US 20230012953A1

(19) United States
(12) Patent Application Publication
MOHSENI et al.
(10) Pub. No.: US 2023/0012953 A1
(43) Pub. Date: Jan. 19, 2023

(54) **AEROSOL GENERATING ARTICLE WITH DIRECTING ELEMENT**

(71) Applicant: **Philip Morris Products S.A.**, Neuchatel (CH)

(72) Inventors: **Farhang MOHSENI**, Neuchatel (CH); **Leonardo NAPPI**, Neuchatel (CH)

(73) Assignee: **Philip Morris Products S.A.**, Neuchatel (CH)

(21) Appl. No.: **17/785,086**

(22) PCT Filed: **Dec. 2, 2020**

(86) PCT No.: **PCT/EP2020/084332**

§ 371 (c)(1),
(2) Date: **Jun. 14, 2022**

(30) **Foreign Application Priority Data**

Dec. 17, 2019 (EP) 19217176.7

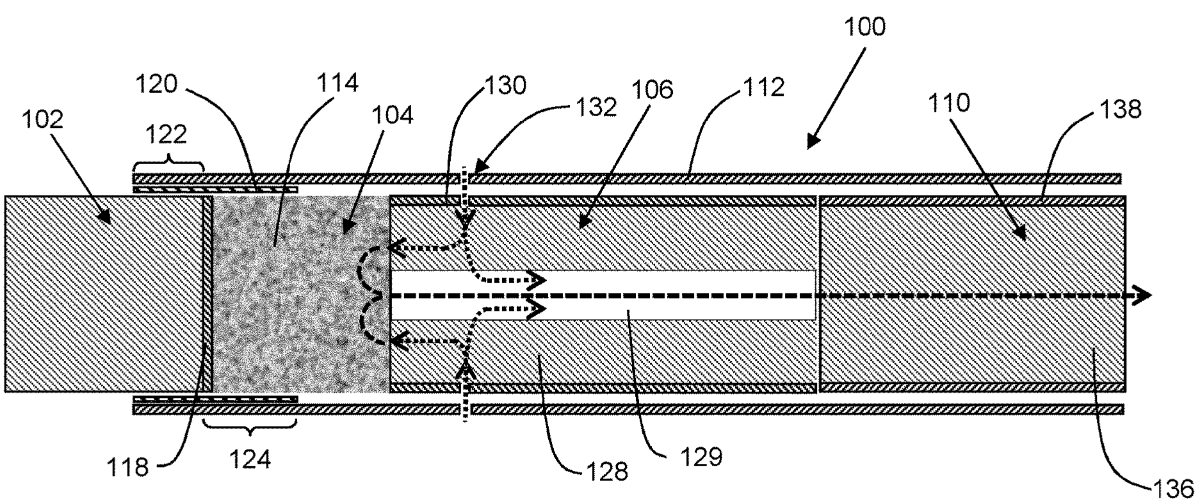
Publication Classification

(51) **Int. Cl.**
A24D 1/22 (2006.01)
A24D 1/02 (2006.01)

(52) **U.S. Cl.**
CPC *A24D 1/22* (2020.01); *A24D 1/027* (2013.01)

(57) **ABSTRACT**

An aerosol-generating article is provided, including: a heat source; an aerosol-forming substrate downstream of the heat source; an airflow-directing element downstream of the substrate, the airflow-directing element including an air-permeable segment defining a cavity; at least one air inlet to allow air to be drawn into the article; and first and second airflow pathways, in which the first airflow pathway extends from the air inlet, through the substrate, and into a distal end of the cavity, in which the second airflow pathway extends from the air inlet, through the air-permeable segment, and into the cavity at a point downstream of the distal end of the cavity, in which the air inlet is located downstream of the distal end of the airflow-directing element, and in which a longitudinal cross-sectional area of the cavity is at least 30 percent of a total longitudinal cross-sectional area of the article.



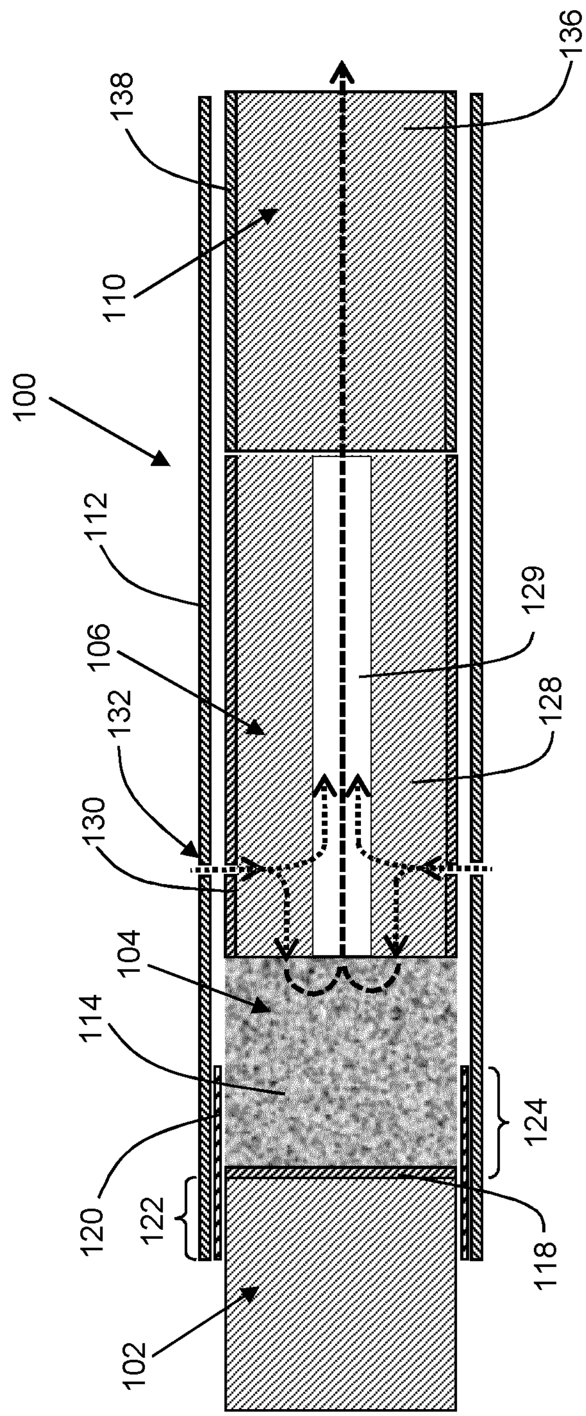
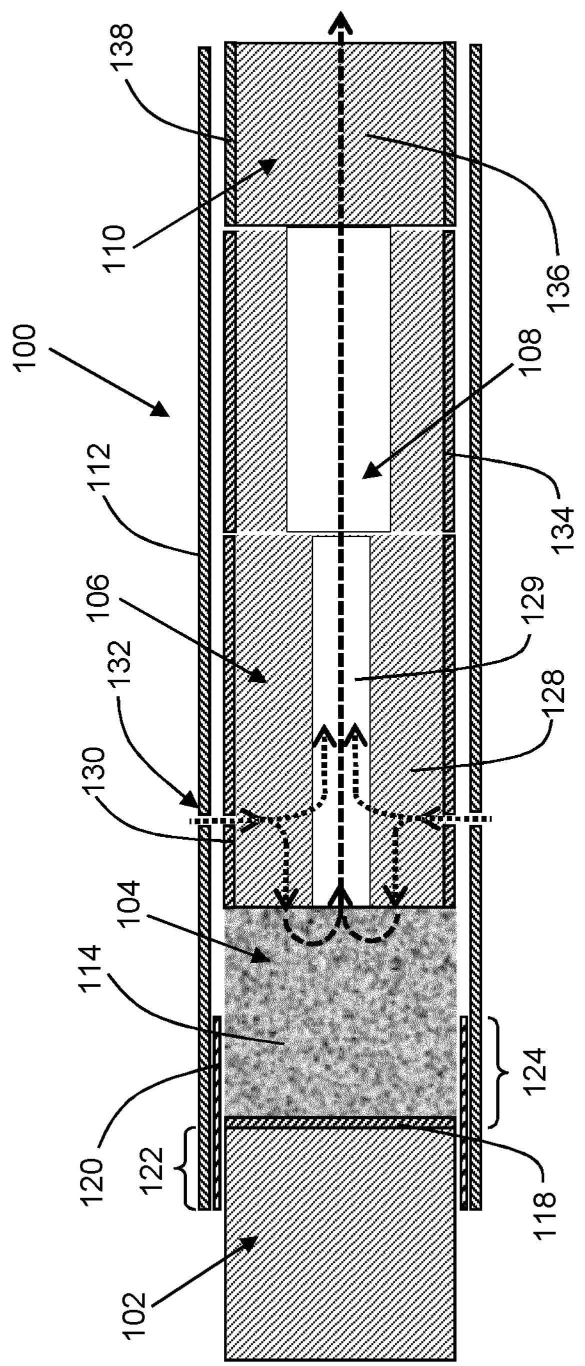

