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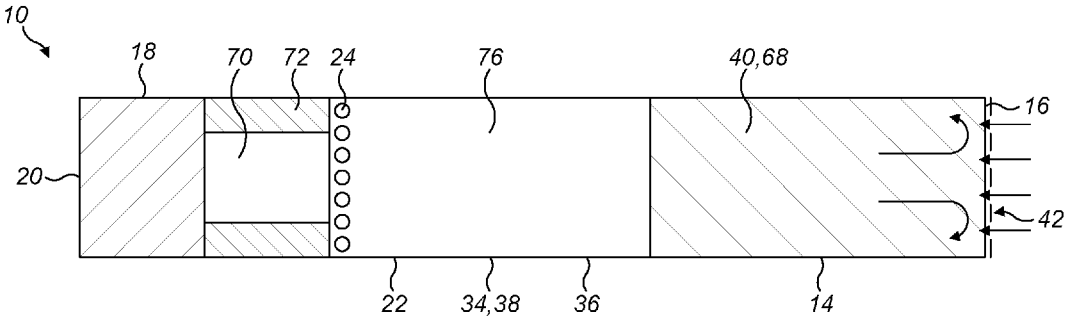

FIG. 1

(57) Abstract: An aerosol generating article (10, 94) adapted for being heated but not burnt in an aerosol generating device (12). The aerosol generating article (10, 94) comprises an aerosol generating portion (14) at or close to an air inlet end (16), the aerosol generating portion (14) comprising an aerosol generating substrate (68) for generating aerosol in use. The aerosol generating article (10, 94) further comprises a filter (18) at a mouth end (20). The aerosol generating article (10, 94) further comprises a ventilation portion (22) positioned between the aerosol generating portion (14) and the filter (18). The ventilation portion (22) comprises a plurality of ventilation holes (24) for allowing ambient ventilation air to enter the ventilation portion (22) and a one-way valve (26) associated with the ventilation holes (24). The one-way valve (26) comprises a plurality of ventilation flaps (28) each of which is associated with one of the ventilation holes (24). The ventilation flaps (28) are configured to be movable to open the ventilation holes (24) when a puff is being drawn from the mouth end (20) to allow ambient ventilation air to enter the ventilation portion (22). The ventilation flaps (28) are also configured to close the ventilation holes (24) caused by a positive pressure of aerosol inside the ventilation portion (22) when no puff is being drawn from the mouth end (20) to prevent aerosol leaking from the ventilation portion (22) through the ventilation holes (24).

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AN AEROSOL GENERATING ARTICLE

Technical Field

The present disclosure relates generally to an aerosol generating article, and more particularly to an aerosol generating article for an aerosol generating device.

Technical Background

The popularity and use of reduced-risk or modified-risk devices (also known as vaporisers) has grown rapidly in recent years as an alternative to the use of traditional tobacco products. Various devices and systems are available that heat or warm, rather than burn, an aerosol generating substrate to generate an aerosol for inhalation by a user.

A commonly available reduced-risk or modified-risk device is an aerosol generating device, or so-called heat-not-burn device. Devices of this type generate an aerosol or vapour by heating an aerosol generating substrate comprised in an aerosol generating portion of an aerosol generating article such as a heated tobacco stick, to a temperature typically in the range 150°C to 300°C. Heating the aerosol generating substrate to a temperature within this range, without burning or combusting the aerosol generating substrate, generates a vapour which typically cools and condenses in a ventilation portion of the aerosol generating article to form an aerosol for inhalation by a user of the device.

In known arrangements, aerosol generated in use may leak from the aerosol generating article when no puff is being drawn by a user. The leaked aerosol can settle on a surface of the aerosol generating device causing an undesirable surface residue which may attract dirt and become unhygienic. There is, therefore, a need to provide aerosol generating articles which mitigate this drawback.

Summary of the Disclosure

According to a first aspect of the present disclosure, there is provided an aerosol generating article adapted for being heated but not burnt in an aerosol generating device, the aerosol generating article comprising:

an aerosol generating portion at or close to an air inlet end, the aerosol generating portion comprising an aerosol generating substrate for generating aerosol in use;

a filter at or close to a mouth end; and

a ventilation portion positioned between the aerosol generating portion and the filter, wherein the ventilation portion comprises a plurality of ventilation holes for allowing ambient ventilation air to enter the ventilation portion and a one-way valve associated with the ventilation holes, wherein the one-way valve is configured:

to open the ventilation holes when a puff is being drawn from the mouth end to allow ambient ventilation air to enter the ventilation portion; and

to close the ventilation holes caused by a positive pressure of aerosol inside the ventilation portion when no puff is being drawn from the mouth end to prevent aerosol leaking from the ventilation portion through the ventilation holes.

To facilitate cooling of the aerosol generated prior to inhalation by a user, ventilation holes are provided in the ventilation portion to allow the ingress of ambient ventilation air to mix with and cool the aerosol generated. By preventing aerosol leaking from the ventilation portion through the ventilation holes, an undesirable surface residue caused by leaked aerosol settling on a surface of the device proximal to the ventilation holes is not formed. Accordingly, a user is better able to maintain a clean and hygienic aerosol generating device.

In examples of the disclosure, the term "when a puff is being drawn from the mouth end" refers to normalized flow conditions. Normalized flow conditions require the airflow leaving the mouth end of an unlit cigarette, in the present case replaced by an aerosol generating article, to be 17.5 ml/s in a cigarette smoking machine, i.e., in an aerosol generating device (ISO9512:2019). In examples of the disclosure, the term "when no puff is being drawn from the mouth end" refers to the situation where no vacuum is exerted at the mouth end.

Possibly, the one-way valve comprises ventilation flaps associated with the ventilation holes, wherein the ventilation flaps are configured:

to be moveable to open the ventilation holes caused by ambient ventilation air displacing the ventilation flaps to uncover the ventilation holes when a puff is being drawn from the mouth end; and

to be moveable to close the ventilation holes caused by a positive pressure of aerosol inside the ventilation portion displacing the ventilation flaps to cover the ventilation holes when no puff is being drawn from the mouth end.

The ventilation flaps may be arranged on an inside surface of the ventilation portion. The ventilation flaps may be provided by a notched strip.

Possibly, the ventilation portion has an outer wall, e.g., a circumferential wall, through which the ventilation holes extend into the interior of the ventilation portion, wherein the ventilation flaps associated with the ventilation holes are integrated in the circumferential wall. The ventilation holes may extend in a direction substantially orthogonal to a longitudinal direction (or longitudinal axis) of the aerosol generating article. In the case of an aerosol generating article having a substantially circular cross-section, the ventilation holes may extend in a radial direction.

Possibly, sides of the ventilation flaps and sides of the ventilation holes comprise bevelled edges. Possibly, in a closed condition of the ventilation holes, the bevelled edges of the ventilation flaps abut against the bevelled edges of the ventilation holes to prevent the ventilation flaps from opening outwardly from the ventilation portion. Accordingly, the ventilation flaps can only open inwardly into the ventilation portion and thus function as one-way valves.

The ventilation portion may be part of a tubular member forming a condensation chamber. The tubular member may be a paper tube. The tubular member may be overlaid with a wrapper such as a paper layer.

