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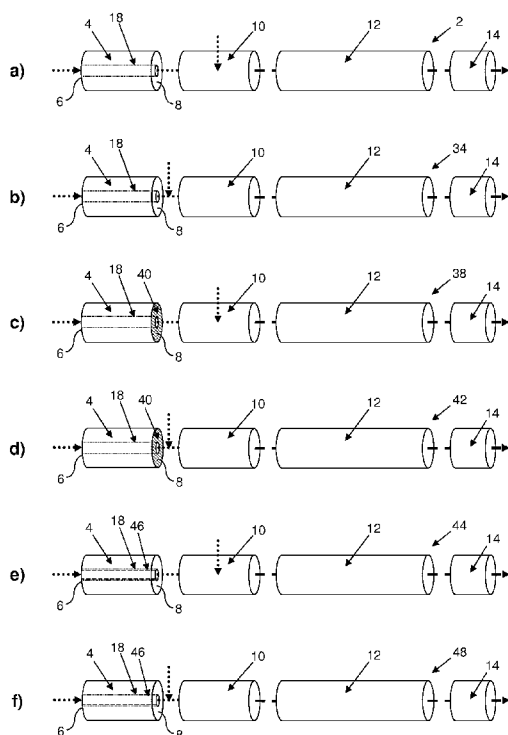
(54) Title: SMOKING ARTICLE COMPRISING A COMBUSTIBLE HEAT SOURCE WITH AT LEAST ONE AIRFLOW
CHANNEL

Figure 1

(57) Abstract: A smoking article (2, 34, 38, 42, 44, 48) comprises: a com-
bustible heat source (4) having opposed front (6) and rear faces (8); one or
more airflow channels (18) extending from the front face (6) to the rear face
(8) of the combustible heat source (4); an aerosol-forming substrate (10)
downstream of the rear face (8) of the combustible heat source (4); a mouth-
piece (14) downstream of the aerosol-forming substrate (10); and one or
more air inlets (32, 36) located downstream of the rear face (8) of the com-
bustible heat source (4) and upstream of the mouthpiece (14). The one or
more air inlets (32, 36) are located between the rear face (8) of the combus-
tible heat source (4) and a downstream end of the aerosol-forming substrate
(10). In use, air drawn through the aerosol-forming substrate (10) enters the
smoking article (2, 34, 38, 42, 44, 48) through the one or more airflow chan-
nels (18) and the one or more air inlets (32, 36) and at least some of the air
drawn through the aerosol-forming substrate (10) comes into direct contact
with a combustible portion of the combustible heat source (4).

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SMOKING ARTICLE COMPRISING A COMBUSTIBLE HEAT SOURCE WITH AT LEAST ONE AIRFLOW CHANNEL

The present invention relates to a smoking article comprising a combustible heat source
5 with opposed front and rear faces and at least one airflow channel and an aerosol-forming substrate downstream of the rear face of the combustible heat source.

A number of smoking articles in which tobacco is heated rather than combusted have been proposed in the art. One aim of such 'heated' smoking articles is to reduce known harmful smoke constituents of the type produced by the combustion and pyrolytic degradation of tobacco in conventional cigarettes. In one known type of heated smoking article, an aerosol is
10 generated by the transfer of heat from a combustible heat source to an aerosol-forming substrate. The aerosol-forming substrate may be located within, around or 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
15 through the smoking article. As the released compounds cool, they condense to form an aerosol that is inhaled by the user. Typically, air is 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 forced convection and conduction.

For example, WO-A2-2009/022232 discloses a smoking article comprising a combustible heat source, an aerosol-forming substrate downstream of the combustible heat source, and a heat-conducting element around and in direct contact with a rear portion of the combustible heat source and an adjacent front portion of the aerosol-forming substrate. To provide a controlled amount of forced convective heating of the aerosol-forming substrate, at
20 least one longitudinal airflow channel is provided through the combustible heat source.

In known heated smoking articles in which heat transfer from the combustible heat source to the aerosol-forming substrate occurs primarily by forced convection, the forced convective heat transfer and hence the temperature in the aerosol-forming substrate can vary considerably depending upon the puffing behaviour of a user. As a result, the composition and
30 hence the sensory properties of the mainstream aerosol generated by such known heated smoking articles may disadvantageously be highly sensitive to a user's puffing regime.