136
138
110
100
112
129
106
128
132
130
104
114
124
120
122
118
102

Figure 1



138
110
136
100
108
112
134
106
129
132
128
130
104
114
124
120
122
118
102

Figure 2

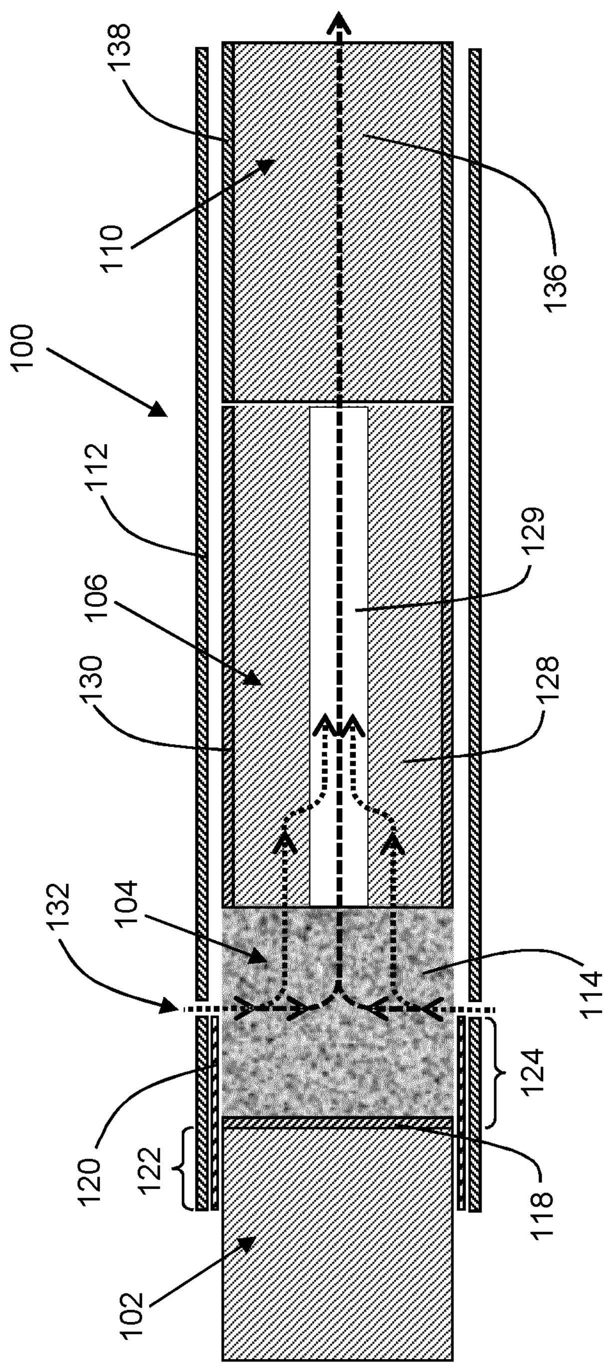

138
110
136
100
112
129
106
128
130
132
104
114
124
120
122
118
102

Figure 3

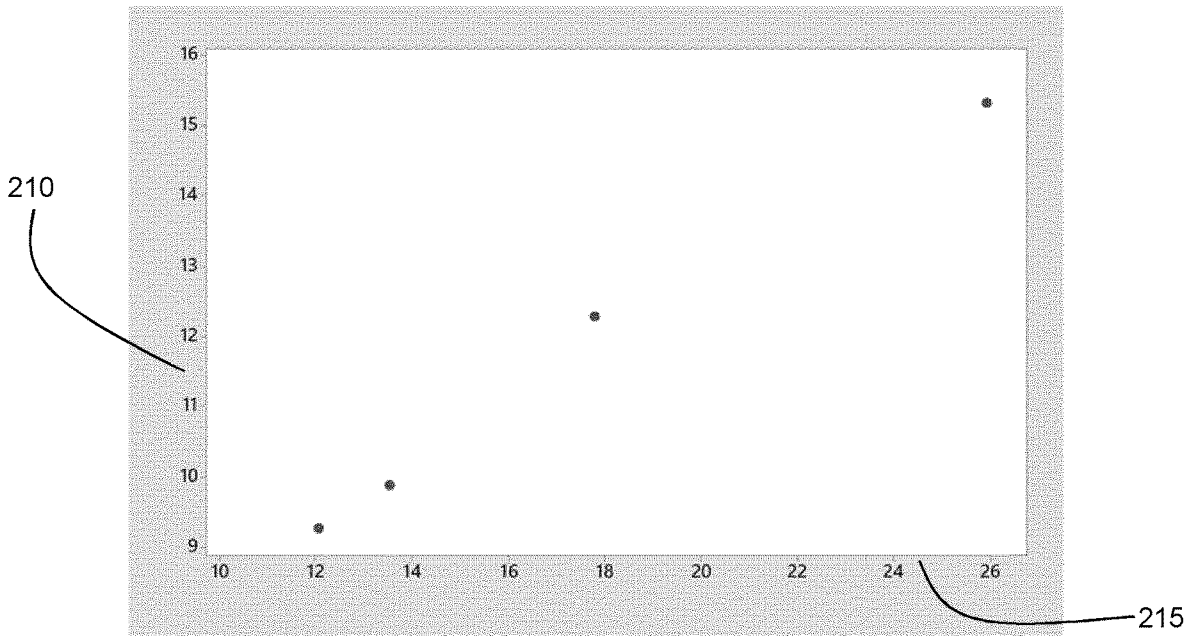


Figure 4

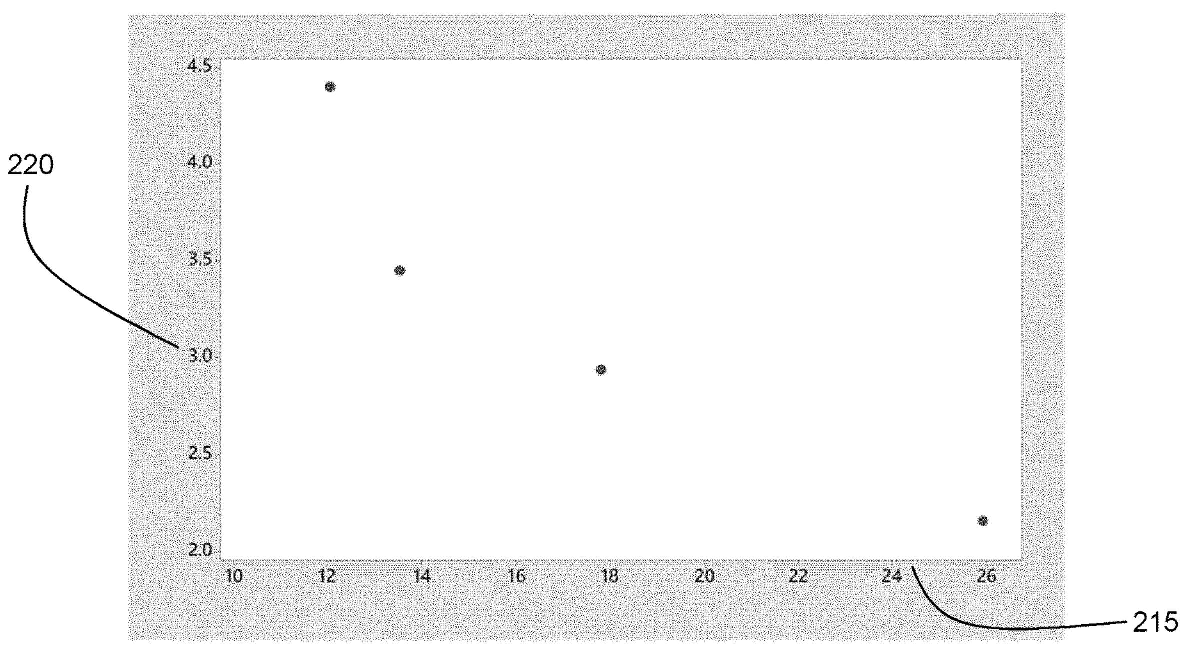


Figure 5

AEROSOL GENERATING ARTICLE WITH DIRECTING ELEMENT

[0001] The present invention relates to an aerosol generating article comprising an airflow directing element. In particular, the present invention relates to an aerosol generating article comprising an airflow directing element and including two airflow pathways.