The number of ventilation holes may be from 8 to 20. The number of ventilation holes may be from 10 to 18. Possibly, in at least one dimension the size of the ventilation holes is from 80 μm to 500 μm. The ventilation holes may be formed through the ventilation portion, in particular through the tubular member and the wrapper. The ventilation holes may be produced by laser perforation.

The aerosol generating substrate may comprise a tobacco substrate. The tobacco substrate may contain at least 8 wt.% on a dry weight basis of an aerosol-former. The tobacco substrate may contain from 10 wt.% to 30 wt.% on a dry weight basis of an aerosol-former. The aerosol-former can be selected from a polyol such as sorbitol, glycerol, and glycols like propylene glycol or triethylene glycol; a non-polyol such as monohydric alcohols, acids such as lactic

acid, glycerol derivatives, esters such as triacetin, triethylene glycol diacetate, triethyl citrate, glycerin or vegetable glycerin.

The tobacco substrate may contain:

- processed tobacco such as shredded sheet, gathered sheet, tobacco mousse, crumbed tobacco, tobacco extract,
- tobacco lamina or tobacco stems,
- filler such as cellulose fibre,
- and combinations thereof.

The aerosol generating substrate may be associated with (e.g., embed or be in contact with) a heating element capable of heating the tobacco substrate. The heating element can be an induction heatable susceptor.

Possibly, the air inlet end comprises a second one-way valve, the second one-way valve being configured:

to allow ambient ventilation air to enter the aerosol generating portion through the air inlet end when a puff is being drawn from the mouth end; and

to prevent aerosol leaking from the aerosol generating portion through the air inlet end when no puff is being drawn from the mouth end.

By preventing aerosol leaking from the air inlet end, an undesirable surface residue caused by leaked aerosol settling on a surface of the device proximal to the air inlet end is not formed. Accordingly, a user is better able to maintain a clean and hygienic aerosol generating device. In known arrangements, to minimise leakage of aerosol through an air inlet end, a lowermost portion of an aerosol generating substrate comprised in an aerosol generating portion is not heated, which reduces the number of available puffs and compromises the user experience. In examples of the disclosure, because the second one-way valve prevents leakage of aerosol through the air inlet end, a larger portion of the aerosol generating substrate comprised in the aerosol generating portion can be heated for an improved user experience and a greater number of puffs.

The second one-way valve may comprise a deflector. Possibly, the deflector is configured:

to be moveable to open the second one-way valve caused by ambient ventilation air displacing the deflector to allow ambient ventilation air to enter the aerosol generating portion through the air inlet end when a puff is being drawn from the mouth end; and

to be moveable to close the second one-way valve to prevent aerosol leaking from the aerosol generating portion through the air inlet end when no puff is being drawn from the mouth end.

According to a second aspect of the present disclosure, there is provided an aerosol generating article adapted for being heated but not burnt in an aerosol generating device, the aerosol generating article comprising:

an aerosol generating portion at or close to an air inlet end, the aerosol generating portion comprising an aerosol generating substrate for generating aerosol in use;

a filter at or close to a mouth end; and

wherein the inlet end comprises a one-way valve, the one-way valve being configured:

to allow ambient ventilation air to enter the aerosol generating portion through the air inlet end when a puff is being drawn from the mouth end; and

to prevent aerosol leaking from the aerosol generating portion through the air inlet end when no puff is being drawn from the mouth end.

Brief Description of the Drawings

Figure 1 is a diagrammatic cross-sectional view of an aerosol generating article according to examples of the disclosure;

Figure 2 is a diagrammatic cutaway top view of a part of the aerosol generating article of Figure 1;

Figure 3 is a diagrammatic side view of the part of the aerosol generating article of Figure 2;

Figure 4 is a diagrammatic perspective detailed view of another part of the aerosol generating article of Figure 1;

Figure 5 is a diagrammatic side view of the part of the aerosol generating article of Figure 4;

Figure 6 is a diagrammatic cross-sectional view of an aerosol generating device in use with the aerosol generating article of Figure 1; and

Figure 7 is a diagrammatic view of a part of another aerosol generating article.

Detailed Description of Embodiments

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

Referring initially to Figures 1 to 6, there is shown diagrammatically an aerosol generating article 10 according to the present disclosure. The aerosol generating article 10 comprises an aerosol generating portion 14. The aerosol generating portion 14 comprises an aerosol generating substrate 68 for generating aerosol in use. The aerosol generating article 10 is configured to be used with an aerosol generating device 12, for instance as shown diagrammatically in Figure 6. The aerosol generating article 10 and the aerosol generating device 12 together form an aerosol generating system 200, as illustrated in Figure 6.

The aerosol generating device 12 may equally be referred to as a "heated tobacco device", a "heat-not-burn tobacco device", a "device for vaporising tobacco products", and the like, with this being interpreted as a device suitable for achieving these effects. The features disclosed herein are equally applicable to devices which are designed to vaporise any aerosol generating substrate. As described below, aerosol generating articles 10 according to examples of the present disclosure are adapted for being heated but not burnt in an aerosol generating device 12.

Referring initially to Figure 6, the aerosol generating device 12 with which the aerosol generating article 10 is useable is a hand-held, portable, device, by which it is meant that a user is able to hold and support the device unaided, in a single hand. The aerosol generating device 12 has a first (or proximal) end 46 and a second (or distal) end 48 and comprises a device housing 50.

The aerosol generating device 12 includes a controller 52. The aerosol generating device 12 may include a user interface for controlling the operation of the aerosol generating device 12 via the controller 52.

The controller 52 is configured to detect the initiation of use of the aerosol generating device 12, for example, in response to a user input, such as a button press to activate the aerosol generating device 12, or in response to a detected airflow through the aerosol generating device 12. As will be understood by one of ordinary skill in the art, an airflow through the aerosol

generating device 12 is indicative of a user inhalation or 'puff'. The aerosol generating device 12 may, for example, include a puff detector, such as an airflow sensor (not shown), to detect an airflow through the aerosol generating device 12.

The controller 52 includes electronic circuitry. The aerosol generating device 12 includes a power source 54, such as a battery. The power source 54 and the electronic circuitry may be configured to operate at a high frequency in the case of an inductively heated vapour generating device 12. For example, the power source 54 and the electronic circuitry may be configured to operate at a frequency of between approximately 80 kHz and 500 kHz, possibly between approximately 150 kHz and 250 kHz, and possibly at approximately 200 kHz. The power source 54 and the electronic circuitry could be configured to operate at a higher frequency, for example in the MHz range, if required.

The aerosol generating device 12 comprises a heating assembly 56. The heating assembly 56 further comprises a heating compartment 58. The heating compartment 58 is arranged to receive an aerosol generating article 10 according to examples of the present disclosure. In some examples, the heating compartment 58 has a substantially cylindrical cross-section. The heating compartment 58 defines a cavity.

The heating compartment 58 has a first end 60 and a second end 62. The heating compartment 58 includes an opening 64 at the first end 60 for receiving an aerosol generating article 10. In the illustrated example, the heating compartment 58 includes a substantially cylindrical side wall 66, i.e., a side wall 66 which has a substantially circular cross-section. The heating compartment 58 may comprise a tubular guide (not shown) in the vicinity of the opening 64 to hold the aerosol generating article 10 in place in the heating compartment 58. The tubular guide may include circumferentially distributed ribs for engaging the aerosol generating article 10 while allowing air to pass between the heating compartment 58 and the aerosol generating article 10.