In addition, in known heated smoking articles comprising one or more airflow channels along the combustible heat source, direct contact between air drawn through the one or more airflow channels and the combustible heat source during puffing by a user results in activation
35 of combustion of the combustible heat source. Intense puffing regimes may therefore lead to sufficiently high forced convective heat transfer to cause spikes in the temperature of the aerosol-forming substrate, disadvantageously leading to pyrolysis and potentially even localised

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combustion of the aerosol-forming substrate. As used herein, the term 'spike' is used to describe a short-lived increase in the temperature of the aerosol-forming substrate. As a result, the levels of undesirable pyrolytic and combustion by-products in the mainstream aerosols generated by such known heated smoking articles may also disadvantageously vary significantly depending upon the particular puffing regime adopted by a user.

US 4,714,082 discloses smoking articles comprising a combustible fuel element, an aerosol generating means and a mouth end filter. In the embodiments shown in Figs. 1, 3, 4, 6, 7, 8 and 9 the combustible fuel element 10 comprises one or more longitudinally extending holes 16. In these embodiments there are no air inlets located between the rear face of the combustible fuel element 10 and the downstream end of the aerosol generating means 12. In the embodiment shown in FIG. 2 the aerosol generating means 12 includes a thermally stable carbonaceous substrate 28 and the combustible fuel element 24 is connected to the aerosol generating means 12 by a heat conductive rod 26 and by a foil lined paper tube 14. This embodiment includes a void space 30 between the combustible fuel element 10 and the substrate 28 and the portion of the foil lined tube 14 surrounding the void space 30 includes a plurality of peripheral holes 32 which permit sufficient air to enter the void space to provide appropriate pressure drop. In this embodiment the combustible fuel element 24 does not include any longitudinally extending holes 16.

It is known to include additives in the combustible heat sources of heated smoking articles in order to improve the ignition and combustion properties of the combustible heat sources. However, the inclusion of ignition and combustion additives can give rise to decomposition and reaction products, which may disadvantageously enter air drawn through one or more airflow channels provided along the combustible heat source of such known heated smoking articles during use thereof.

To facilitate aerosol formation, the aerosol-forming substrates of heated smoking articles typically comprise a polyhydric alcohol, such as glycerine, or other known aerosol-formers. During storage and smoking, such aerosol-formers may migrate from the aerosol-forming substrates of known heated smoking articles to the combustible heat sources thereof. Migration of aerosol-formers to the combustible heat sources of known heated smoking articles can disadvantageously lead to decomposition of the aerosol-formers, particularly during smoking of the heated smoking articles.

There remains a need for heated smoking articles comprising a combustible heat source with opposed front and rear faces and an aerosol-forming substrate downstream of the rear face of the combustible heat source in which spikes in the temperature of the aerosol-forming substrate are avoided under intense puffing regimes. In particular, there remains a need for heated smoking articles comprising a combustible heat source with opposed front and rear faces and an aerosol-forming substrate downstream of the rear face of the combustible heat

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source in which substantially no combustion or pyrolysis of the aerosol-forming substrate occurs under intense puffing regimes.

According to the invention, there is provided a smoking article comprising: a combustible heat source having opposed front and rear faces; one or more airflow channels extending from the front face to the rear face of the combustible heat source; an aerosol-forming substrate downstream of the rear face of the combustible heat source; a mouthpiece downstream of the aerosol-forming substrate; and one or more air inlets located downstream of the rear face of the combustible heat source and upstream of the mouthpiece. The one or more air inlets are located between the rear face of the combustible heat source and a downstream end of the aerosol-forming substrate. In use, air drawn through the aerosol-forming substrate enters the smoking article through the one or more airflow channels and the one or more air inlets and at least some of the air drawn through the aerosol-forming substrate comes into direct contact with a combustible portion of the combustible heat source.

As used herein, 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 smoking 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.

The aerosol-forming substrate may be in the form of a plug or segment comprising a material capable of releasing upon heating volatile compounds, which can form an aerosol, circumscribed by a wrapper. Where an aerosol-forming substrate is in the form of such a plug or segment, the entire plug or segment including the wrapper is considered to be the aerosol-forming substrate.

As used herein, the terms 'distal', 'upstream' and 'front', and 'proximal', 'downstream' and 'rear', are used to describe the relative positions of components, or portions of components, of the smoking article in relation to the direction in which a user draws on the smoking article during use thereof. Smoking articles according to the invention comprise a proximal end through which, in use, an aerosol exits the smoking article for delivery to a user. The proximal end of the smoking article may also be referred to as the mouth end. In use, a user draws on the proximal end of the smoking article in order to inhale an aerosol generated by the smoking article.