[0002] A number of smoking articles in which tobacco is heated rather than combusted have been proposed in the art. In one known type of heated smoking article, an aerosol is generated by the transfer of heat from a combustible heat source to an aerosol-forming substrate located downstream of the combustible heat source. During smoking, volatile compounds are released from the aerosol-forming substrate by heat transfer from the combustible heat source and entrained in air drawn through the smoking article. As the released compounds cool, they condense to form an aerosol.

[0003] Air may be drawn into such known heated smoking articles through one or more airflow channels provided through the combustible heat source and heat transfer from the combustible heat source to the aerosol-forming substrate occurs by convection and conduction.

[0004] Alternatively, air may be drawn into known heated smoking articles through at least one air inlet arranged along the length of the smoking article. Air may pass through the at least one air inlet directly to the aerosol-forming substrate. In this example, the heat transfer from the heat source to the aerosol-forming substrate may occur primarily by conduction. Other known smoking articles comprise components downstream of the aerosol-forming substrate. For example, some known smoking articles, such as aerosol generating articles, may comprise an airflow directing element downstream of the aerosol-forming substrate. In addition, such aerosol generating articles may include at least one air inlet arranged to allow air to pass directly to the airflow directing element. The airflow directing element may be configured to allow air to pass from the at least one air inlet through a first portion of the airflow directing element, to the aerosol-forming substrate, and then through a second portion of the airflow directing element. As a result, such airflow directing elements may comprise an air impermeable barrier to prevent air passing directly from the first portion to the second portion without first passing through the aerosol-forming substrate. However, providing airflow directing elements which direct airflow in the way described above may be technically challenging or difficult to engineer.

[0005] It may be desirable to provide an aerosol generating article which is more straightforward to manufacture but which still provides acceptable delivery of volatile constituents from the aerosol-forming substrate.

[0006] According to a first aspect of the invention, there is provided an aerosol generating article comprising a heat source, and an aerosol-forming substrate downstream of the heat source.

[0007] The aerosol generating article may further comprise an airflow directing element. The airflow directing element may be provided downstream of the aerosol-forming substrate. The airflow directing element may comprise an air-permeable segment defining a cavity. The aerosol generating article may further comprise at least one air inlet for allowing air to be drawn into the aerosol generating article. The provision of the at least one air inlet may prevent the need for air to pass along airflow channels provided through the combustible heat source. This may advantageously substantially prevent or inhibit activation of combustion of the combustible heat source during puffing by a user. This may substantially prevent or inhibit spikes in the temperature of the aerosol-forming substrate during puffing by a user.

[0008] The aerosol generating article may include a first airflow pathway, the first airflow pathway may extend from the at least one air inlet, through the aerosol-forming substrate and into the distal end of the cavity. This may advantageously allow air passing through the first airflow pathway to become entrained with aerosol from the aerosol-forming substrate before leaving the aerosol generating article.

[0009] The aerosol generating article may include a second airflow pathway, the second airflow pathway may extend from the at least one air inlet, through the air-permeable segment and into to the cavity at a point downstream of the distal end of the cavity. The provision of a second airflow pathway may mean that a proportion of the air entering the aerosol generating article through the at least one air inlet may pass along the first airflow pathway, and a proportion of the air entering the aerosol generating article through the at least one air inlet may pass along the second airflow pathway.

[0010] The provision of a first and second airflow pathway prevents the need to include an air impermeable barrier in the airflow directing element. This may advantageously simplify manufacture of the airflow directing element. Furthermore, the inventors of the present invention have identified that, by controlling the proportion of air passing through each of the first and second airflow pathways, the characteristics of the aerosol delivered to a user may be controlled.

[0011] According to a first aspect of the invention, preferably there is provided an aerosol generating article comprising a heat source, an aerosol-forming substrate downstream of the heat source, and an airflow directing element downstream of the aerosol-forming substrate. The airflow directing element comprises an air-permeable segment, the air-permeable segment defines a cavity. The aerosol generating article further comprises at least one air inlet for allowing air to be drawn into the aerosol generating article. The aerosol generating article includes a first airflow pathway and a second airflow pathway. The first airflow pathway extends from the at least one air inlet, through the aerosol-forming substrate and into the distal end of the cavity. The second airflow pathway extends from the at least one air inlet, through the air-permeable segment and into to the cavity at a point downstream of the distal end of the cavity.

[0012] The provision of an aerosol generating article according to the present invention may overcome many of the shortcoming associated with the prior art.

[0013] The provision of at least one air inlet may advantageously substantially prevent or inhibit activation of combustion of a combustible heat source during puffing by a user. This may substantially prevent or inhibit spikes in the temperature of the aerosol-forming substrate during puffing by a user. By preventing or inhibiting activation of combustion of the combustible heat source, and so preventing or inhibiting excess temperature increases in the aerosol-forming substrate, combustion or pyrolysis of the aerosol-forming substrate under intense puffing regimes may be advantageously avoided. In addition, the impact of a user's puffing regime on the composition of the mainstream aerosol may be advantageously minimised or reduced.

[0014] Unlike smoking articles of the prior art, the aerosol generating article of the present invention does not include an airflow directing element having an air impermeable barrier to prevent air passing directly from the first portion to the second portion without first passing through the aerosol-forming substrate. Instead, air entering the at least one air inlet may follow the second airflow pathway which extends from the at least one air inlet, through the air-permeable segment and into the cavity at a point downstream of the distal end of the cavity. This may advantageously simplify the manufacture of the aerosol generating article. As discussed below, the inventors of the present invention have achieved this while maintaining acceptable delivery of volatile constituents from the aerosol-forming substrate by carefully controlling parameters such as the cross sectional area of the cavity and the position of the at least one air inlet.

[0015] Furthermore, the inventors of the present invention have identified that the proportion of air following the first and second airflow pathways may be controlled in order to optimise the delivery of nicotine and aerosol former. As set out in more detail below, this may be achieved by controlling at least one of the diameter of the cavity and the position of the at least one air inlet.

[0016] In use, heat from the heat source is transferred to the aerosol-forming substrate by conduction. The heating of the aerosol-forming substrate may cause the release of volatile constituents, such as nicotine and aerosol former. The aerosol former may comprise glycerine. When air is drawn into the aerosol generating article through the at least one air inlet, the air will either follow the first airflow pathway, or it will follow the second airflow pathway.

[0017] Air that follows the first airflow pathway will pass through the aerosol-forming substrate and will entrain the volatile compounds released from the aerosol-forming substrate to form an aerosol. The aerosol then passes into the cavity through the upstream end of the cavity, passes through the cavity and out of the aerosol generating article.

[0018] Where the at least one air inlet is located downstream of the distal end of the airflow directing element, air that follows the second airflow pathway may pass directly from the air-permeable segment to the cavity without passing through the aerosol-forming substrate. Where the at least one air inlet is located upstream of the distal end of the airflow directing element, air that follows the second airflow pathway may pass through the aerosol-forming substrate before passing into the air-permeable segment. In either case, the air that follows the second airflow pathway passes from the air-permeable segment into the cavity at a point downstream of the distal end of the cavity. This air then passes along the cavity towards the downstream end of the cavity and out of the aerosol generating article.

[0019] In addition to simplifying manufacture, the inventors of the present invention have surprisingly identified that the airflow through the aerosol generating article may be effectively controlled by varying the diameter of the cavity and the position of the at least one air inlet. This is in contrast to aerosol generating articles of the prior art in which airflow was controlled by use of air impermeable members (such as tubes).

[0020] By controlling the airflow through the aerosol generating article in this way, the delivery of volatile compounds from the aerosol-forming substrate. Examples of volatile constituents include nicotine and aerosol former. For example, by controlling the diameter of the cavity and the position of the at least one air inlet, the delivery of nicotine and aerosol former may be optimised.

[0021] As used herein with reference to the present invention, the term "air-permeable segment" refers to a segment that is not blocked, plugged or sealed in a way to completely block air from passing through the air-permeable segment. As such, each portion of the air-permeable segment has a finite resistance to draw. Manufacturing the air-permeable segment without such a plug or seal advantageously reduces manufacturing complexity. Additionally, manufacturing the air-permeable segment without such a plug or seal advantageously can reduce or eliminate the need to undertake the onerous procedure of selecting and testing materials for use in forming the seal to determine their suitability for use in the aerosol generating articles. In certain preferred embodiments, the air-permeable segment is open ended so as to permit air to pass through it from the upstream end to the downstream end of the air-permeable segment.

[0022] The air-permeable segment may comprise any suitable material, provided it is sufficiently permeable to allow air following the airflow pathways to pass through it. The air-permeable segment may comprise a fibrous material. The air-permeable segment may comprise a porous material. The air-permeable segment may comprise at least one of, substantially uniformly distributed cellulose acetate tow, polylactic acid, polyhydroxyalkanoate, viscose, polypropylene, or combinations thereof. The density of the cellulose acetate tow provided in the air-permeable segment may be used to control the resistance to draw of portions of the air-permeable segment. The air-permeable segment may comprise a hollow acetate tube. Where the air-permeable segment comprises a hollow acetate tube, the inner surface of the tube defines the cavity. The inner surface of the tube is also air-permeable such that air is able to pass from the air-permeable segment into the cavity.