The heating assembly 56 further comprises a heater 74, i.e., a heating element, arranged to heat the aerosol generating substrate 68 comprised in the aerosol generating portion 14 of an aerosol generating article 10 according to examples of the disclosure received in the heating compartment 58.

The heating assembly 56 may be an induction heating assembly (not shown). The induction heating assembly further comprises an induction coil (not shown). The induction coil is arranged to be energised to generate an alternating electromagnetic field for inductively heating an induction heatable susceptor (not shown). Accordingly, in such examples the heater 74 is an induction heatable susceptor.

The induction heatable susceptor may be arranged around the periphery of the heating compartment 58. Alternatively, in some examples (not comprising a second one-way valve 42 as described below) the induction heatable susceptor may be arranged to project into the heating compartment 58 from the second end 62 (e.g., as a heating blade or pin) to penetrate the aerosol generating substrate 68 when the aerosol generating article 10 is inserted into the aerosol generating device 12. In other examples, the induction heatable susceptor is instead provided in the aerosol generating substrate 68 during manufacture of the aerosol generating article 10. In such examples, the aerosol generating article 10 comprises the induction heatable susceptor.

The induction coil can be energised by the power source 54 and controller 52. The induction coil may comprise a Litz wire or a Litz cable. It will, however, be understood that other materials could be used.

The induction coil may extend around the heating compartment 58. Accordingly, the induction coil may be annular. The induction coil may be substantially helical in shape. In some examples, the circular cross-section of a helical induction coil may facilitate the insertion of an aerosol generating article 10 and optionally one or more induction heatable susceptors, into the heating compartment 58 and ensure uniform heating of the aerosol generating substrate 68.

The induction heatable susceptor comprises an electrically conductive material. The induction heatable susceptor may comprise one or more, but not limited to, of graphite, molybdenum, silicon carbide, niobium, aluminium, iron, nickel, nickel containing compounds, titanium, mild steel, stainless steel, low carbon steel and alloys thereof, e.g., nickel chromium or nickel copper, and composites of metallic materials. In some examples, the induction heatable susceptor comprises a metal selected from the group consisting of mild steel, stainless steel, and low carbon stainless steel.

In use, with the application of an electromagnetic field in its vicinity, the induction heatable susceptor(s) generate heat due to eddy currents and magnetic hysteresis losses resulting in a conversion of energy from electromagnetic to heat.

The induction coil may be arranged to operate in use with a fluctuating electromagnetic field having a magnetic flux density of between approximately 20mT and approximately 2.0T at the point of highest concentration.

An alternative approach is to employ a resistive heating assembly (not shown). In such cases, the heater 74 is a resistive heater (not shown). The resistive heater may surround the aerosol generating substrate 68 and transfer heat to an outer surface of the aerosol generating substrate 68, for instance, the resistive heater may be arranged around the periphery of the heating compartment 58. Alternatively, in some examples (not comprising a second one-way valve 42 as described below) the resistive heater may be arranged to project into the heating compartment 58 from the second end 62 (e.g., as a heating blade or pin) to penetrate the aerosol generating substrate 68 when the aerosol generating article 10 is inserted into the aerosol generating device 12. In use, current from the power source 54 is supplied directly to the resistive heater to generate heat. Other alternative heating element(s) may be arranged such as infrared or microwave heaters.

Referring to Figures 1 and 6, the aerosol generating article 10 has a mouth end 20 (or first end), an air inlet end 16 (or second end), and comprises a filter 18 (i.e., a filter portion) at or close to the mouth end 20. The filter 18 acts as a mouthpiece and may comprise an air-permeable plug, for example comprising cellulose acetate fibres or paper filter. The filter 18 may comprise one or more segments including a cavity. The filter 18 may further comprise a flavouring capsule. The flavouring capsule may be contained in a filter segment or a cavity. The filter 18 may comprise at least one segment filled with cellulose acetate or paper fibre (e.g. tow) or non-woven paper.

The aerosol generating portion 14 of the aerosol generating article 10 is at or close to the air inlet end 16.

The aerosol generating substrate 68 comprised in the aerosol generating portion 14 may be any type of solid or semi-solid material. Example types of aerosol generating solids include powder,

granules, pellets, shreds, strands, particles, gel, strips, loose leaves, cut leaves, cut filler, porous material, foam material or sheets. The aerosol generating substrate 68 may comprise plant derived material and in particular, may comprise tobacco. It may advantageously comprise processed tobacco. It may comprise a blend of processed tobacco material, tobacco lamina and/or cellulose pulp. Processed tobacco material refers to a tobacco substrate obtained by forming a slurry or paste from tobacco particles, solvent (e.g., aerosol-formers and/or water) and optionally a binding agent by mixing and forming and drying into a sheet or other continuous element and possibly cutting into shreds, strands, strips and so on. The processing technology may encompass paper making process, casting, moulding or extrusion.

The aerosol generating substrate 68 may comprise an aerosol-former, i.e., an aerosol forming agent. Examples of aerosol-formers include polyhydric alcohols and mixtures thereof such as glycerine or propylene glycol. Typically, the aerosol generating substrate 68 may comprise an aerosol-former content of between approximately 5% and approximately 50% on a dry weight basis. In some examples, the aerosol generating substrate 12 may comprise an aerosol-former content of between approximately 10% and approximately 20% on a dry weight basis, and possibly approximately 15% on a dry weight basis.

The aerosol generating substrate 68 may be a tobacco substrate 40, for instance in the form of a tobacco plug. The tobacco substrate 40 may contain at least 8 wt.% on a dry weight basis of an aerosol-former. In some examples, the tobacco substrate 40 contains from 10 wt.% to 30 wt.% on a dry weight basis of an aerosol-former.

The aerosol generating article 10 may comprise, upstream of the aerosol generating substrate 68, a front cylindrical plug (not shown) made of non-tobacco material such as a filter plug made of paper or cellulose acetate.

Upon heating, the aerosol generating substrate 68 may release volatile compounds. The volatile compounds may include nicotine or flavour compounds such as tobacco flavouring or other flavouring such as menthol or a cooling agent (e.g., WS3, WS5).

Typically, the shape of the aerosol generating article 10 corresponds to the shape of the heating compartment 58. The aerosol generating article 10 may be generally cylindrical or rod-shaped. Accordingly, the aerosol generating article may be formed as a cylindrical rod. The aerosol

generating article 10 may be formed substantially in the shape of a stick, and may broadly resemble a cigarette, having a tubular region with the aerosol generating substrate 68 arranged in a suitable manner. The aerosol generating article 10 may be a disposable and replaceable article which may, for example, contain tobacco as the aerosol generating substrate. The aerosol generating article 10 may be a heated tobacco stick. The aerosol generating article 10 is a consumable. In an alternative, the aerosol generating article 10 may have a flat cuboid shape resembling the shape of a SIM card. In this case, the heating compartment 58 is adapted to the flat shape of the aerosol generating article 10 with, e.g., two parallel flat heating elements spaced apart by a distance corresponding substantially to the thickness of the aerosol generating article 10.

