aerosol cooling element may be at least partly (e.g. completely) circumscribed by the (paper) wrapping layer.

[0059] The aerosol-cooling element may be formed of a plastics material selected from the group consisting of polylactic acid (PLA), polyvinyl chloride (PVC), polyethylene (PE) and polyethylene terephthalate (PET). The aerosol-cooling element may be formed of a crimped/gathered sheet of material to form a structure having a high surface area with a plurality of longitudinal channels to maximise heat exchange and cooling of the aerosol.

[0060] The article/consumable may comprise a spacer element that defines a space or cavity or chamber between the aerosol-forming substrate and the downstream end of the article/consumable. For example, it may be provided between the aerosol-forming substrate and the upstream filter element and/or between the two filter elements. The spacer acts to allow both cooling and mixing of the aerosol. The spacer element may be a tubular spacer element e.g. it may comprise a cardboard tube. The spacer element may be at least partly (e.g. entirely) circumscribed by the (paper) wrapping layer.

[0061] The spacer element may have an external diameter of between 5 and 10mm e.g. between 6 and 9mm or 6 and 8mm e.g. around 7 mm. It may have an axial length greater than the axial length of the terminal filter element. It may have any axial length of between 10 and 15mm e.g. between 12 and 14 mm or 13 and 14mm e.g. around 14mm.

[0062] In a second aspect, there is provided a smoking substitute system comprising an aerosol-forming article according to the first aspect and a device comprising a heating element.

[0063] The device may be a HNB device i.e. a device adapted to heat but not combust the aerosol-forming substrate.

[0064] The device may comprise a main body for housing the heating element. The heating element may comprise an elongated e.g. rod, tube-shaped or blade heating element. The heating element may project into or surround a cavity within the main body for receiving the article/consumable described above.

[0065] In some embodiments, the heating element is a rod-shaped heater having a diameter of around 2mm (e.g. 2.1 mm). The provision of a bore diameter of around 3mm or 3.5 mm in the upstream hollow bore filter element in the article may be particularly suited to use with a device having such a rod heater as the plant material e.g. tobacco closest to the rod heater (which will be subjected to the highest temperatures) will be axially aligned with the upstream axial end of the bore in the upstream hollow bore filter element so that the vapour released from this axially aligned portion of plant material can flow directly into the bore of the upstream hollow bore filter element. Accordingly, in preferred embodiment of the system, the internal diameter of the bore of the upstream hollow bore filter element is greater than the external diameter of the rod heater.

[0066] The device (e.g. the main body) may further comprise an electrical power supply e.g. a (rechargeable) battery for powering the heating element. It may further comprise a control unit to control the supply of power to the heating element.

[0067] In a third aspect, there is provided a method of using a smoking substitute system according to the second aspect, the method comprising:

inserting the article/consumable into the device; and
heating the article/consumable using the heating element.

[0068] In some embodiments, the method comprises inserting the article/consumable into a cavity within the main body and penetrating the article/consumable with the heating element upon insertion of the article/consumable. For example, the heating element may penetrate the aerosol-forming substrate in the article/consumable.

[0069] The skilled person will appreciate that except where mutually exclusive, a feature or parameter described in relation to any one of the above aspects may be applied to any other aspect. Furthermore, except where mutually exclusive, any feature or parameter described herein may be applied to any aspect and/or combined with any other feature or parameter described herein.

Summary of the Figures

[0070] So that the invention may be understood, and so that further aspects and features thereof may be appreciated, embodiments illustrating the principles of the invention will now be discussed in further detail with reference to the accompanying figures, in which:

Figure 1 shows a first embodiment of an HNB consumable;

Figure 2 shows a second embodiment of an HNB consumable; and

Figure 3 shows the first embodiment within a device forming an HNB system.

Detailed Description of the Figures

[0071] As shown in Figure 1, the HNB consumable 1 comprises an aerosol-forming substrate 2 at the upstream end of the consumable 1.

[0072] The aerosol-forming substrate comprises reconstituted tobacco which includes nicotine as a volatile compound.

