



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.06.2024 Bulletin 2024/25

(51) International Patent Classification (IPC):
A24D 3/04 (2006.01)

(21) Application number: **24166528.0**

(52) Cooperative Patent Classification (CPC):
A24D 1/20; A24D 3/04

(22) Date of filing: **25.10.2019**

(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

• **FERRIE, Kate**
Liverpool, L24 9HP (GB)
• **SHENTON, Edward Ross**
Liverpool, L24 9HP (GB)

(30) Priority: **29.10.2018 GB 201817579**

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

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
19798005.5 / 3 873 264

(71) Applicant: **Imperial Tobacco Limited**
Bristol, BS3 2LL (GB)

Remarks:

This application was filed on 26-03-2024 as a divisional application to the application mentioned under INID code 62.

(72) Inventors:
• **LORD, Chris**
Liverpool, L24 9HP (GB)

(54) **SMOKING SUBSTITUTE CONSUMABLE**

(57) The present disclosure provides an aerosol-forming article comprising an aerosol-forming substrate (2) and an axially adjacent, downstream filter arrangement. The filter arrangement comprises an upstream filter element (4), an intermediate filter element (6) and a terminal filter element (5). The upstream and

terminal filter elements are independently selected from a solid filter element and a hollow bore filter element. The intermediate filter element is a hollow bore filter element having a greater bore diameter than any other hollow bore filter element in the filter arrangement.

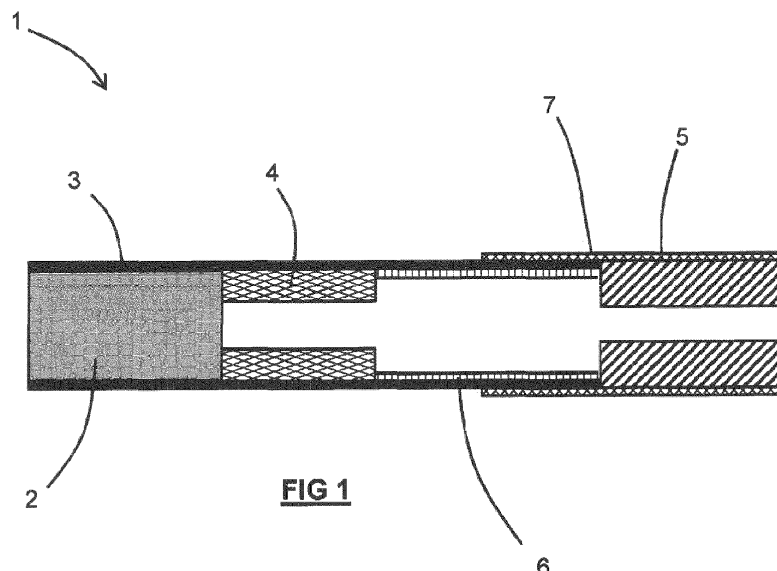


FIG 1

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 a thin-

walled hollow bore filter element interposed between two other filter elements.

[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 an axially adjacent, downstream filter arrangement wherein the filter arrangement comprises an upstream filter element, an intermediate filter element and a terminal filter element, wherein the upstream and terminal filter elements are independently selected from a solid filter element and a hollow bore filter element and wherein intermediate filter element is a hollow bore filter element having a greater bore diameter than any other hollow bore filter element in the filter arrangement.

[0019] The provision of an intermediate hollow bore filter element interposed between two other filter elements within a filter arrangement axially downstream of the substrate, the intermediate filter element can act as a cooling/mixing chamber by allowing cooling/mixing of the aerosol/vapour generated by heating the substrate within its axial bore. The intermediate filter element thus helps reduce thermal transfer to the user's lips whilst having little effect on the volume of visible vapour (unlike known polylactic acid cooling elements which reduce visible vapour).