The aerosol generating article 10 further comprises a ventilation portion 22 positioned between the aerosol generating portion 14 and the filter 18. In the illustrated example, the ventilation portion 22 is part of a tubular member 34 forming a condensation chamber 36. The tubular member 34 may be a paper tube 38 which is overlaid with a wrapper. Accordingly, the aerosol generating substrate 68 and filter 18 are circumscribed by a wrapper, which in examples of the disclosure is a paper wrapper, and are thus embodied as an aerosol generating article 10. The wrapper may be permeable. The wrapper may be an outer wrapper. The filter 18, the tubular member 34 and the aerosol generating substrate 68 can be assembled by a secondary paper wrapper (also known as tipping paper). The filter 18 is also usually wrapped by its own wrapper, i.e., a plug wrap. One or more vapour collection regions, cooling regions, and other structure may also be included in some designs.

To use the aerosol generating device 12, a user inserts an aerosol generating article 10 through the opening 64 into the heating compartment 58, so that the air inlet end 16 of the aerosol generating article 10 is positioned at the second end 62 of the heating compartment 58 and so that the filter 18 at or close to the mouth end 20 of the aerosol generating article 10 projects from the first end 60 of the heating compartment 58 to permit engagement by a user's lips. In use of the aerosol generating system 200, heat from the heater 74 (i.e., induction heatable susceptor or resistive heater) is transferred to the aerosol generating substrate 68 comprised in the aerosol generating portion 14 of an aerosol generating article 10 positioned in the heating compartment 58, for example by conduction, radiation and convection, to heat the aerosol generating substrate 68 (without burning the aerosol generating substrate 68) and thereby generate a vapour which cools and condenses to form an aerosol for inhalation by a user of the

aerosol generating device 12 through the filter 18. The vaporisation of the aerosol generating substrate 68 is facilitated by the addition of air from the surrounding environment.

In general terms, a vapour is a substance in the gas phase at a temperature lower than its critical temperature, which means that the vapour can be condensed to a liquid by increasing its pressure without reducing the temperature, whereas an aerosol is a suspension of fine solid particles or liquid droplets, in air or another gas. It should, however, be noted that the terms 'aerosol' and 'vapour' may be used interchangeably in this specification, particularly with regard to the form of the inhalable medium that is generated for inhalation by a user.

With reference to Figures 1, 2 and 3, in examples of the disclosure the ventilation portion 22 comprises a plurality of ventilation holes 24 for allowing ambient ventilation air, i.e., cold air, to enter the ventilation portion 22. Ambient ventilation air enters the ventilation portion 22 through the ventilation holes 24 upon suction caused by a user inhaling. Ambient ventilation air entering the ventilation portion 22 mixes with aerosol generated in the aerosol generating portion 14 from heating the aerosol generating substrate 68. Accordingly, after the outside cooler air enters the ventilation portion 22, it merges with the aerosol, i.e., flue gas, to achieve a cooling effect. The ventilation holes 24 therefore allow the ingress of ambient or warm ventilation air to mix with and cool the aerosol generated prior to inhalation by a user.

The ventilation portion 22 comprises an outer wall 76. In the illustrated example, the outer wall 76 is a circumferential wall 76. The plurality of ventilation holes 24 extend through the circumferential wall 76 in a substantially radial direction (with respect to a longitudinal direction or longitudinal axis of the aerosol generating article 10) into the interior of the ventilation portion 22. The plurality of ventilation holes 24, in use, allow ambient ventilation air to enter the ventilation portion 22 without passing through the aerosol generating portion 14. The ventilation holes 24 define an ambient air flow path into the ventilation portion 22. The ventilation holes 24 traverse the tubular member 34 and the wrapper covering the tubular member 34. The ventilation holes 24 may be produced by laser perforation to ensure a precise and constant dimension in the different perforated layers.

The ventilation holes 24 may be of equal size, or may be substantially of equal size. The ventilation holes 24 may be evenly distributed around the circumference the ventilation portion 22.

Figure 2 is a diagrammatic cutaway view showing a part of the inside of the ventilation portion 22. Figure 3 is a diagrammatic side view of the part of the inside of the ventilation portion 22 shown in Figure 2. Referring to Figures 2 and 3, the ventilation portion 22 further comprises a one-way valve 26 associated with the ventilation holes 24. The one-way valve 26 is operatively associated with the ventilation holes 24.

As a puff is being drawn there is a slight under-pressure in the ventilation portion 22. The one-way valve 26 is configured to open the ventilation holes 24 when a puff is being drawn from the mouth end 20 to allow ambient ventilation air to enter the ventilation portion 22. After inhalation by a user (i.e., after a puff has been drawn) vape (i.e., aerosol) builds up in the ventilation portion 22 creating a slight over-pressure (i.e., a positive pressure inside the ventilation portion 22). The one-way valve 26 is configured to close the ventilation holes 24 caused by the positive pressure of aerosol inside the ventilation portion 22 when no puff is being drawn from the mouth end 20 (i.e., during the time period between user inhalations). Accordingly, when no puff is being drawn from the mouth end 20, a pressure differential in the ventilation portion 22 is greater than that exerted by ambient air. Closing the ventilation holes 24 prevents aerosol leaking from the ventilation portion 22 through the ventilation holes 24. In a closed condition of the one-way valve 26, aerosol is therefore prevented from exiting the ventilation portion 22 through the ventilation holes 24. Accordingly, in the closed condition the one-way valve 26 effectively blocks leakage of the aerosol. The one-way valve 26 therefore prevents aerosol from leaving the ventilation portion 22 without passing through the filter 18.

By preventing aerosol leaking from the ventilation portion 22 through the ventilation holes 24, an undesirable surface residue caused by leaked aerosol settling on a surface of the device 10 proximal to the ventilation holes 24 is not formed. Accordingly, a user is better able to maintain a clean and hygienic aerosol generating device 12.

In the open condition of the one-way valve 26, the ventilation holes 24 are preferably unhindered in that air can pass through the full cross-section of the ventilation holes 24, as if the one-way valve 26 would not exist. Accordingly, the diameter of the ventilation holes 24 and the number of ventilation holes 24 determine the flow characteristics of the ventilation portion 22 in the puffing conditions. The air ventilation (Vf) through the ventilation holes 24 is preferably at least 50% in the open condition of the one-way valve 26 (under standard

conditions). The air ventilation (Vf) through the ventilation holes 24 is preferably from 55 to 70% in the open condition of the one-way valve 26 (under standard conditions). The air ventilation (Vf) is the ratio, expressed as a percentage, of the ventilation air flow through the ventilation holes 24 to the total airflow. The principle to determine air ventilation is that air is drawn by vacuum, at a normalized constant flow (17.5 ml/s), in the standard smoking direction through the aerosol generating article (e.g., through the stick) (ISO9512:2019 "Cigarettes – Determination of ventilation – Definitions and measurement principles).

In examples of the disclosure, the ventilation holes 24 are automatically closed by the one-way valve 26, and without interaction with blocking or moving part(s), when no puff is being drawn from the mouth end 20.

The number of ventilation holes 24 may be from 8 to 20. In some examples, the number of ventilation holes 24 is from 10 to 18. In at least one dimension, the size of the ventilation holes 24 is from 80 μm to 500 μm, and preferably between 100 μm and 400 μm. The ventilation holes 24 may have a circular perimeter or an elongated perimeter such as forming an oblong or rectangular shape. The longer dimension of the elongated perimeter may be oriented in the longitudinal direction or in the circumferential direction.