[0023] The air-permeable segment may comprise a material having a density of at least about 0.05 milligrams per cubic millimetre. For example, the air-permeable segment may comprise a material having a density of at least about 0.1 milligrams per cubic millimetre, or at least about 0.15 milligrams per cubic millimetre. Preferably, the air-permeable segment comprises a material having a density of at least about 0.18 milligrams per cubic millimetre.

[0024] The air-permeable segment may comprise a fibrous material. For example, the air-permeable segment may comprise cellulose acetate fibres. The air-permeable segment may comprise additives. For example, the air-permeable segment may comprise a plasticizer such as triacetin.

[0025] The airflow directing element comprises the air-permeable segment defining a cavity. The airflow directing element may comprise additional components. For example, the airflow directing element may comprise at least one element surrounding or circumscribing the air-permeable segment. The additional components may be air permeable. The additional components may be air impermeable. The additional components may have any thickness.

[0026] The total cross sectional area of the airflow directing element, including the air-permeable segment and any additional components, may be the same, or substantially the same as the total cross sectional area of the aerosol generating article. Where the total cross sectional area of the airflow directing element, including the air-permeable segment and any additional components, is substantially the same as the total cross sectional area of the aerosol generating article, the difference may be accounted for by at least one wrapper circumscribing the airflow directing element. In this example, the total cross sectional area of the aerosol generating article consists of the total cross sectional area of the airflow directing element, including the air-permeable segment and any additional components, and the cross sectional area of the at least one wrapper.

[0027] As used herein with reference to the present invention, the term "airflow pathway" is used to describe a route along which air may be drawn through the aerosol generating article.

[0028] As used herein with reference to the present invention, the terms "upstream" and "front", and "downstream" and "rear", are used to describe the relative positions of components, or portions of components, of the aerosol generating article in relation to the direction in which airflows through the aerosol generating article during use thereof. Aerosol generating articles according to the invention comprise a proximal end through which, in use, an aerosol exits the article. The proximal end of the aerosol generating article may also be referred to as the mouth end or the downstream end. The mouth end is downstream of the distal end. The heat source is located at or proximate to the distal end. The distal end of the aerosol generating article may also be referred to as the upstream end. Components, or portions of components, of the aerosol generating article may be described as being upstream or downstream of one another based on their relative positions between the proximal end of the aerosol generating article and the distal end of the aerosol generating article. The front of a component, or portion of a component, of the aerosol generating article is the portion at the end closest to the upstream end of the aerosol generating article. The rear of a component, or portion of a component, of the aerosol generating article is the portion at the end closest to the downstream end of the aerosol generating article.

[0029] The airflow directing element and the aerosol-forming substrate may define the first airflow pathway.

[0030] This may advantageously ensure that the air following the first airflow pathway entrains the volatile compounds from the aerosol-forming substrate.

[0031] The at least one air inlet may be located downstream of the distal end of the airflow directing element. Where this is the case, air entering the aerosol generating article through the at least one air inlet may pass directly into the aerosol directing element.

[0032] Where the at least one air inlet is located downstream of the distal end of the airflow directing element, air entering the aerosol generating article through the at least one air inlet may pass directly into the air-permeable segment.

[0033] The first airflow pathway may extend from the at least one air inlet, through the air-permeable segment, through the aerosol-forming substrate and into the distal end of the cavity.

[0034] The second airflow pathway may extend from the at least one air inlet, through the air-permeable segment and directly into the cavity at a point downstream of the distal end of the cavity.

[0035] Where the at least one air inlet is located downstream of the distal end of the airflow directing element, air following second airflow pathway does not pass through the aerosol-forming substrate. Air following the second airflow pathway may therefore not directly entrain any volatile compounds from the aerosol-forming substrate. Air following the second airflow pathway may dilute the aerosol when the air following the second airflow pathway passes into the cavity at a point downstream of the distal end of the cavity.

[0036] The at least one air inlet may be located at any point downstream of the distal end of the airflow directing element. The at least one air inlet may be located between the distal end and the proximal end of the airflow directing element. The at least one air inlet may be located no more than 5 millimetres downstream of the distal end of the aerosol directing element.

[0037] For example, the at least one air inlet may be located no more than 3 millimetres downstream of the distal end of the airflow directing element.

[0038] This may help ensure that a proportion of air passing into the at least one air inlet passes through the aerosol-forming substrate following the second airflow pathway. This may advantageously lead to a greater amount of volatile compounds being entrained in the air as it passes through the aerosol generating article.

[0039] The at least one air inlet may be located upstream of the distal end of the airflow directing element. Where this is the case, air entering the aerosol generating article through the at least one air inlet may pass directly into the aerosol-forming substrate, before then passing into either the air-permeable segment or the distal end of the cavity.

[0040] The provision of the at least one air inlet being located upstream of the distal end of the airflow directing element may ensure air passes through a warmer portion of the aerosol-forming substrate. This may advantageously enable a greater amount of volatile compounds to become entrained in the air passing through the aerosol-forming substrate.

[0041] The first airflow pathway may extend from the at least one air inlet, through the aerosol-forming substrate and into the distal end of the cavity.

[0042] The second airflow pathway may extend from the at least one air inlet, through the aerosol-forming substrate, through the air-permeable segment and into the cavity at a point downstream of the distal end of the cavity.

[0043] Where the at least one air inlet is located upstream of the distal end of the airflow directing element, both the first and second airflow pathways pass through the aerosol-forming substrate. Air following both the first and second airflow pathways may therefore directly entrain volatile compounds from the aerosol-forming substrate. This may advantageously increase the concentration of volatile compounds in the aerosol.

[0044] The at least one air inlet may be located at any point upstream of the distal end of the airflow directing element. The at least one air inlet may be located between the distal end and the proximal end of the aerosol-forming substrate. The at least one air inlet may be located no more than 5 millimetres upstream of the distal end of the aerosol directing element.

[0045] For example, the at least one air inlet may be located no more than 3 millimetres upstream of the distal end of the airflow directing element.

[0046] The at least one air inlet may comprise any number or configuration of air inlets. The at least one air inlet may comprise a single air inlet. For example, the at least one air inlet may comprise a slit. The slit may be arranged around the circumference of the aerosol generating device, or may be arranged along the longitudinal axis of the aerosol generating device.

[0047] The at least one air inlet may comprise a plurality of air inlets. For example, the at least one air inlet may comprise a plurality of air inlets arranged in circumferential rows, longitudinal columns, or any other pattern. Where the at least one air inlet comprises at least one row of air inlets, each row may comprise a plurality of air inlets. The at least one row of air inlets may circumscribe the aerosol generating article. Each individual air inlet may constitute a hole in the outer wrapper, and any other wrapper, such that air is able to pass through the air inlet to either the aerosol-forming substrate or the airflow directing element. Where the at least one row of air inlets comprises a plurality of row of air inlets, adjacent rows of air inlets may be separated by between 0.5 millimetres and 6 millimetres. Adjacent rows of air inlets may be separated by 1 millimetre.

[0048] Where the at least one air inlet comprises a plurality of air inlets, the at least one air inlet may comprise a plurality of slits. For example, the at least one air inlet may comprise at least a first slit and a second slit. Adjacent slits may be separated by between 0.5 millimetres and 6 millimetres. Adjacent slits may be separated by 1 millimetre.

[0049] The at least one air inlet may comprise a plurality of air inlet zones. The first air inlet zone may be located downstream of the distal end of the airflow directing element. The second air inlet zone may be located upstream of the distal end of the airflow directing element.

[0050] The downstream end of the aerosol-forming substrate may abut the upstream end of the airflow directing element.

[0051] This may force air passing from the air-permeable segment towards the aerosol-forming substrate to pass into the aerosol-forming substrate rather than passing into a gap, and then directly into the cavity. This may advantageously lead to a greater amount of volatile compounds becoming entrained in the first airflow pathway where the at least one air inlet is located downstream of the distal end of the airflow directing element.

[0052] The air-permeable segment may have any shape. For example, the air-permeable segment may have the shape of a prism. The air-permeable segment may be a cylindrical air-permeable segment.

[0053] The cavity may have any shape. For example, the cavity may have the shape of a prism. The cavity may be a cylindrical cavity.

[0054] The air-permeable segment may be a cylindrical air-permeable segment and the cavity may be a cylindrical cavity.