The combustible heat source is located at or proximate to the distal end. The mouthpiece is located at the proximal end. The mouth end is downstream of the distal end. The proximal end may also be referred to as the downstream end of the smoking article and the distal end may also be referred to as upstream end of the smoking article. Components, or portions of components, of smoking articles according to the invention may be described as

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being upstream or downstream of one another based on their relative positions between the proximal end and the distal end of the smoking article.

The front face of the combustible heat source is at the upstream end of the combustible heat source. The upstream end of the combustible heat source is the end of the combustible heat source furthest from the proximal end of the smoking article. The rear face of the combustible heat source is at the downstream end of the combustible heat source. The downstream end of the combustible heat source is the end of the combustible heat source closest to the proximal end of the smoking article.

As used herein, the term 'length' is used to describe the maximum dimension in the longitudinal direction of the smoking article. That is, the maximum dimension in the direction between the proximal end and the opposed distal end of the smoking article.

As used herein, the term 'airflow channel' is used to describe a channel extending along the length of a combustible heat source through which air may be drawn downstream for inhalation by a user.

As used herein, the term 'direct contact' is used to describe contact between a surface of a combustible portion of the combustible heat source and at least some of the air that enters the smoking article through the one or more airflow channels and the one or more air inlets and is drawn through the aerosol-forming substrate.

Smoking articles according to the invention comprise a non-blind combustible heat source. As used herein, the term 'non-blind' is used to describe a combustible heat source including at least one airflow channel.

The one or more airflow channels may comprise one or more enclosed airflow channels.

As used herein, the term 'enclosed' is used to describe airflow channels that extend through the interior of the combustible heat source and are surrounded by the combustible heat source.

Alternatively or in addition, the one or more airflow channels may comprise one or more non-enclosed airflow channels. For example, the one or more airflow pathways may comprise one or more grooves or other non-enclosed airflow channels that extend along the exterior of the combustible heat source.

The one or more airflow channels may comprise one or more enclosed airflow channels or one or more non-enclosed airflow channels or a combination thereof.

In certain embodiments, smoking articles according to the invention comprise one, two or three airflow channels extending from the front face to the rear face of the combustible heat source.

In preferred embodiments, smoking articles according to the invention comprise a single airflow channel extending from the front face to the rear face of the combustible heat source.

In particularly preferred embodiments, smoking articles according to the invention

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comprise comprises a single substantially central or axial airflow channel extending from the front face to the rear face of the combustible heat source.

In such embodiments, the diameter of the single airflow channel is preferably between about 1.5 mm and about 3 mm.

5 It will be appreciated that in addition to one or more airflow channels through which air may be drawn for inhalation by a user, combustible heat sources of smoking articles according to the invention may also comprise one or more closed or blocked passageways through which air may not be drawn for inhalation by a user.

For example, smoking articles according to the invention may comprise combustible
10 heat sources comprising one or more airflow channels extending from the front face to the rear face of the combustible heat source and one or more closed passageways that extend from the front face of the combustible heat source only part way along the length combustible heat source.

The inclusion of one or more closed air passageways increases the surface area of the
15 combustible heat source that is exposed to oxygen from the air and may advantageously facilitate ignition and sustained combustion of the combustible heat source.

Smoking articles according to the invention comprise one or more air inlets located downstream of the rear face of the combustible heat source and upstream of the mouthpiece.

As used herein, the term 'air inlet' is used to describe a hole, slit, slot or other aperture
20 through which air may be drawn into the smoking article.

The one or more air inlets are located between the rear face of the combustible heat source and a downstream end of the aerosol-forming substrate. The one or more air inlets do not comprise any air inlets located between the downstream end of the aerosol-forming substrate and an upstream end of the mouthpiece. In other words, smoking articles according
25 to the invention do not comprise any air inlets located downstream of the aerosol-forming substrate and upstream of the mouthpiece.

The number, shape, size and location of the air inlets may be appropriately adjusted to achieve a good smoking performance.

In use, air drawn through the aerosol-forming substrate of the smoking article enters the
30 smoking article through the one or more airflow channels and the one or more air inlets. The drawn air passes downstream through the smoking article to the mouthpiece and exits the smoking article through the proximal end thereof.

In use at least some of the air drawn through the aerosol-forming substrate comes into direct contact with a combustible portion of the combustible heat source.