In the illustrated example, the one-way valve 26 comprises ventilation flaps 28 associated with the ventilation holes 24. In the illustrated example, the ventilation flaps 28 are substantially shaped as triangles in outline. Alternatively, the ventilation flaps may have a different shape in outline, for example, any polygonal shape such as square, pentagonal, rectangular, or substantially circular or substantially oval. The ventilation flaps 28 may be part of a tubular strip 88 which is glued to the inside surface of the tubular member 34. The tubular strip 88 has a fixing portion 90 and flap portion 92 formed of successive flaps 28, e.g., of triangular shape. The fixing portion 90 is glued to the tubular member 34. The flap portion 92, which is overlapping with the row of ventilation holes 24, is left free to move between the open and closed position. Alternatively, the ventilation flaps 28 can be individually formed and affixed to the tubular member 34.

In some examples, an inner most layer of the condensation chamber 36 may have notched endings (providing the ventilation flaps 28). The ventilation holes 24 may be subsequently formed by selective laser piercing of the outside cardboard tube, for instance at a selected laser

wavelength. The depth of laser piercing can be controlled such that the ventilation flaps 28 provided by the notched endings are not pierced by the laser. This can be achieved by precise control of the focus point of the laser, or by making the notched endings of a material not able to be affected by the selected laser wavelength.

The ventilation flaps 28 are configured to be moveable to open the ventilation holes 24 caused by ambient ventilation air displacing the ventilation flaps 28 to uncover the ventilation holes 24 when a puff is being drawn from the mouth end 20. This is facilitated by the slight under-pressure in the ventilation portion 22 as a puff is drawn. Ambient ventilation air is then admitted into the ventilation portion 22 through the ventilation holes 24 into the flow path of the aerosol. Accordingly, the opened ventilation flaps 28 at least partially uncover the ventilation holes 24 through which ambient air can ingress into the ventilation portion 22.

The ventilation flaps 28 are configured to be moveable to close the ventilation holes 24 caused by the positive pressure of aerosol (i.e., slight over-pressure) inside the ventilation portion 22 displacing the ventilation flaps 28 to cover the ventilation holes 24 when no puff is being drawn from the mouth end 20. Accordingly, in use pressure within the ventilation portion 22 will close the ventilation flaps 28 thereby closing, i.e., occluding or shutting off, the ventilation holes 24. In this closed condition, aerosol is prevented from leaking from, i.e., exiting, the ventilation portion 22 through the ventilation holes 24.

Accordingly, the ventilation flaps 28 are configured to be moveable to open and close the ventilation holes 24 by respectively uncovering and covering the ventilation holes 24. The ventilation flaps 28 may be substantially larger in all directions than the ventilation holes 24, and are thus dimensioned to fully close the ventilation holes 24.

In the example illustrated in Figures 1, 2 and 3, the ventilation flaps 28 are arranged on an inside surface 30 of the ventilation portion 22, i.e., an inside surface 30 of the circumferential wall 76. In the illustrated example, the ventilation flaps 28 are distributed circumferentially around the inner circumference of the ventilation portion 22. The neighbouring ventilation flaps may be spaced a certain distance or be contiguous. The ventilation flaps 28 are configured to open inwardly into the aerosol generating portion 14. The tubular strip 88 may comprise a notched strip 32, which may be a notched paper strip. Accordingly, the ventilation flaps 28

may be provided by a notched strip 32, e.g., notched paper. The ventilation flaps 28 may be flap members 28.

The ventilation flaps 28 are resilient flaps. The ventilation flaps 28 act as flap valves. The ventilation flaps 28 are pivotable or bendable about a hinge line 100. The ventilation flaps 28 are configured to be hinged open by ambient air flow through the ventilation holes 24 alone.

The ventilation flaps 28 and/or notched strip 32 may comprise relatively rigid paper to provide the ventilation flaps 28 enough resilience to open and close repeatedly. For instance, the ventilation flaps 28 may comprise a paper layer having a thickness of between 50 μm and 700 μm, preferably between 80 μm and 500 μm, and/or a basis weight of between 35 and 250 gsm, preferably between 45 and 150 gsm. The material can be selected to affect as little as possible the resistance to draw while providing efficient sealing and resilience to repeated flex. The ventilation flaps 28 may comprise paper and an additional metal layer to further improve resiliency and/or sealing, for example aluminium. For example, the additional layer, e.g., aluminium, has a thickness of between 5 and 50 μm, preferably between 7 μm and 25 μm. The hinge line 100 may be formed to be more resilient and/or more rigid than the rest of the ventilation flap 28 so that the movement of the ventilation flap 28 is repeatable with lower variability. In an alternative, the ventilation flaps 28 are entirely formed of a resilient metal (e.g., aluminium) foil. For example, the hinge line 100 is formed of an additional strip of paper and/or an additional band of metal such as aluminium.

The material of the ventilation flaps 28 may also be coated or treated to resist moisture so that its rigidity and flexibility are not affected during vaping. In particular, the material, if paper, can be coated with metal, moisture resistant coating such as wax, Arabic gum, PVA, PVOH, ethyl cellulose.

Referring to Figures 1, 4 and 5, in the illustrated example, the air inlet end 16 comprises a second one-way valve 42. In other examples, a second one-way valve 42 is not provided at the air inlet end 16. In other examples, only the air inlet 16 is provided with a one-way valve 42. Figure 4 is a diagrammatic perspective detailed view of the second one-way valve 42. Figure 5 is a diagrammatic side view of the second one-way valve 42 shown in Figure 5.

The second one-way valve 42 is configured to allow ambient ventilation air to enter the aerosol generating portion 14 when a puff is being drawn from the mouth end 20. The second one-way valve 42 is also configured to prevent aerosol leaking from the aerosol generating portion 14 through the air inlet end 16 when no puff is being drawn from the mouth end 20.

By preventing aerosol leaking from, i.e., exiting from, the air inlet end 16, an undesirable surface residue caused by leaked aerosol settling on a surface of the device 10 proximal to the air inlet end 16 is not formed. As this surface of the device is generally of difficult access such as in a bottom of the heating or receiving compartment 58, and furthermore generally hot, dry residue can settle and be then difficult to remove. Accordingly, a user is better able to maintain a clean and 17 hygienic aerosol generating device 12. In known arrangements, to minimise leakage of aerosol through an air inlet end, a lowermost portion of an aerosol generating substrate comprised in an aerosol generating portion is not heated, which reduces the number of available puffs and compromises the user experience. In examples of the disclosure, because the second one-way valve 42 prevents leakage of aerosol through the air inlet end 16, a larger portion of the aerosol generating substrate 68 comprised in the aerosol generating portion 14 can be heated for an improved user experience and a greater number of puffs.