[0055] The cavity may be located centrally in the air-permeable segment. The longitudinal axis of the cavity may be parallel to the longitudinal axis of the air-permeable segment. The cavity may have any cross sectional shape. For example, the cavity may have a circle shaped cross section, or a square shaped cross section, or a cloverleaf shaped cross section.

[0056] The cavity may have the same outer cross sectional shape as the air-permeable segment.

[0057] The longitudinal cross sectional area of the cavity may be at least 14 percent of the total longitudinal cross sectional area of the aerosol generating article. Where this is the case, the cavity accounts for at least 14 percent of the total cross sectional area of the aerosol generating article.

[0058] For example, the longitudinal cross sectional area of the cavity may be at least 18 percent, at least 20 percent, at least 25 percent, at least 27 percent, at least 30 percent, or at least 35 percent of the total longitudinal cross sectional area of the aerosol generating article.

[0059] The provision of a cavity having a cross sectional area at least 14 percent of the total longitudinal cross sectional area of the aerosol generating article may advantageously maximise the delivery of volatile constituents such as nicotine and aerosol former. Without wishing to be bound by theory, the provision of cavities having smaller cross sectional areas relative to the total longitudinal cross sectional area of the aerosol generating article may lead to a proportion of the volatile compounds being removed from the aerosol as it passes along the cavity towards the downstream end of the airflow directing element. In addition, where the at least one air inlet is located upstream of the distal end of the airflow directing element, air following the second airflow pathway, which has entrained volatile compounds from the aerosol-forming substrate must pass a greater distance through the air-permeable segment before passing into the cavity at a point downstream of the distal end of the cavity. This may lead to a higher proportion of volatile compounds being removed from the aerosol.

[0060] Accordingly, increasing the cross sectional area of the cavity relative to the total longitudinal cross sectional area of the aerosol generating article may increase delivery of volatile compounds by reducing the proportion of volatile compounds removed by the air-permeable segment.

[0061] The longitudinal cross sectional area of the cavity may be less than or equal to 40 percent of the total longitudinal cross sectional area of the aerosol generating article. Where this is the case, the cavity accounts for less than or equal to 40 percent of the total cross sectional area of the aerosol generating article.

[0062] For example, the longitudinal cross sectional area of the cavity may be less than or equal to 35 percent, or less than or equal to 30 percent of the total longitudinal cross sectional area of the aerosol generating article.

[0063] The provision of a cavity having a cross sectional area less than or equal to 40 percent of the total longitudinal cross sectional area of the aerosol generating article may advantageously maximise the delivery of volatile constituents such as nicotine and aerosol former. Without wishing to be bound by theory, the provision of cavities having larger cross sectional areas relative to the total longitudinal cross sectional area of the aerosol generating article may lead to a greater proportion of the air following the second airflow pathway. Where the at least one air inlet is located downstream of the distal end of the airflow directing element, this may mean that a greater proportion of the air does not pass through the aerosol-forming substrate at all, meaning that the air following the second airflow pathway would not entrain volatile compounds from the aerosol-forming substrate. Furthermore, where the at least one air inlet is located upstream of the distal end of the airflow directing element, this may mean that air following the first airflow pathway passes through less of the aerosol-forming substrate once it enters the aerosol-forming substrate through the at least one air inlet, before it passes into the distal end of the cavity. This may result in less volatile compounds being entrained in the air following the second airflow pathway.

[0064] Accordingly, decreasing the cross sectional area of the cavity relative to the total longitudinal cross sectional area of the aerosol generating article may increase delivery of volatile compounds by forcing more air through the aerosol-forming substrate.

[0065] The longitudinal cross sectional area of the cavity may be between 14 percent and 40 percent of the total longitudinal cross sectional area of the aerosol generating article.

[0066] For example, the longitudinal cross sectional area of the cavity may be between 18 percent and 35 percent, between 30 percent and 40 percent, between 30 percent and 35 percent, between 35 percent and between 40 percent, between 20 percent and 35 percent, or between 25 percent and 30 percent of the total longitudinal cross sectional area of the aerosol generating article.

[0067] In some preferred embodiments, the longitudinal cross sectional area of the cavity is about 27 percent of the total longitudinal cross sectional area of the aerosol generating article.

[0068] As set out above, providing a cavity having a large longitudinal cross sectional area relative to the total longitudinal cross sectional area of the aerosol generating article may result in less air flowing through the aerosol-forming substrate, but also may result in less volatile compounds being removed from the aerosol by the air-permeable segment. Conversely, providing a cavity having a small longitudinal cross sectional area relative to the total longitudinal cross sectional area of the aerosol generating article may result in more volatile compounds being removed from the aerosol by the air-permeable segment, but may also result in more air flowing through the aerosol-forming substrate.

[0069] With these competing factors in mind, the inventors of the present invention have identified that a cavity having a longitudinal cross sectional area of between 14 percent and 40 percent of the total longitudinal cross sectional area of the aerosol generating article represents an optimal balance between these effects. The provision of a cavity having a longitudinal cross sectional area of between 14 percent and 40 percent of the total longitudinal cross sectional area of the aerosol generating article may provide optimal delivery of volatile constituents such as nicotine and aerosol former.

[0070] The airflow directing element may have a diameter of between about 5 millimetres and about 9 millimetres. For example, the airflow directing element may have a diameter of between about 5.4 millimetres and about 8.1 millimetres. The aerosol generating article may have a diameter of about 7.8 millimetres.

[0071] The airflow directing element may have a longitudinal cross sectional area of at least 19 millimetres squared. For example, the airflow directing element may have a longitudinal cross sectional area of at least 25 millimetres squared, or at least 30 millimetres squared.

[0072] The airflow directing element may have a longitudinal cross sectional area of no more than 50 millimetres squared. For example, the airflow directing element may have a longitudinal cross sectional area of no more than 40 millimetres squared, or no more than 35 millimetres squared.

[0073] The airflow directing element may have a longitudinal cross sectional area of between 19 millimetres squared and 50 millimetres squared, between 25 millimetres squared and 40 millimetres squared, and between 30 millimetres squared and 35 millimetres squared.

[0074] The airflow directing element may have a longitudinal cross sectional area of 40 millimetres squared.

[0075] The cavity may have a diameter of at least 1 millimetre. For example, the cavity may have a diameter of at least 2 millimetres, or at least 3 millimetres.

[0076] The cavity may have a diameter of no more than 6 millimetres. For example, the cavity may have a diameter of no more than 5 millimetres, or no more than 4 millimetres.

[0077] The cavity may have a diameter of 4 millimetres.

[0078] The cavity may have a longitudinal cross sectional area of at least 3 millimetres squared. For example, the cavity may have a longitudinal cross sectional area of at least 5 millimetres squared, or at least 10 millimetres squared.

[0079] The cavity may have a longitudinal cross sectional area of no more than 30 millimetres squared. For example, the cavity may have a longitudinal cross sectional area of no more than 20 millimetres squared, or no more than 15 millimetres squared.

[0080] The cavity may have a longitudinal cross sectional area of between 3 millimetres squared and 30 millimetres squared, between 5 millimetres squared and 20 millimetres squared, and between 10 millimetres squared and 15 millimetres squared.

[0081] The cavity may have a longitudinal cross sectional area of 12 millimetres squared.

[0082] The airflow directing element may have any length. For example, the airflow directing element may have a length of between 10 millimetres and 40 millimetres, between 15 millimetres and 35 millimetres, or between 20 millimetres and 30 millimetres. The airflow directing element may have a length of 25 millimetres.

[0083] The heat source may be any heat source. The heat source may be a single use heat source. The heat source may be a multiple use heat source. The heat source may be a combustible, chemical, electrical or any other heat source. The heat source may be a combustible heat source.

[0084] The heat source may be a blind heat source. The heat source may be a blind combustible heat source.

[0085] As used herein with reference to the invention, the term “blind” describes a heat source that does not comprise any airflow channels extending from the front end face to the rear end face of the combustible heat source. As used herein with reference to the invention, the term “blind” is also used to describe a combustible heat source including one or more channels extending from the front end face of the combustible heat source to the rear end face of the combustible heat source, wherein a combustible substantially air impermeable barrier between the rear end face of the combustible heat source and the aerosol-forming substrate barrier prevents air from being drawn along the length of the combustible heat source through the one or more channels.

[0086] In use, air drawn along the first or second airflow pathway of aerosol generating article according to the invention comprising a blind combustible heat source does not pass through any airflow channels along the blind combustible heat source. The lack of any airflow channels through the blind combustible heat source advantageously substantially prevents or inhibits activation of combustion of the blind combustible heat source during puffing by a user. This substantially prevents or inhibits spikes in the temperature of the aerosol-forming substrate during puffing by a user. By preventing or inhibiting activation of combustion of the blind combustible heat source, and so preventing or inhibiting excess temperature increases in the aerosol-forming substrate, combustion or pyrolysis of the aerosol-forming substrate under intense puffing regimes may be advantageously avoided. In addition, the impact of a user's puffing regime on the composition of the mainstream aerosol may be advantageously minimised or reduced.