35 The air drawn through the aerosol-forming substrate of the smoking article that enters the smoking article through the one or more airflow channels may come into direct contact with a combustible portion of the combustible heat source as it passes through the one or more

airflow channels.

Alternatively or in addition, the air drawn through the aerosol-forming substrate of the smoking article that enters the smoking article through the one or more airflow channels may come into direct contact with the rear face of the combustible heat source. In such
5 embodiments, the air drawn through the aerosol-forming substrate of the smoking article that enters the smoking article through the one or more air inlets may also come into direct contact with the rear face of the combustible heat source.

In smoking articles according to the invention heating of the aerosol-forming substrate occurs by conduction and forced convection.

10 During puffing by a user, cool air drawn through the one or more air inlets between the rear face of the combustible heat source and the aerosol-forming substrate advantageously reduces the temperature of the aerosol-forming substrate of smoking articles according to the invention. This advantageously substantially prevents or inhibits spikes in the temperature of the aerosol-forming substrate of smoking articles according to the invention during puffing by a
15 user.

As used herein, the term 'cool air' is used to describe ambient air that is not significantly heated by the combustible heat source upon puffing by a user.

By preventing or inhibiting spikes in the temperature of the aerosol-forming substrate, the inclusion of one or more air inlets between the rear face of the combustible heat source and
20 a downstream end of the aerosol-forming substrate, advantageously helps to avoid or reduce combustion or pyrolysis of the aerosol-forming substrate of smoking articles according to the invention under intense puffing regimes. In addition, the inclusion of one or more air inlets between the rear face of the combustible heat source and a downstream end of the aerosol-forming substrate advantageously helps to minimise or reduce the impact of a user's puffing
25 regime on the composition of the mainstream aerosol of smoking articles according to the invention.

The one or more air inlets may comprise one or more first inlets around the periphery of the aerosol-forming substrate through which air may be drawn into the aerosol-forming substrate. In such embodiments, in use, cool air is drawn into the aerosol-forming substrate of
30 the smoking article through the first air inlets. The air drawn into the aerosol-forming substrate through the first air inlets passes downstream through the smoking article from the aerosol-forming substrate to the mouthpiece and exits the smoking article through the proximal end thereof.

During puffing by a user, cool air drawn through the one or more first inlets around the
35 periphery of the aerosol-forming substrate advantageously reduces the temperature of the aerosol-forming substrate of smoking articles according to the invention. This advantageously

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substantially prevents or inhibits spikes in the temperature of the aerosol-forming substrate of smoking articles according to the invention during puffing by a user.

In certain preferred embodiments, the one or more first air inlets are located proximate to the downstream end of the aerosol-forming substrate.

5 In certain embodiments, the aerosol-forming substrate may abut the rear face of the combustible heat source or a non-combustible substantially air impermeable first barrier coating provided on the rear face of the combustible heat source.

As used herein, the term 'abut' is used to describe the aerosol-forming substrate being in direct contact with the rear face of the combustible heat source or a non-combustible
10 substantially air impermeable first barrier coating provided on the rear face of the combustible heat source.

In other embodiments, the aerosol-forming substrate may be spaced apart from the rear face of the combustible heat source. That is, there may be a space or gap between the aerosol-forming substrate and the rear face of the combustible heat source.

15 In such embodiments, the one or more air inlets may comprise one or more second air inlets between the rear face of the combustible heat source and the aerosol-forming substrate. In use, cool air is drawn into the space between the combustible heat source and the aerosol-forming substrate through the second air inlets. The air drawn into the space between the combustible heat source and the aerosol-forming substrate through the second air inlets passes
20 downstream through the smoking article from the space between the combustible heat source and the aerosol-forming substrate to the mouthpiece and exits the smoking article through the proximal end thereof.

During puffing by a user, cool air drawn through the one or more second inlets between the rear face of the combustible heat source and the aerosol-forming substrate advantageously
25 reduces the temperature of the aerosol-forming substrate of smoking articles according to the invention. This advantageously substantially prevents or inhibits spikes in the temperature of the aerosol-forming substrate of smoking articles according to the invention during puffing by a user.

It will be appreciated that smoking articles according to the invention may comprise one
30 or more first air inlets around the periphery of the aerosol-forming substrate, or one or more second air inlets between the rear face of the combustible heat source and the aerosol-forming substrate, or a combination of one or more first air inlets around the periphery of the aerosol-forming substrate and one or more second air inlets between the rear face of the combustible heat source and the aerosol-forming substrate.