In the illustrated example, the second one-way valve 42 comprises a deflector 44. The deflector 44 is configured to be moveable to open the second one-way valve 42 caused by ambient ventilation air displacing the deflector 44 to allow ambient ventilation air to enter the aerosol generating portion 14 through the air inlet end 16 when a puff is being drawn from the mouth end 20. The deflector 44 is also configured to be moveable to close the second one-way valve 42 to prevent aerosol leaking from the aerosol generating portion 14 through the air inlet end 16 when no puff is being drawn from the mouth end 20. The deflector 44 therefore prevents aerosol from leaking from the aerosol generating portion 14 through the air inlet end 16. Accordingly, in a closed condition the deflector 44 effectively blocks leakage of the aerosol through the air inlet end 16. The deflector 44 may be a deflectable membrane, which may be a deflectable paper membrane. The second one-way valve 42 may comprise a tubular element 78 comprising apertures 80 covered by the deflector 44. The tubular element 78 may comprise radial struts 82 to define an apertured front wall 84 with a central portion 86 to which the deflector 44 can be fixed. The deflector 44 can be unattached to the tubular element 78 outside the central portion 86. Additionally or alternatively, the deflector 44 can be attached to other points of the front wall 84 such as at a point or two or more points of the tubular element 78

other than the central portion 86 such as at one or more of the radial struts 82. The tubular element 78 can be made of cardboard or moulded cellulose pulp. The tubular element 78 can be at least partially filled with aerosol generating substrate 68. The tubular element 78 can be attached to the rest of the aerosol generating article 10 by a wrapper such as the wrapper wrapping the aerosol generating substrate 68.

The second one-way valve 42 may comprise a flap valve or a slit valve. The second one-way valve 42 may also be configured to prevent aerosol generating substrate 68 (or other internal components) from falling out of the air inlet end 16 and/or be configured to absorb leakage of materials.

In illustrated example, the aerosol generating article 10 includes a vapour outlet channel 70 adjacent the filter 18. The vapour outlet channel 70 comprises a hollow tube 72, for instance, an acetate tube.

Figure 7 is a diagrammatic view of the ventilation portion 22 of a second aerosol generating article 94 according to examples of the disclosure. The aerosol generating article 94 is similar to the aerosol generating article 10 described above and corresponding components are identified using the same reference numerals.

In the example illustrated in Figure 7, the ventilation portion 22 has a circumferential wall 76 through which the ventilation holes 24 extend into the interior of the ventilation portion 22. The ventilation flaps 28 associated with the ventilation holes 24 are integrated in the circumferential wall 76. Accordingly, the ventilation portion 22 comprises integral ventilation flaps 28. In particular, the ventilation portion 22 comprises a plurality of integral ventilation flaps 28 spaced circumferentially around the circumference of the ventilation portion 22.

The ventilation flaps 28 are formed by cuts 98 through the circumferential wall 76, and in particular cuts 98 through the tubular member 34 and the wrapper. The ventilation flaps 28 are therefore integrated in the wall thickness of the circumferential wall 76. In the illustrated example, each of the ventilation flaps 28 is formed by a single cut 98, i.e., a single cutting action. Accordingly, each of the ventilation holes 24 is also formed by a single cut 98. The cuts 98 may be made by laser perforation, i.e., selective laser cutting.

The cuts 98 define sides 102 (i.e., contours) of the ventilation flaps 28, apart from the hinge line 100. The cuts 98 also define sides 103 (i.e., contours) of the ventilation holes 24. The ventilation flaps 28 are attached to the ventilation portion 22 along the hinge line 100. The ventilation flaps 28 are pivotable or bendable about the hinge line 100. The hinge line 100 extends circumferentially at a rearward end 104 of the ventilation flaps 28. The cuts 98 define a distal edge 106 extending opposite to the hinge line 100. The distal edge 106 is longer than the hinge line 100. The relatively short hinge line 100 provides a relatively large surface area for the ventilation flaps 28 whilst allowing the ventilation flaps 28 to easily open.

In the illustrated example, the cuts 98 are slanted, i.e., angled, through the thickness of the circumferential wall 76. Accordingly, the cuts 98 extend obliquely through the thickness of the circumferential wall 76. This causes the sides 102 of the ventilation flaps 28 to have bevelled edges 108. Accordingly, the distal edge 106 is bevelled. This also causes the sides 103 of the ventilation holes 24 to have correspondingly bevelled edges 110. Accordingly, the sides 102 of the ventilation flaps 28 and the sides 103 of the ventilation holes 24 comprise bevelled edges 108, 110.

In use, the corresponding bevelled edges 108, 110 cooperate to close the ventilation holes 24. In a closed condition of the ventilation holes 24, the bevelled edges 108 of the ventilation flaps 28 abut against the bevelled edges 110 of the ventilation holes 24 to prevent the ventilation flaps 28 from opening outwardly from the ventilation portion 22. Accordingly, the ventilation flaps 28 can only open inwardly into the ventilation portion 22 and thus function as one-way valves. In such examples, the cuts 98 are angled to extend outwardly through the thickness of the circumferential wall 76. Accordingly, the distance between the sides 103 of the ventilation holes 24 is greater on the inside surface 30 of the circumferential wall 76 than on an outside surface of the circumferential wall 76.

In the example illustrated in Figure 7, a ventilation flap 28 has been displaced to an extent into the ventilation portion 28 partially uncovering a ventilation hole 24. In this condition, the bevelled edge 108 of the ventilation flap 28 is shown with a discontinuous line and the bevelled edge 110 of the ventilation hole 24 is shown with a continuous line. The ventilation flap 28 has pivoted about the hinge line 100 and/or bent along its length from the hinge line 100 to create an opening. For illustrative purposes, only three ventilation flaps 28 are shown in Figure 7, and only one of these is shown to be displaced to uncover a ventilation hole 24. In practice, a user

drawing a puff from the mouth end 20 is likely to simultaneously displace all of the ventilation flaps 28 to uncover the associated ventilation holes 24.

Examples of the disclosure also provide a method of manufacturing an aerosol generating article 10, 94 according to examples of the disclosure. The first one-way valve 26 and/or the second one-way valve 42 may be provided in the aerosol generating article 10 during manufacture of the aerosol generating article 10, 94. Accordingly, the first one-way valve 26 and/or the second one-way valve 42 may be integrated in the aerosol generating article 10, 94 during the manufacturing process.

In the illustrated example, the aerosol generating article 10, 94 is generally cylindrical and thus has a generally cylindrical cross-sectional shape. In other examples, the aerosol generating article 10, 94 may have a different cross-sectional shape, for instance, a rectangular or an oval cross-sectional shape.

The Figures also illustrate a method of manufacturing an aerosol generating device 12 according to examples of the disclosure. The Figures also illustrate a method of providing an aerosol generating system 200 according to examples of the disclosure.

Although exemplary embodiments have been described in the preceding paragraphs, it should be understood that various modifications may be made to those embodiments without departing from the scope of the appended claims. Thus, the breadth and scope of the claims should not be limited to the above-described exemplary embodiments.

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

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

Claims

1. An aerosol generating article (10, 94) adapted for being heated but not burnt in an aerosol generating device (12), the aerosol generating article (10, 94) comprising:

an aerosol generating portion (14) at or close to an air inlet end (16), the aerosol generating portion (14) comprising an aerosol generating substrate (68) for generating aerosol in use;

a filter (18) at or close to a mouth end (20); and

a ventilation portion (22) positioned between the aerosol generating portion (14) and the filter (18), wherein the ventilation portion (22) comprises a plurality of ventilation holes (24) for allowing ambient ventilation air to enter the ventilation portion (22) and a one-way valve (26) associated with the ventilation holes (24), wherein the one-way valve (26) comprises a plurality of ventilation flaps (28) each of which is associated with one of the ventilation holes (24), wherein the ventilation flaps (28) are configured:

to be moveable to open the ventilation holes (24) caused by ambient ventilation air displacing the ventilation flaps (28) to at least partially uncover the ventilation holes (24) when a puff is being drawn from the mouth end (20) to allow ambient ventilation air to enter the ventilation portion (22); and

to be moveable to close the ventilation holes (24) caused by a positive pressure of aerosol inside the ventilation portion (22) displacing the ventilation flaps (28) to cover the ventilation holes (24) when no puff is being drawn from the mouth end (20) to prevent aerosol leaking from the ventilation portion (22) through the ventilation holes (24);

wherein the ventilation portion (22) has an outer wall (76) through which the ventilation holes (24) extend into the interior of the ventilation portion (22) and the ventilation flaps (28) associated with the ventilation holes (24) are integrated in the outer wall (76).