[0073] The aerosol-forming substrate 2 comprises 65 wt% tobacco which is provided in the form of gathered shreds produced from a sheet of slurry/paper recon tobacco. The tobacco is dosed with 20wt% of a humectant such as propylene glycol (PG) or vegetable glycerine (VG) and has a moisture content of between 7-9 wt%. The aerosol-forming substrate further comprises cellulose pulp filler and guar gum binder.

[0074] The aerosol-forming substrate 2 is formed in a substantially cylindrical shape such that the consumable resembles a conventional cigarette. It has diameter of around 7mm and an axial length of around 12 mm.

[0075] The aerosol-forming substrate 2 is circumscribed by a paper wrapping layer 3.

[0076] The consumable 1 comprises an upstream filter element 4 and a downstream (terminal) filter element 5. The two filter elements 4, 5 and spaced by a cardboard tube spacer 6. Both filter elements 4, 5 are formed of cellulose acetate tow and wrapped with a respective paper plug layer (not shown).

[0077] Both filter elements have a substantially cylindrical shape. The diameter of the upstream filter 4 matches the diameter of the aerosol-forming substrate 2. The diameter of the terminal filter element 5 is slightly larger and matches the combined diameter of the aerosol-forming substrate 2 and the wrapping layer 3. The upstream filter element is shorter in axial length than the terminal filter element at an axial length of 10mm compared to 12mm for the terminal filter element.

[0078] The cardboard tube spacer is longer than each of the two filter elements having an axial length of around 14mm.

[0079] Each filter element 4, 5 is a hollow bore filter element with a respective hollow, longitudinally extending bore 4a, 5a. The diameter of the bore 4a in the upstream filter element 4 is larger than the diameter of the bore 5a in the terminal filter element 5 having a diameter of 3mm compared to 2 mm for the terminal filter element 5. The porosity of the upstream filter element 4 is greater than the porosity of the terminal filter element 5.

[0080] The cardboard tube spacer 6 and the upstream filter element 4 are circumscribed by the wrapping layer 3.

[0081] The terminal filter element 5 is joined to the upstream elements forming the consumable by a circumscribing paper tipping layer 7. The tipping layer 7 encircles the terminal filter element 5 and has an axial length of around 20mm such that it overlays a portion of the cardboard tube spacer 6.

[0082] Figure 2 shows a third embodiment of a consumable 1" which is the same as the first embodiment except that the wrapping layer 3 does not completely circumscribe the cardboard tube spacer 6 such that there is an annular gap 9 between the tipping layer 7 and the cardboard tube spacer 6 downstream of the end of the wrapping layer 3.

[0083] Figure 3 shows the first embodiment inserted into an HNB device 10 comprising a rod-shaped heating element 20. The heating element 20 projects into a cavity 11 within the main body 12 of the device.

[0084] The consumable 1 is inserted into the cavity 11 of the main body 12 of the device 10 such that the heating rod 20 penetrates the aerosol-forming substrate 2. Heating of the reconstituted tobacco in the aerosol-forming substrate 2 is effected by powering the heating element (e.g. with a rechargeable battery (not shown)). As the tobacco is heated, moisture and volatile compound (e.g. nicotine) within the tobacco and the humectant are released as a vapour and entrained within an airflow generated by inhalation by the user at the terminal filter element 5.

[0085] As the vapour cools within the upstream filter element 4 and the cardboard tube spacer 6, it condenses to form an aerosol containing the volatile compounds for inhalation by the user.

[0086] By providing a terminal filter element 5 with a bore 5a having a reduced bore diameter (compared to the bore 4a in the upstream hollow bore filter element 4), a greater mixing effect is achieved within the terminal hollow bore filter element 5 as all of the components of the vapour/aerosol are forced to co-locate within the more restricted hollow bore 5a. The increased length of the terminal hollow bore filter 5 also provides for good mixing (within the bore) of the vapour components.

[0087] The increased density of the terminal filter element 5 also helps increase flow and therefore mixing of the aerosol/vapour within the bore 5a of the terminal filter element 5.