35 Smoking articles according to the invention may further comprise either (i) a non-combustible, substantially air impermeable first barrier between the rear face of the combustible heat source and the aerosol-forming substrate or (ii) a non-combustible substantially air

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impermeable second barrier between the combustible heat source and the one or more airflow channels.

It will be appreciated that smoking articles according to the invention may not comprise both (i) a non-combustible, substantially air impermeable first barrier between the rear face of the combustible heat source and the aerosol-forming substrate and (ii) a non-combustible substantially air impermeable second barrier between the combustible heat source and the one or more airflow channels.

As used herein, the term 'non-combustible' is used to describe a barrier that is substantially non-combustible at temperatures reached by the combustible heat source during combustion and ignition thereof.

Where smoking articles according to the invention further comprise (i) a non-combustible substantially air impermeable first barrier between the rear face of the combustible heat source and the aerosol-forming substrate, air drawn through the aerosol-forming substrate that enters the smoking article through the one or more airflow channels and the one or more air inlets does not come into direct contact with the rear face of the combustible heat source. However, in such embodiments, air drawn through the aerosol-forming substrate that enters the smoking article through the one or more airflow channels does come into direct contact with a combustible portion of the combustible heat source as it passes through the one or more airflow channels.

In such embodiments, the first barrier allows air entering the smoking article through the one or more airflow channels to be drawn downstream through the smoking article.

The first barrier may abut one or both of the rear face of the combustible heat source and the aerosol-forming substrate. Alternatively, the first barrier may be spaced apart from one or both of the aerosol-forming substrate and the mouthpiece.

The first barrier may be adhered or otherwise affixed to one or both of the rear face of the combustible heat source and the aerosol-forming substrate.

In certain preferred embodiments, the first barrier comprises a non-combustible substantially air impermeable first barrier coating provided on the rear face of the combustible heat source. In such embodiments, preferably the first barrier comprises a first barrier coating provided on at least substantially the entire rear face of the combustible heat source. More preferably, the first barrier comprises a first barrier coating provided on the entire rear face of the combustible heat source.

In such embodiments, the first barrier coating allows air to be drawn downstream through the one or more airflow channels extending from the front face to the rear face of the combustible heat source.

As used herein, the term 'coating' is used to describe a layer of material that covers and is adhered to the combustible heat source.

The first barrier may advantageously limit the temperature to which the aerosol-forming substrate is exposed during ignition and combustion of the combustible heat source, and so help to avoid or reduce thermal degradation or combustion of the aerosol-forming substrate during use of the smoking article. This is particularly advantageous where the combustible heat source comprises one or more additives to aid ignition of the combustible heat source.

Inclusion of a non-combustible substantially air impermeable first barrier between the rear face of the combustible heat source and the aerosol-forming substrate may also advantageously substantially prevent or inhibit migration of components of the aerosol-forming substrate of smoking articles according to the invention to the combustible heat source during storage of the smoking articles.

Alternatively or in addition, inclusion of a non-combustible substantially air impermeable first barrier between the rear face of the combustible heat source and the aerosol-forming substrate may advantageously substantially prevent or inhibit migration of components of the aerosol-forming substrate of smoking articles according to the invention to the combustible heat source during use of the smoking articles.

Inclusion of a non-combustible substantially air impermeable first barrier between the rear face of the combustible heat source and the aerosol-forming substrate may be particularly advantageous where the aerosol-forming substrate comprises at least one aerosol-former.

In such embodiments, inclusion of a non-combustible substantially air impermeable first barrier between the rear face of the combustible heat source and the aerosol-forming substrate may advantageously prevent or inhibit migration of the at least one aerosol-former from the aerosol-forming substrate to the combustible heat source during storage and use of the smoking article. Decomposition of the at least one aerosol-former during use of the smoking articles may thus be advantageously substantially avoided or reduced.

Depending upon the desired characteristics and performance of the smoking article, the first barrier may have a low thermal conductivity or a high thermal conductivity. In certain embodiments, the first barrier may be formed from material having a bulk thermal conductivity of between about 0.1 W per metre Kelvin ($W/(m \cdot K)$) and about 200 W per metre Kelvin ($W/(m \cdot K)$), at 23°C and a relative humidity of 50% as measured using the modified transient plane source (MTPS) method.

The thickness of the first barrier may be appropriately adjusted to achieve good smoking performance. In certain embodiments, the first barrier may have a thickness of between about 10 microns and about 500 microns.