[0087] The inclusion of a blind combustible heat source may also advantageously substantially prevent or inhibit combustion and decomposition products and other materials formed during ignition and combustion of the blind combustible heat source from entering air drawn through aerosol generating articles according to the invention during use thereof. This is particularly advantageous where the blind combustible heat source comprises one or more additives to aid ignition or combustion of the blind combustible heat source.

[0088] In aerosol generating articles according to the invention comprising a blind combustible heat source, heat transfer from the blind combustible heat source to the aerosol-forming substrate occurs primarily by conduction. Heating of the aerosol-forming substrate by forced convection is minimised or reduced. This may advantageously help to minimise or reduce the impact of a user's puffing regime on the composition of the mainstream aerosol of articles according to the invention.

[0089] The Heat Source May be a Solid Heat Source.

[0090] As used herein with reference to the invention, the term "aerosol-forming substrate" is used to describe a substrate capable of releasing upon heating volatile compounds, which can form an aerosol. The aerosols generated from aerosol-forming substrates of aerosol generating articles according to the invention may be visible or invisible and may include vapours (for example, fine particles of substances, which are in a gaseous state, that are ordinarily liquid or solid at room temperature) as well as gases and liquid droplets of condensed vapours.

[0091] The aerosol-forming substrate may be a solid aerosol-forming substrate. Alternatively, the aerosol-forming substrate may comprise both solid and liquid components. The aerosol-forming substrate may comprise a tobacco-containing material containing volatile tobacco flavour compounds, which are released from the substrate upon heating. Alternatively, the aerosol-forming substrate may comprise a non-tobacco material. The aerosol-forming substrate may further comprise one or more aerosol formers. Examples of suitable aerosol formers include, but are not limited to, glycerine and propylene glycol.

[0092] The Aerosol-Forming Substrate May be a Rod Comprising a Tobacco-Containing Material.

[0093] If the aerosol-forming substrate is a solid aerosol-forming substrate, the solid aerosol-forming substrate may comprise, for example, one or more of: powder, granules, pellets, shreds, spaghetti strands, strips or sheets containing one or more of: herb leaf, tobacco leaf, fragments of tobacco ribs, reconstituted tobacco, homogenised tobacco, extruded tobacco and expanded tobacco. The solid aerosol-forming substrate may be in loose form, or may be provided in a suitable container or cartridge. For example, the aerosol-forming material of the solid aerosol-forming substrate may be contained within a paper or other wrapper and have the form of a plug. Where an aerosol-forming substrate is in the form of a plug, the entire plug including any wrapper is considered to be the aerosol-forming substrate.

[0094] The solid aerosol-forming substrate may contain additional tobacco or nontobacco volatile flavour compounds, to be released upon heating of the solid aerosol-forming substrate. The solid aerosol-forming substrate may also contain capsules that, for example, include the additional tobacco or non-tobacco volatile flavour compounds and such capsules may melt during heating of the solid aerosol-forming substrate.

[0095] The solid aerosol-forming substrate may be provided on or embedded in a thermally stable carrier. The carrier may take the form of powder, granules, pellets, shreds, spaghetti strands, strips or sheets. The solid aerosol-forming substrate may be deposited on the surface of the carrier in the form of, for example, a sheet, foam, gel or slurry. The solid aerosol-forming substrate may be deposited on the entire surface of the carrier, or alternatively, may be deposited in a pattern in order to provide a non-uniform flavour delivery during use.

[0096] The aerosol-forming substrate may be in the form of a plug or segment comprising a material capable of emitting volatile compounds in response to heating circumscribed by a paper or other wrapper. Where an aerosol-forming substrate is in the form of such a plug or segment, the entire plug or segment including any wrapper is considered to be the aerosol-forming substrate.

[0097] The aerosol-forming substrate preferably has a length of between about 5 millimetres and about 20 millimetres. In certain embodiments, the aerosol-forming substrate may have a length of between about 6 millimetres and about 15 millimetres or a length of between about 7 millimetres and about 12 millimetres.

[0098] The aerosol-forming substrate may comprise a plug of tobacco-based material wrapped in a plug wrap. In preferred embodiments, the aerosol-forming substrate comprises a plug of homogenised tobacco-based material wrapped in a plug wrap.

[0099] The aerosol generating article may comprise a heat conducting element around and in direct contact with a rear portion of the heat source and an adjacent front portion of the aerosol-forming substrate. The heat conducting element is preferably combustion resistant.

[0100] The heat conducting element may be around and in direct contact with the peripheries of both the rear portion of the combustible heat source and the front portion of the aerosol-forming substrate. The heat conducting element may provide a thermal link between these two components of the aerosol generating article.

[0101] Suitable heat conducting elements for use in aerosol generating articles according to the invention include, but are not limited to: metal foil wrappers such as, for example, aluminium foil wrappers, steel wrappers, iron foil wrappers and copper foil wrappers; and metal alloy foil wrappers.

[0102] Where the heat source is a combustible heat source, the rear portion of the combustible heat source surrounded by the heat conducting element may be between about 2 millimetres and about 8 millimetres in length, more preferably between about 3 millimetres and about 5 millimetres in length.

[0103] The front portion of the combustible heat source may not be surrounded by the heat conducting element. The front portion of the combustible heat source not surrounded by the heat conducting element may be between about 4 millimetres and about 15 millimetres in length, more preferably between about 4 millimetres and about 8 millimetres in length.

[0104] The aerosol-forming substrate may extend at least about 3 millimetres downstream beyond the heat-conducting element.

[0105] The front portion of the aerosol-forming substrate surrounded by the heat-conducting element may be between about 2 millimetres and about 10 millimetres in length, more preferably between about 3 millimetres and about 8 millimetres in length, most preferably between about 4 millimetres and about 6 millimetres in length. The rear portion of the aerosol-forming substrate not surrounded by the heat-conducting element may be between about 3 millimetres and about 10 millimetres in length. In other words, the aerosol-forming substrate preferably extends between about 3 millimetres and about 10 millimetres downstream beyond the heat-conducting element. More preferably, the aerosol-forming substrate extends at least about 4 millimetres downstream beyond the heat-conducting element.

[0106] The aerosol-forming substrate may extend less than 3 millimetres downstream beyond the heat-conducting element.

[0107] The entire length of the aerosol-forming substrate may be surrounded by a heat-conducting element.

[0108] Aerosol generating articles according to the invention may comprise an expansion chamber downstream of the aerosol-forming substrate and the airflow directing element. The inclusion of an expansion chamber may advantageously allow further cooling of the aerosol generated by heat transfer from the combustible heat source to the aerosol-forming substrate. The expansion chamber may advantageously allow the overall length of the aerosol generating articles according to the invention to be adjusted to a desired value through an appropriate choice of the length of the expansion chamber. The expansion chamber may be an elongate hollow tube.

[0109] The aerosol generating article may comprise a filter segment configured to further cool the aerosol. The filter segment may comprise PLA.

[0110] The aerosol generating article may comprise a mouthpiece downstream of the aerosol-forming substrate and the airflow directing element and, where present, downstream of the expansion chamber. The mouthpiece may be of low filtration efficiency, or of very low filtration efficiency. The mouthpiece may be a single segment or component mouthpiece. The mouthpiece may be a multi-segment or multi-component mouthpiece.

[0111] The mouthpiece may comprise a filter made of cellulose acetate, paper or other suitable known filtration materials. The mouthpiece may comprise one or more segments comprising absorbents, adsorbents, flavourants, and other aerosol modifiers and additives or combinations thereof.

[0112] The aerosol generating article may have a diameter of between about 5 millimetres and about 9 millimetres. For example, the aerosol generating article may have a diameter of between about 5.4 millimetres and about 8.1 millimetres. The aerosol generating article may have a diameter of about 7.8 millimetres.

[0113] The aerosol generating article may have any length. For example, the aerosol generating article may have a total length of between approximately 65 millimetres and approximately 100 millimetres. The aerosol generating article may have any desired external diameter. For example, the aerosol generating article may have an external diameter of between approximately 5 millimetres and approximately 12 millimetres.

[0114] It should be appreciated that particular combinations of the various features described and defined in any aspects of the invention can be implemented, supplied, or used independently.

[0115] Below, there is provided a non-exhaustive list of non-limiting examples. Any one or more of the features of these examples may be combined with any one or more features of another example, embodiment, or aspect described herein.