[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 opioids, 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), *Ce-*

cropia mexicana (Guamara), *Cestrum nocturnum*, *Cynoglossum virginianum* (wild comfrey), *Cytisus scoparius*, *Damiana*, *Entada rheedii*, *Eschscholzia californica* (California Poppy), *Fittonia albivenis*, *Hippobroma longiflora*, *Humulus japonica* (Japanese Hops), *Humulus lupulus* (Hops), *Lactuca virosa* (Lettuce Opium), *Lagdera 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 incarnata* (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), *Tarhonanthus 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/m², e.g. greater than or equal to 110 g/m² such as greater than or equal to 120 g/m².

[0031] The sheet may have a grammage of less than or equal to 300 g/m² e.g. less than or equal to 250 g/m² or less than or equal to 200 g/m².

[0032] The sheet may have a grammage of between 120 and 190 g/m².

[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, flavour-

ants, 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 at 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 %

[0039] 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.

[0040] Preferably the binder content is 5 to 10 wt% of the aerosol-forming substrate e.g. around 6 to 8 wt%.

[0041] 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.

[0042] Preferably, the filler content is 5 to 10 wt% of the aerosol-forming substrate e.g. around 6 to 9 wt%.

[0043] 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%.

[0044] 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.

[0045] 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.

[0046] 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).

[0047] The filter arrangement comprises an upstream filter element which is axially adjacent/immediately downstream of the aerosol-forming substrate, a terminal filter element which is at the downstream axial end of the article/consumable and an intermediate filter element which is interposed in abutment with the other two filter elements.

[0048] The upstream and intermediate filter elements may be at least partly (e.g. entirely) circumscribed by the (paper) wrapping layer.

[0049] The or at least one of the filter element(s) (e.g. the terminal filter element/upstream filter element/intermediate filter element) may be comprised of cellulose acetate or polypropylene tow. The or at least one of the filter element(s) (e.g. the terminal filter element/upstream filter element/intermediate filter element) may be comprised of activated charcoal. The or at least one of the filter element(s) (e.g. the terminal filter element/upstream filter element/intermediate filter element) may be comprised of paper. The or at least one of the filter element(s) (e.g. the terminal filter element/upstream filter element/intermediate filter element) may be comprised of plant material e.g. extruded plant material. The or each filter element may be circumscribed with a plug wrap e.g. a paper plug wrap.

[0050] The or 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). The axial length of the upstream and/or terminal filter element may be less than 20mm, e.g. between 8 and 15mm, for example between 9 and 13 mm e.g. between 10 and 12mm. The axial length of the intermediate filter element may be between 10 and 15mm e.g. between 12 and 14 mm or 13 and 14mm e.g. around 14mm.

[0051] The intermediate filter element is a hollow bore filter element having a larger bore diameter than any other hollow bore filter element in the filter arrangement.

[0052] In some embodiments, the bore diameter in the intermediate filter element is greater than 3 mm, e.g. greater than or equal to 4 mm, such as greater than or equal to 5 or 6 mm. Given that the external diameter of the intermediate filter element preferably matches the diameter of the substrate (e.g. with a diameter around 7 mm), it can be seen that the intermediate hollow bore filter element is preferably a thin-walled hollow bore filter element. This maximises the volume of the axial bore to maximise mixing/cooling of the vapour.

[0053] The terminal filter element and/or upstream filter element may be a solid filter element.

[0054] The terminal filter element and/or upstream filter element may be a hollow bore filter element. In that case, the upstream and or terminal hollow bore filter el-

ement may have a bore diameter of between 1 and 5 mm, e.g. between 2 and 4 mm or between 2 and 3 mm. Where both the upstream and terminal filter elements are hollow bore filter elements, the upstream filter element may have a larger bore diameter than the terminal filter element (with the intermediate filter element having the largest bore diameter within the filter arrangement).

[0055] In preferred embodiments, the upstream filter element is a hollow bore filter element (with a bore diameter less than the bore diameter of the intermediate hollow bore filter element. In this way, the vapour passing through the axial bore of the upstream hollow bore filter element can expand into the larger axial bore in the intermediate hollow bore filter element, this expansion resulting in effective cooling/mixing.