2. An aerosol generating article according to claim 1, wherein the ventilation flaps (28) are arranged on an inside surface (30) of the ventilation portion (22).

3. An aerosol generating article according to claim 1 or claim 2, wherein the ventilation flaps (28) are provided by a notched strip (32).

4. An aerosol generating article according to any of the preceding claims, wherein sides (102) of the ventilation flaps (28) and sides (103) of the ventilation holes (24) comprise bevelled edges (108, 110).

5. An aerosol generating article according to claim 4, wherein in a closed condition of the ventilation holes (24), the bevelled edges (108) of the ventilation flaps (28) abut against the bevelled edges (110) of the ventilation holes (110) to prevent the ventilation flaps (28) from opening outwardly from the ventilation portion (22).

6. An aerosol generating article according to any of the preceding claims, wherein the ventilation portion (22) is part of a tubular member (34) forming a condensation chamber (36).

7. An aerosol generating article according to claim 6, wherein the tubular member (34) is a paper tube (38) which is overlaid with a wrapper.

8. An aerosol generating article according to any of the preceding claims, wherein in at least one dimension the size of the ventilation holes (24) is from 80 μm to 500 μm.

9. An aerosol generating article according to any of the preceding claims, wherein the aerosol generating substrate (68) comprises a tobacco substrate (40).

10. An aerosol generating article according to claim 9, wherein the tobacco substrate (40) contains at least 8 wt.% on a dry weight basis of an aerosol-former.

11. An aerosol generating article according to any of the preceding claims, wherein the air inlet end (16) comprises a second one-way valve (42), the second one-way valve (42) being configured:

to allow ambient ventilation air to enter the aerosol generating portion (14) when a puff is being drawn from the mouth end (20); and

to prevent aerosol leaking from the aerosol generating portion (14) through the air inlet end (16) when no puff is being drawn from the mouth end (20).

12. An aerosol generating article according to claim 11, wherein the second one-way valve (42) comprises a deflector (44).

13. An aerosol generating article according to claim 12, wherein the deflector (44) is configured:

to be moveable to open the second one-way valve (42) caused by ambient ventilation air displacing the deflector (44) to allow ambient ventilation air to enter the aerosol generating portion (14) through the air inlet end when a puff is being drawn from the mouth end (20); and

to be moveable to close the second one-way valve (42) to prevent aerosol leaking from the aerosol generating portion (14) through the air inlet end (16) when no puff is being drawn from the mouth end (20).