[0088] The features disclosed in the foregoing description, or in the following claims, or in the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for obtaining the disclosed results, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

[0089] 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 scope of the invention.

[0090] 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.

[0091] Any section headings used herein are for organizational purposes only and are not to be construed as limiting the subject matter described.

[0092] 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.

[0093] 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%.

[0094] 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.

[0095] Features of embodiments of the invention are set out in the following paragraphs:

Clause 1. An aerosol-forming article comprising an aerosol-forming substrate and a plurality of hollow bore filter elements having different internal bore diameters.

Clause 2. An article according to clause 1 wherein the article is a heat-not-burn (HNB) consumable.

Clause 3. An article according to clause 1 or 2 comprising a terminal hollow bore filter element at the downstream/mouth end of the article and an upstream hollow bore filter element upstream of the terminal filter element.

Clause 4. An article according to clause 3 wherein the terminal hollow bore filter element has an axial bore having a smaller diameter than an axial bore in the upstream hollow bore filter element.

Clause 5. An article according to clause 4 wherein the diameter of the axial bore in the upstream hollow bore filter element is at least 1mm greater than the diameter of the axial bore in the terminal filter element.

Clause 6. An article according to any one of clauses 3 to 5 wherein the axial length of the terminal hollow bore filter element is greater than the axial length of the upstream hollow bore filter element.

Clause 7. An article according to clause 6 wherein the axial length of the terminal hollow bore filter element is 2 mm or more greater than the axial length of the upstream hollow bore filter element.

Clause 8. An article according to any one of clauses 3 to 7 wherein the upstream hollow bore filter element has a greater porosity than the terminal hollow bore filter element.

Clause 9. An article according to any one of clauses 3 to 8 wherein the upstream hollow bore filter element and terminal hollow bore filter element are spaced by an aerosol-cooling element and/or a spacer element.

Clause 10. A system comprising a smoking substitute article according to any one of the preceding clauses and a device comprising a heating element.

Clause 11. A system according to clause 10 wherein the device comprises a main body for housing the heating element and the heating element comprises an elongated heating element.

Clause 12. A system according to clause 10 or 11 comprising a rod-shaped heater having an external diameter wherein the internal diameter of the bore of the upstream hollow bore filter element is greater than the external diameter of the rod-shaped heater.

Clause 13. A method of using the system according to any one of clauses 10 to 12, the method comprising: inserting the article into the device; and heating the article using the heating element.

Clause 14. A method according to clause 13 comprising inserting the article into a cavity within a main body of the device and penetrating the article with the heating element upon insertion of the article.

Claims

1. An aerosol-forming article (1) comprising:

   an aerosol-forming substrate (2);
   and a plurality of hollow bore filter elements (4, 5) having different internal bore diameters.

2. An article (1) according to claim 1 wherein the article (1) is a heat-not-burn (HNB) consumable.

3. An article (1) according to claim 1 or 2, wherein the plurality of hollow bore filter elements (4, 5) comprises an upstream hollow bore filter element (4) that is upstream of a downstream/mouth end of the article and downstream of the aerosol-forming substrate (2), the upstream hollow bore filter element (4) being adjacent to the aerosol-forming substrate (2).

4. An article (1) according to claim 3, wherein the upstream hollow bore filter element (4) has a bore diameter of about 3mm to 3.5mm.

5. An article (1) according to any preceding claim, wherein the plurality of hollow bore filter elements (4,5) comprises a terminal hollow bore filter element (5) at the downstream/mouth end of the article (1).

6. An article according to claim 5, when dependent on claim 3 or 4, wherein the terminal hollow bore filter element (5) has an axial bore (5a) having a smaller diameter than an axial bore (4a) in the upstream hollow bore filter element (4)
   optionally wherein the diameter of the axial bore (4a) in the upstream hollow bore filter element (4) is at least 1mm greater than the diameter of the axial bore (5a) in the terminal filter element (5).