[0056] Providing a terminal hollow bore filter element may help the components of the vapour/aerosol within the larger axial bore of the intermediate filter element co-locate prior to inhalation by the user.

[0057] 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.

[0058] Where one of the upstream/terminal filter elements is a solid filter element, it may include a capsule e.g. a crushable capsule (crush-ball) containing a liquid flavourant e.g. any of the flavourants listed above. The capsule can be crushed by the user during smoking of the article/consumable to release the flavourant. The capsule may be located at the axial centre of the solid filter element.

[0059] 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.

[0060] The device may be a HNB device i.e. a device adapted to heat but not combust the aerosol-forming substrate.

[0061] 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.

[0062] 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.

[0063] 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.

[0064] 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.

[0065] 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.

20 **Summary of the Figures**

[0066] 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

Figure 3 shows a third embodiment of an HNB consumable; and

Figure 4 shows the first embodiment within a device forming an HNB system.

40 **Detailed Description of the Figures**

[0067] As shown in Figure 1, the HNB consumable 1 comprises an aerosol-forming substrate 2 at the upstream end of the consumable 1.

[0068] The aerosol-forming substrate comprises reconstituted tobacco which includes nicotine as a volatile compound.

[0069] 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 reconstituted 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.

[0070] 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 7 mm and an axial length of around 12 mm.

[0071] The aerosol-forming substrate 2 is circumscribed by a paper wrapping layer 3.

[0072] The consumable 1 comprises an upstream filter element 4 and a downstream (terminal) filter element 5. The upstream and terminal filter elements 4, 5 are spaced by an intermediate hollow bore filter element 6. All filter elements 4, 5, 6 are formed of cellulose acetate tow and wrapped with a respective paper plug layer (not shown).

[0073] All filter elements have a substantially cylindrical shape. The diameter of the upstream filter element 4 and intermediate hollow bore filter element 6 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.

[0074] The upstream filter element 4 is slightly shorter in axial length than the terminal filter element 5 at an axial length of 10 mm compared to 12 mm for the terminal filter element 5. The intermediate filter element 6 is longer than each of the two filter elements 4, 5 having an axial length of around 14 mm.

[0075] Each filter element 4, 5, 6 is a hollow bore filter element with a hollow, longitudinally-extending axial bore. The diameter of the bore in the upstream filter element 4 is slightly larger than the diameter of the bore in the terminal filter element 5 having a diameter of 3 mm compared to 2 mm for the terminal filter element 5.

[0076] The intermediate hollow bore filter element 6 has the largest bore diameter at around 5 or 6 mm.

[0077] The upstream filter element 4 and intermediate filter element 6 are circumscribed by the wrapping layer 3.

[0078] 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 intermediate filter element 6.

[0079] Figure 2 shows a second embodiment of a consumable 1' which is the same as that shown in Figure 1 except that the terminal filter element 5 is a solid filter element and comprises a crushable capsule 8 (crush-ball) having a shell wall containing a liquid menthol or cherry or vanilla flavourant. The capsule 8 is spherical and has a diameter of 3.5mm. It is positioned within the axial centre of the terminal filter element 5.

[0080] Figure 3 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 intermediate filter element 6 downstream of the end of the wrapping layer 3.

[0081] Figure 4 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.

[0082] 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.

[0083] As the vapour cools within the upstream filter element 4 and the intermediate filter element 6, it condenses to form an aerosol containing the volatile compounds for inhalation by the user.

[0084] 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.

[0085] 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.

[0086] 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.

[0087] Any section headings used herein are for organizational purposes only and are not to be construed as limiting the subject matter described.

[0088] 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.

[0089] 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%.

[0090] 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.

[0091] 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 an axially adjacent, downstream filter arrangement wherein the filter arrangement comprises an upstream filter element, an intermediate filter element and a terminal filter element, wherein the upstream and terminal filter elements are independently selected from a solid filter element and a hollow bore filter element, and wherein intermediate filter element is a hollow bore filter element having a greater bore diameter than any other hollow bore filter element in the filter arrangement.