[0116] A: An aerosol generating article comprising: a heat source; an aerosol-forming substrate downstream of the heat source; an airflow directing element downstream of the aerosol-forming substrate, the airflow directing element comprising an air-permeable segment, the air-permeable segment defining a cavity; and at least one air inlet for allowing air to be drawn into the aerosol generating article, wherein the aerosol generating article includes a first airflow pathway and a second airflow pathway, wherein the first airflow pathway extends from the at least one air inlet, through the aerosol-forming substrate and into the distal end of the cavity, and wherein the second airflow pathway extends from the at least one air inlet, through the air-permeable segment and into the cavity at a point downstream of the distal end of the cavity.

[0117] B: An aerosol generating article according to example A, wherein the at least one air inlet is located downstream of the distal end of the airflow directing element.

[0118] C: An aerosol generating article according to example B, wherein the first airflow pathway extends from the at least one air inlet, through the air-permeable segment, through the aerosol-forming substrate and into the distal end of the cavity.

[0119] D: An aerosol generating article according to example B or example C, wherein the second airflow pathway extends from the at least one air inlet, through the air-permeable segment and directly into the cavity at a point downstream of the distal end of the cavity.

[0120] E: An aerosol generating article according to any one of examples B to D wherein the at least one air inlet is located no more than 5 millimeters downstream of the distal end of the airflow directing element.

[0121] F: An aerosol generating article according to example A, wherein the at least one air inlet is located upstream of the distal end of the airflow directing element.

[0122] G: An aerosol generating article according to example F, wherein the first airflow pathway extends from the at least one air inlet, through the aerosol-forming substrate and into the distal end of the cavity.

[0123] H. An aerosol generating article according to example F or example G, wherein the second airflow pathway extends from the at least one air inlet, through the aerosol-forming substrate, through the air-permeable segment and into the cavity at a point downstream of the distal end of the cavity.

[0124] I: An aerosol generating article according to any one of examples F to H, wherein the wherein the at least one air inlet is located no more than 5 millimeters upstream of the distal end of the airflow directing element.

[0125] J: An aerosol generating article according to any preceding example, wherein the downstream end of the aerosol-forming substrate abuts the upstream end of the airflow directing element.

[0126] K: An aerosol generating article according to any preceding example, wherein the air-permeable segment is a cylindrical air-permeable segment and the cavity is a cylindrical cavity.

[0127] L: An aerosol generating article according to any preceding example, wherein the cavity has a circle shaped cross section, or a square shaped cross section, or a cloverleaf shaped cross section.

[0128] M: An aerosol generating article according to any preceding example, wherein the longitudinal cross sectional area of the cavity is at least 14 percent of the total longitudinal cross sectional area of the aerosol generating article.

[0129] N: An aerosol generating article according to any preceding example, wherein the longitudinal cross sectional area of the cavity is less than or equal to 40 percent of the total longitudinal cross sectional area of the aerosol generating article.

[0130] O: An aerosol generating article according to any preceding example, wherein the longitudinal cross sectional area of the cavity is between 14 percent and 40 percent of the total longitudinal cross sectional area of the aerosol generating article.

[0131] P: An aerosol generating article according to any preceding example, wherein the airflow directing element and the aerosol-forming substrate defines the first airflow pathway.

[0132] Q: An aerosol generating article according to any preceding example, wherein the heat source is a blind heat source.

[0133] R: An aerosol generating article according to any preceding example, wherein the heat source is a solid heat source.

[0134] S: An aerosol generating article according to any preceding example, wherein the heat source is a combustible heat source.

[0135] The invention will be further described, by way of example only, with reference to the accompanying drawings in which:

[0136] FIG. **1** shows a schematic longitudinal cross sectional view of an aerosol generating article according to the present invention where the at least one air inlet is located downstream of the distal end of the airflow directing element;

[0137] FIG. **2** shows a schematic longitudinal cross sectional view of an alternative aerosol generating article according to the present invention where the at least one air inlet is located downstream of the distal end of the airflow directing element.

[0138] FIG. **3** shows a schematic longitudinal cross sectional view of an aerosol generating article according to the present invention where the at least one air inlet is located upstream of the distal end of the airflow directing element.

[0139] FIG. **4** shows the results of a test to determine how the mass of glycerine remaining in the aerosol-forming substrate after use of an aerosol generating article varied as a function of the cross sectional area of the cavity.

[0140] FIG. **5** shows the results of a test to determine how the mass of glycerine adsorbed by the air-permeable portion of the airflow directing element after use of an aerosol generating article varied as a function of the cross sectional area of the cavity.

[0141] The aerosol generating article **100** according to the first embodiment of the invention shown in FIG. **1** comprises a blind combustible carbonaceous heat source **102**, an aerosol-forming substrate **104**, an airflow directing element **106**, and a mouthpiece **110** in abutting coaxial alignment. The combustible carbonaceous heat source **102**, aerosol-forming substrate **104**, airflow directing element **106**, and mouthpiece **110** are overwrapped in an outer wrapper **112** of cigarette paper of low air permeability.

[0142] The aerosol-forming substrate **104** is located immediately downstream of the combustible carbonaceous heat source **102** and comprises a cylindrical plug **114** of tobacco material comprising glycerine as aerosol former and circumscribed by plug wrap (not shown). A non-combustible, substantially air impermeable barrier is provided between the downstream end of the combustible heat source **102** and the upstream end of the aerosol-forming substrate **104**. As shown in FIG. **1**, the non-combustible, substantially air impermeable barrier consists of a non-combustible, substantially air impermeable, barrier coating **118**, which is provided on the entire rear face of the combustible carbonaceous heat source **102**.

[0143] A heat-conducting element **120** consisting of a tubular layer of aluminium foil surrounds and is in direct contact with a rear portion **122** of the combustible carbonaceous heat source **102** and an abutting front portion **124** of the aerosol-forming substrate **104**. As shown in FIG. **1**, a rear portion of the aerosol-forming substrate **104** is not surrounded by the heat-conducting element **120**.

[0144] The airflow directing element **106** is located downstream of the aerosol-forming substrate **104** and comprises an air-permeable segment **128** defining a cavity **129**. The air-permeable segment **128** comprises substantially uniformly distributed cellulose acetate tow. The cavity **129** is provided along the central longitudinal axis of the air-permeable segment **128**. The longitudinal cross sectional area of the cavity **129** is 20 percent of the total cross sectional area of the aerosol generating article **100**. Both the distal end and the proximal end of the cavity **129** are open such that air may pass into the distal end of the cavity **129**, pass along the length of the cavity **129**, and pass out of the cavity **129** through the proximal end of the cavity.

[0145] As shown in FIG. **1**, the air-permeable segment **128** is circumscribed by an inner wrapper **130**.

[0146] As also shown in FIG. **1**, at least one air inlet **132** is provided in the outer wrapper **112** and the inner wrapper **130**. The at least one air inlet **132** comprises a plurality of air inlets in a circumferential arrangement around the aerosol generating article. In the aerosol generating article **100** shown in FIG. **1**, the at least one air inlet **132** is located 3 millimetres downstream of the distal end of the airflow directing element **106**.

[0147] The mouthpiece **110** of the aerosol generating article **100** is located downstream of the airflow directing element **106** and comprises a cylindrical plug **136** of cellulose acetate tow of very low filtration efficiency circumscribed by filter plug wrap **138**. The mouthpiece **110** may be circumscribed by tipping paper (not shown).

[0148] In use, once the combustible carbonaceous heat source **102** is ignited, the aerosol-forming substrate **104** is heated by conduction through the abutting rear portion **122** of the combustible carbonaceous heat source **102** and the heat-conducting element **120**. The heating of the aerosol-forming substrate **104** releases volatile compounds including glycerine and nicotine from the plug **114** of tobacco material.

[0149] The non-combustible, substantially air impermeable, barrier coating **118** provided on the rear face of the combustible carbonaceous heat source **102** isolates the combustible carbonaceous heat source **102** from the airflow pathway through the aerosol generating article **100** such that, in use, air drawn through the aerosol generating article **100** along the first portion and the second portion of the airflow pathway does not directly contact the combustible carbonaceous heat source **102**.

[0150] Air is drawn into the aerosol generating article **100** through the at least one air inlet **132**. This air first enters the air-permeable segment **128** of the airflow directing element **106**.

[0151] A first portion of this air follows a first airflow pathway and passes from the air-permeable segment **128**, through the distal end of the airflow directing element **106** and into the aerosol-forming substrate **104**. While passing through the aerosol-forming substrate **104**, the air following the first airflow pathway entrains the volatile compounds from the aerosol-forming substrate **104** to form an aerosol. The air following the first airflow pathway then passes into the distal end of the cavity **129**. The aerosol cools and condenses as it passes along the cavity **129**.