7. An article (1) according to claims 5 or 6, when dependent on claim 3 or 4, wherein the upstream hollow bore filter element (4) has a greater porosity than the terminal hollow bore filter element (5).

8. An article according to any one of claims 5 to 7, when dependent on claim 3 or 4, wherein the terminal filter element and upstream filter element are spaced apart.

9. An article (1) according to claim 8 wherein the upstream hollow bore filter element (4) and terminal hollow bore filter element (5) are spaced by an aerosol-cooling element and/or a spacer element (6).

10. An article (1) according to any one of claims 5 to 9, wherein the terminal filter element has an axial length of at least 8mm up to 20 mm, optionally up to 15 mm, optionally up to 13 mm, optionally up to 12 mm.

11. An article according to any preceding claim, wherein at least one of the filter elements is comprised of: cellulose acetate or polypropylene tow; activated charcoal; or paper; optionally wherein at least one of the filter elements is circumscribed with a plug wrap.

12. An article according to any preceding claim, wherein each hollow bore filter element has a bore diameter of at least 1 mm up to 5mm, optionally at least 2 mm up to 4 mm, optionally at least 2 mm up to 3 mm.

13. A system comprising a smoking substitute article (1) according to any one of the preceding claims and a device (10) comprising a heating element (20), optionally wherein the device comprises a main body (12) for housing the heating element (20) and the heating element (20) comprises an elongated heating element (20).

14. A system according to claim13, when dependent on claim 3 or 4, a wherein the heating element (20) comprises a rod-shaped heater (20) having an external diameter, wherein the internal diameter of the bore (4a) of the upstream hollow bore filter element (4) is greater than the external diameter of the rod-shaped heater (20).

15. A system according to claim 14, wherein the external diameter of the rod-shaped heater (20) is about 2mm.

16. A method of using the system according to claim 13 to 15, the method comprising:

   inserting the article (1) into the device (10);
   heating the article (1) using the heating element (20); and optionally
   inserting the article (1) into a cavity within a main body (12) of the device (10) and penetrating the article (1) with the heating element upon insertion of the article (1).