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 wherein the intermediate filter element comprises cellulose acetate or polypropylene tow.

Clause 4. An article according to any one of the preceding clauses wherein the bore diameter in the intermediate filter element is greater than 3 mm.

Clause 5. An article according to clause 4 wherein the bore diameter in the intermediate filter element is greater than or equal to 5 mm.

Clause 6. An article according to any one of the preceding clauses wherein the upstream filter element is a hollow bore filter element having a smaller bore diameter than the intermediate filter element.

Clause 7. An article according to any one of the preceding clauses wherein the terminal filter element is a hollow bore filter element having a smaller bore diameter than the intermediate filter element.

Clause 8. An article according to any one of the preceding clauses wherein both the upstream and terminal filter elements are hollow bore filter element and wherein the upstream filter element has a larger bore diameter than the terminal filter element.

Clause 9. An article according to any one of clauses 1 to 6 wherein the terminal filter element is a solid filter 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 method of using the system according to clause 10 or 11, the method comprising: inserting the article into the device; and heating the article using the heating element.

Clause 13. A method according to clause 12 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 filter arrangement axially adjacent to the aerosol-forming substrate (2) and downstream of the aerosol-forming substrate (2);
wherein the filter arrangement comprises an upstream filter element (4), an intermediate filter element (6) and a terminal filter element (5);
wherein the upstream filter element is a hollow bore filter element;
wherein the terminal filter element is a solid filter element or a hollow bore filter element;
wherein the intermediate filter element is a hollow bore filter element comprising at least one of: cellulose acetate, polypropylene tow, or activated charcoal; and
wherein the intermediate filter element has a greater bore diameter than the bore diameter of the upstream filter element.

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

3. An article according to claim 1 or 2, wherein the upstream filter element (4) is shorter in axial length than the terminal filter element (5).

4. An article according to any one of the preceding claims wherein the bore diameter in the intermediate filter element is greater than 3 mm, optionally greater than or equal to 5 mm, optionally greater than or

equal to 6 mm.

5. An article according to any one of the preceding claims, wherein the intermediate filter element has an external diameter of approximately 7 mm. 5
6. An article according to any one of the preceding claims, wherein the terminal filter element has an axial length of between 8mm and 20mm, optionally between 8 and 15 mm, optionally between 9 and 13 mm, optionally between 10 and 12mm. 10
7. An article according to any one of the preceding claims, wherein the upstream filter element has an axial length of between 8mm and 15mm. 15
8. An article according to any one of the preceding claims, wherein the upstream filter element has a bore diameter of between 1 and 5mm, optionally between 2 and 4mm, optionally between 2 and 3 mm. 20
9. An article according to any one of the preceding claims, wherein the upstream filter element (4) and intermediate filter element (6) each have a diameter matching the diameter of the aerosol-forming substrate (2). 25
10. An article according to any one of the preceding claims, wherein the aerosol-forming substrate has an axial length of between 10 and 15mm, optionally between 11 and 14 mm, optionally 12 or 13 mm. 30
11. An article according to any one of the preceding claims wherein the terminal filter element is a hollow bore filter element, and wherein the terminal filter element has a smaller bore diameter than the intermediate filter element and/or has a smaller bore diameter than the upstream filter element. 35
12. An article according to any one of claims 1 to 10 wherein the terminal filter element is a solid filter element. 40
13. A system comprising a smoking substitute article according to any one of the preceding claims and a device comprising a heating element, optionally wherein the smoking substitute article is a heat-not-burn (HNB) consumable and the device is a HNB device comprising a heating element configured to heat but not combust the aerosol-forming substrate. 45 50
14. A system according to claim 13 wherein the device comprises a main body for housing the heating element and the heating element comprises an elongated heating element. 55
15. A method of using the system according to claim 13 or 14, the method comprising:

inserting the article into the device;
 heating the article using the heating element;
 and optionally
 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.