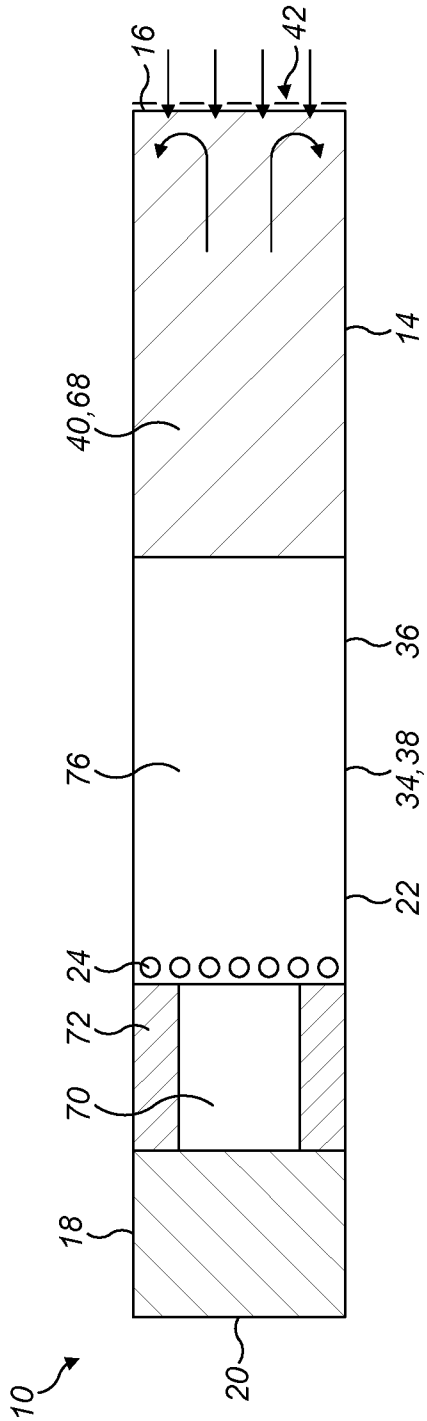


FIG. 1

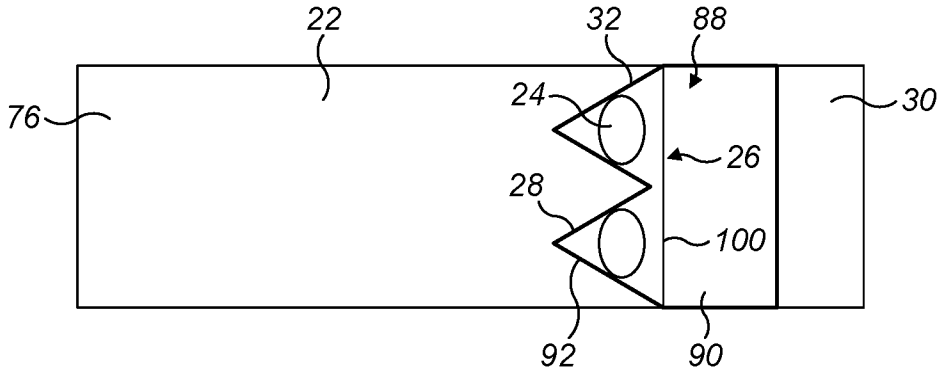


FIG. 2

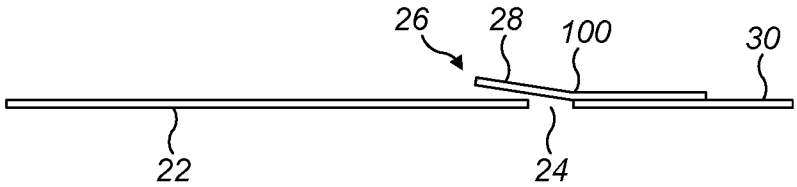


FIG. 3

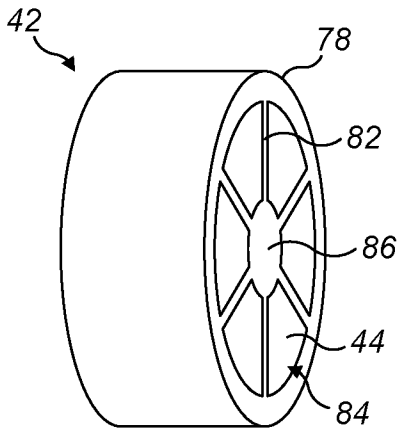


FIG. 4

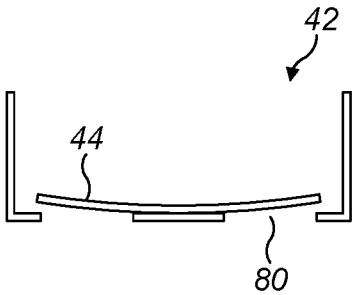
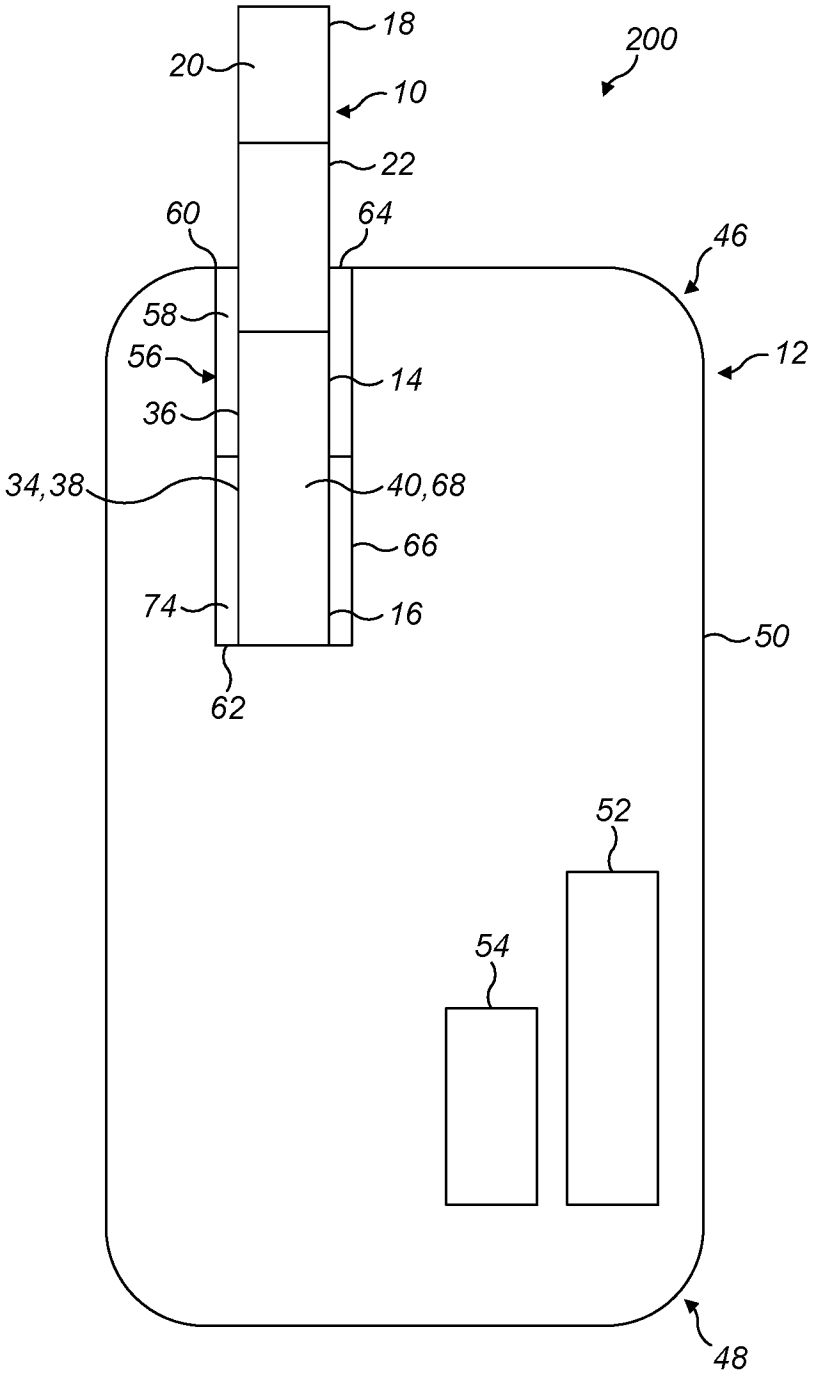


FIG. 5


18
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40,68
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48

FIG. 6

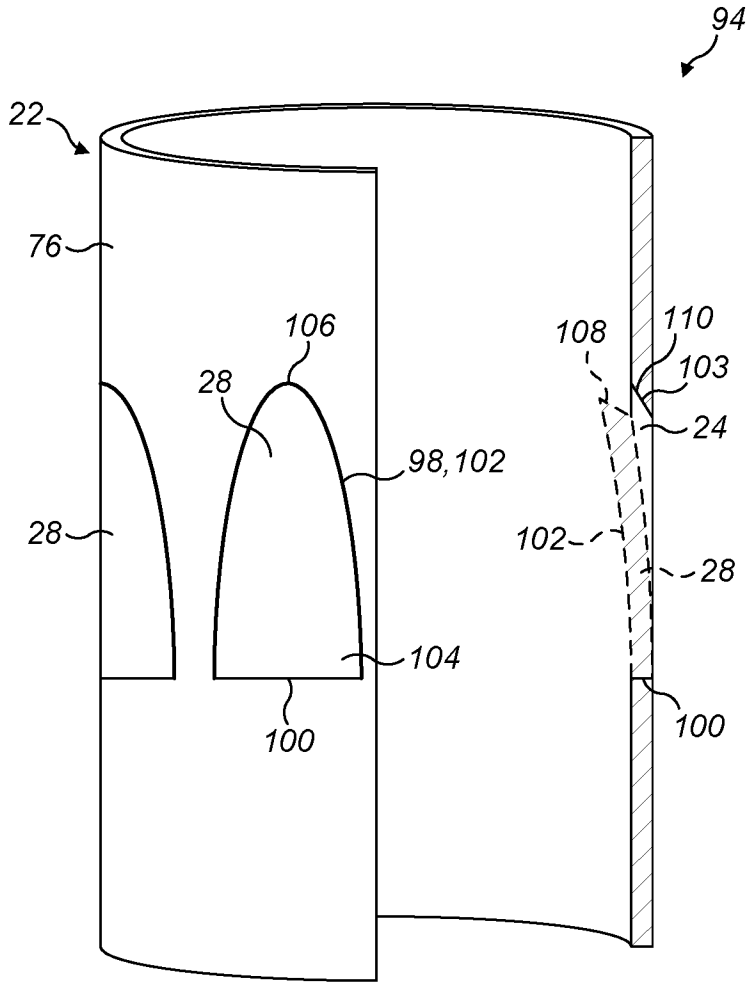

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2023/064530

A. CLASSIFICATION OF SUBJECT MATTER
INV. A24D1/02
ADD. A24D1/20

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A24D

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 638 820 A (ROBERTS DONALD L [US] ET AL) 27 January 1987 (1987-01-27) claim 1; figures 1-3	1-13
A	US 2011/180081 A1 (FIEBELKORN RICHARD [GB]) 28 July 2011 (2011-07-28) paragraphs [0017], [0019], [0023], [0033], [0042], [0048], [0053]; figures 1-4	1-13

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 July 2023	11/08/2023

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Schwarzer, Bernd

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2023/064530

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