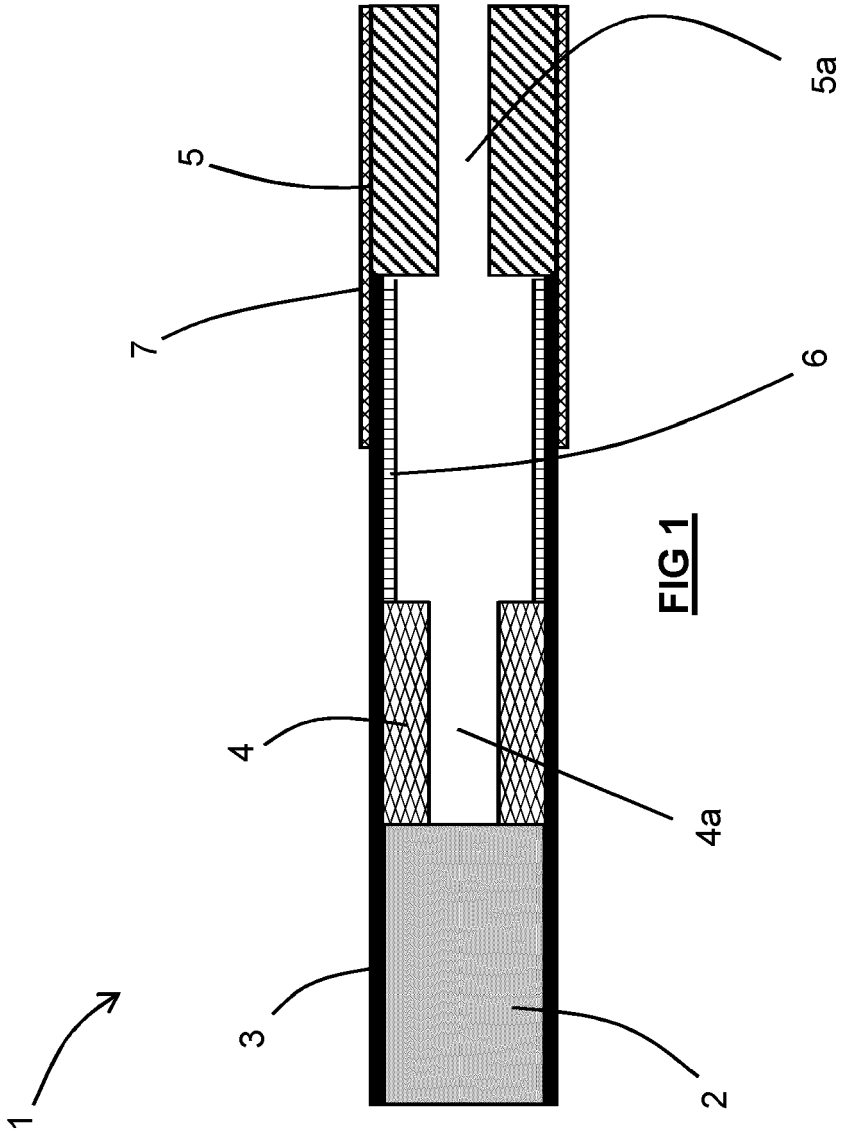

FIG 1

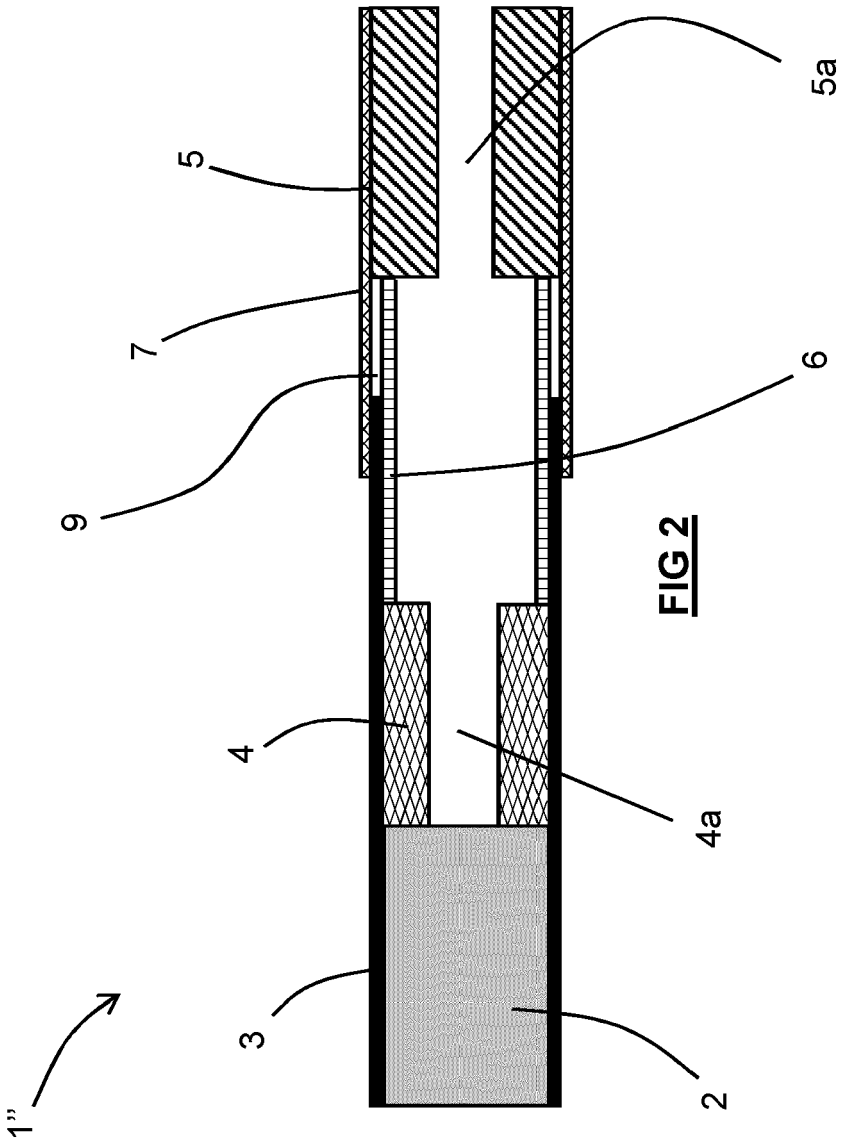