[0152] A second portion of the air entering the aerosol generating article **100** through that at least one air inlet **132** follows a second airflow pathway. This air passes directly from the air-permeable portion **128** of the airflow directing element **106** and into the cavity **129** at a point downstream of the distal end of the cavity **129**. This air does not entrain volatile compounds directly from the aerosol-forming substrate **104** and so may act to dilute the aerosol entrained in the air following the first airflow pathway.

[0153] Air following both the first and second airflow pathways pass through the proximal end of the cavity **129**, through the mouthpiece **110**, and out of the aerosol generating article **100**.

[0154] The first and second airflow pathways are identified by dashed lines and arrows in FIG. **1**.

[0155] FIG. **2** shows an alternative aerosol generating article **100** according to the present invention. The aerosol generating article **100** shown in FIG. **2** is of largely identical construction to the aerosol generating article **100** shown in FIG. **1** and like reference numerals are used to identify common features. However, the aerosol generating article **100** shown in FIG. **2** further comprises an expansion chamber **108** located downstream of the airflow directing element **106** and upstream of the mouthpiece **110**. The expansion chamber **108** comprises an open-ended hollow tube **134** made of, for example, cardboard, which is of substantially the same diameter as the aerosol-forming substrate **104**. To maintain the overall length of the aerosol generating article **100**, both the airflow directing element **106** and the mouthpiece **110** are shorter than the corresponding features in the aerosol generating article shown in FIG. **1**.

[0156] FIG. **3** shown an alternative aerosol generating article **100** according to the present invention. The aerosol generating article **100** shown in FIG. **3** is of largely identical construction to the aerosol generating article **100** shown in FIG. **1** and like reference numerals are used to identify common features. However, the at least one air inlet **132** is located 3 millimeters upstream of the distal end of the airflow directing element **106**.

[0157] In the aerosol generating article shown in FIG. **3**, air is drawn into the aerosol generating article **100** through the at least one air inlet **132**. This air first enters the aerosol-forming substrate **104** where it becomes entrained with volatile compounds from the aerosol-forming substrate **104**.

[0158] A first portion of the air then follows a first airflow pathway and passes into the distal end of the cavity **129**. The aerosol cools and condenses as it passes along the cavity **129**. A second portion of the air then follows a second airflow pathway and passes through the distal end of the air-permeable segment **128**. The air following the second airflow pathway then passes into the cavity **129** at a point downstream of the distal end of the cavity **129**.

[0159] Air following both the first and second airflow pathways pass through the proximal end of the cavity **129**, through the mouthpiece **110**, and out of the aerosol generating article **100**. The first and second airflow pathways are identified by dashed lines and arrows in FIG. **3**.

[0160] FIGS. **4** and **5** show the results of tests to determine the optimum cross sectional area for the cavity.

[0161] Four aerosol generating articles according to the present invention were manufactured. Each aerosol generating article had an airflow directing element with a cavity having a different cross sectional area. Each aerosol generating article was held at 22 degrees Celsius, at 40 percent relative humidity for 48 hours, and then kept in a sealed aluminum bag prior to assessment.

[0162] The downstream ends of each aerosol generating article was connected to a smoking machine, the combustible heat sources were ignited and each of the aerosol generating articles was subjected to the same puff cycle. Following the puff cycle, the aerosol-forming substrate and the air-permeable portion of the airflow directing elements were removed and the mass of glycerine, acting as an aerosol former, in each was measured.

[0163] FIG. **4** is a graph showing the mass of glycerine obtained from the aerosol-forming substrate as a function of the cross sectional area of the cavity. The mass of glycerine per aerosol-forming substrate is shown in milligrams on the vertical axis **210**, and the cross sectional area of the cavity in millimeters squared is shown on the horizontal axis **215**. As shown in the graph, the mass of glycerine obtained from the aerosol-forming substrate after use of the aerosol generating article increases as the diameter of the cavity increases.

[0164] As set out above, the provision of a cavity having a larger cross sectional area may lead to a greater proportion of the air following the second airflow pathway. Where the at least one air inlet is located downstream of the distal end of the airflow directing element, this may mean that a greater proportion of the air does not pass through the aerosol-forming substrate at all, meaning that the air following the second airflow pathway would not entrain glycerine from the aerosol-forming substrate. This may lead to the increase in the mass of glycerine remaining in the aerosol-forming substrate as the cross sectional area of the cavity increases.

[0165] FIG. **5** is a graph showing the mass of glycerine obtained from the air-permeable portion of the airflow directing element as a function of the cross sectional area of the cavity. The mass of glycerine per aerosol-forming substrate is shown in milligrams on the vertical axis **220**, and the cross sectional area of the cavity in millimeters squared is shown on the horizontal axis **215**. As shown in the graph, the mass of glycerine obtained from the air-permeable portion of the airflow directing element after use of the aerosol generating article decreases as the diameter of the cavity increases.

[0166] As set out above, the provision of a cavity having a smaller cross sectional area may lead to a greater proportion of the glycerine entrained by the airflow through the cavity being removed from the aerosol and adsorbed by the air-permeable portion of the air flow directing element. This may lead to an increase in the mass of glycerine remaining in the air-permeable portion of the air flow directing element as the cross sectional area of the cavity decreases.

[0167] Accordingly, the inventors have identified that to optimise the delivery of volatile constituents such as nicotine and glycerine, a balance needs to be struck between these two effects. In other words, the cross sectional area of the cavity must be selected to maximise the release of volatile constituents such as nicotine and glycerine from the aerosol-forming substrate while also minimizing the adsorption of nicotine by the air-permeable portion of the airflow directing element.

[0168] Furthermore, as can be seen from FIG. **5**, once the cross sectional area of the cavity gets to about 12 millimeters squared, the mass of glycerine observed in the air-permeable portion of the airflow directing element increases substantially. Accordingly, the inventors have identified that one way to optimise the delivery of volatile constituents such as nicotine and glycerine may be to provide a cavity having a cross sectional area of about 12 millimeters squared. This corresponds to a diameter of about 4 millimeters.

[0169] The specific embodiments and examples described above illustrate but do not limit the invention. It is to be understood that other embodiments of the invention may be made and the specific embodiments and examples described herein are not exhaustive.

[0170] For the purpose of the present description and claims, except where otherwise indicated, all numbers expressing amounts, quantities, percentages, and so forth, are to be understood as being modified in all instances by the term "about". Also, all ranges include the maximum and minimum points disclosed and include any intermediate ranges therein, which may or may not be specifically enumerated herein.

1.-**12**. (canceled)

13. An aerosol-generating article, comprising:

a heat source;

an aerosol-forming substrate downstream of the heat source;

an airflow-directing element downstream of the aerosol-forming substrate, the airflow-directing element comprising an air-permeable segment, the air-permeable segment defining a cavity;

at least one air inlet configured to allow air to be drawn into the aerosol-generating article;

a first airflow pathway; and

a second airflow pathway,

wherein the first airflow pathway extends from the at least one air inlet, through the aerosol-forming substrate, and into a distal end of the cavity,

wherein the second airflow pathway extends from the at least one air inlet, through the air-permeable segment, and into the cavity at a point downstream of the distal end of the cavity,

wherein the at least one air inlet is located downstream of the distal end of the airflow-directing element, and

wherein a longitudinal cross-sectional area of the cavity is at least 30 percent of a total longitudinal cross-sectional area of the aerosol-generating article.

14. The aerosol-generating article according to claim **13**, wherein the air-permeable segment comprises a material having a density of at least 0.05 milligrams per cubic millimetre.

15. The aerosol-generating article according to claim **13**, wherein the at least one air inlet is located no more than 3 millimetres downstream of the distal end of the airflow-directing element.

16. The aerosol-generating article according to claim **13**, wherein the first airflow pathway extends from the at least one air inlet, through the air-permeable segment, through the aerosol-forming substrate, and into the distal end of the cavity.

17. The aerosol-generating article according to claim **13**, wherein the second airflow pathway extends from the at least one air inlet, through the air-permeable segment, and directly into the cavity at a point downstream of the distal end of the cavity.

18. The aerosol-generating article according to claim **13**, wherein the at least one air inlet is located no more than 5 millimetres downstream of the distal end of the airflow-directing element.

19. The aerosol-generating article according to claim **13**, wherein a downstream end of the aerosol-forming substrate abuts an upstream end of the airflow-directing element.

20. The aerosol-generating article according to claim **13**, wherein the air-permeable segment is a cylindrical air-permeable segment and the cavity is a cylindrical cavity.

21. The aerosol-generating article according to claim **13**, wherein the cavity has a circle shaped cross-section, or a square shaped cross-section, or a cloverleaf shaped cross-section.

22. The aerosol-generating article according to claim **13**, wherein a longitudinal cross-sectional area of the cavity is less than or equal to 40 percent of a total longitudinal cross-sectional area of the aerosol-generating article.

* * * * *