FIG 2

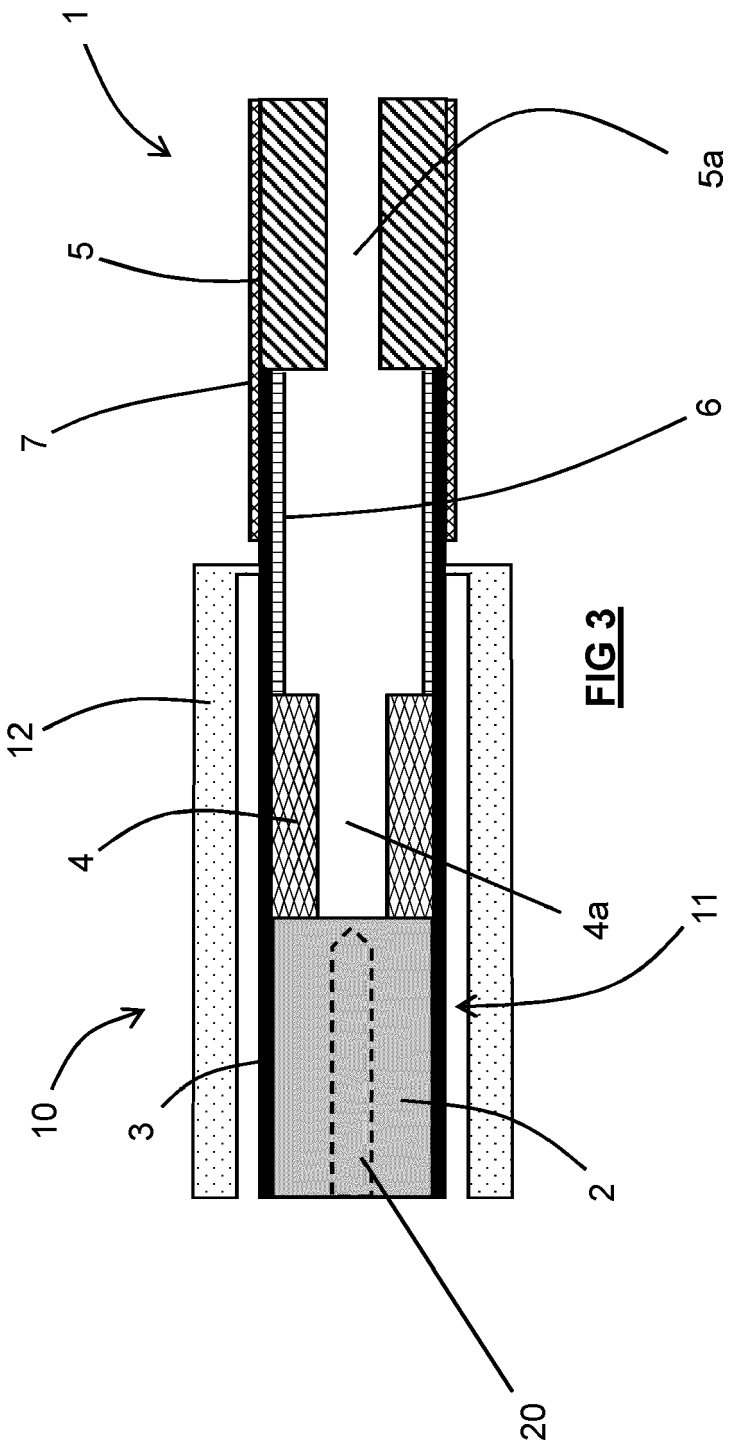

FIG 3