The first barrier may be formed from one or more suitable materials that are substantially thermally stable and non-combustible at temperatures achieved by the combustible heat source during ignition and combustion. Suitable materials are known in the art and include, but are not limited to, clays (such as, for example, bentonite and kaolinite), glasses, minerals, ceramic

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materials, resins, metals and combinations thereof.

Preferred materials from which the first barrier may be formed include clays and glasses. More preferred materials from which the first barrier may be formed include copper, aluminium, stainless steel, alloys, alumina (Al_2O_3), resins, and mineral glues.

5 In certain preferred embodiments, the first barrier comprises a clay coating comprising a 50/50 mixture of bentonite and kaolinite provided on the rear face of the combustible heat source. In other preferred embodiments, the first barrier comprises a glass coating, more preferably a sintered glass coating, provided on the rear face of the combustible heat source.

10 In certain particularly preferred embodiments, the first barrier comprises an aluminium coating provided on the rear face of the combustible heat source.

Preferably, the first barrier has a thickness of at least about 10 microns.

Due to the slight permeability of clays to air, in embodiments where the first barrier comprises a clay coating provided on the rear face of the combustible heat source, the clay coating more preferably has a thickness of at least about 50 microns, and most preferably of 15 between about 50 microns and about 350 microns.

In embodiments where the first barrier is formed from one or more materials that are more impervious to air, such as aluminium, the first barrier may be thinner, and generally will preferably have a thickness of less than about 100 microns, and more preferably of about 20 microns.

20 In embodiments where the first barrier comprises a glass coating provided on the rear face of the combustible heat source, the glass coating preferably has a thickness of less than about 200 microns.

The thickness of the first barrier may be measured using a microscope, a scanning electron microscope (SEM) or any other suitable measurement methods known in the art.

25 Where the first barrier comprises a first barrier coating provided on the rear face of the combustible heat source, the first barrier coating may be applied to cover and adhere to the rear face of the combustible heat source by any suitable methods known in the art including, but not limited to, spray-coating, vapour deposition, dipping, material transfer (for example, brushing or gluing), electrostatic deposition or any combination thereof.

30 For example, the first barrier coating may be made by pre-forming a barrier in the approximate size and shape of the rear face of the combustible heat source, and applying it to the rear face of the combustible heat source to cover and adhere to at least substantially the entire rear face of the combustible heat source. Alternatively, the first barrier coating may be cut or otherwise machined after it is applied to the rear face of the combustible heat source. In 35 one preferred embodiment, aluminium foil is applied to the rear face of the combustible heat source by gluing or pressing it to the combustible heat source, and is cut or otherwise machined so that the aluminium foil covers and adheres to at least substantially the entire rear face of the

combustible heat source, preferably to the entire rear face of the combustible heat source.

In another preferred embodiment, the first barrier coating is formed by applying a solution or suspension of one or more suitable coating materials to the rear face of the combustible heat source. For example, the first barrier coating may be applied to the rear face of the combustible heat source by dipping the rear face of the combustible heat source in a solution or suspension of one or more suitable coating materials or by brushing or spray-coating a solution or suspension or electrostatically depositing a powder or powder mixture of one or more suitable coating materials onto the rear face of the combustible heat source. Where the first barrier coating is applied to the rear face of the combustible heat source by electrostatically depositing a powder or powder mixture of one or more suitable coating materials onto the rear face of the combustible heat source, the rear face of the combustible heat source is preferably pre-treated with water glass before electrostatic deposition. Preferably, the first barrier coating is applied by spray-coating.

The first barrier coating may be formed through a single application of a solution or suspension of one or more suitable coating materials to the rear face of the combustible heat source. Alternatively, the first barrier coating may be formed through multiple applications of a solution or suspension of one or more suitable coating materials to the rear face of the combustible heat source. For example, the first barrier coating may be formed through one, two, three, four, five, six, seven or eight successive applications of a solution or suspension of one or more suitable coating materials to the rear face of the combustible heat source.

Preferably, the first barrier coating is formed through between one and ten applications of a solution or suspension of one or more suitable coating materials to the rear face of the combustible heat source.

After application of the solution or suspension of one or more coating materials to the rear face thereof, the combustible heat source may be dried to form the first barrier coating.

Where the first barrier coating is formed through multiple applications of a solution or suspension of one or more suitable coating materials to the rear face thereof, the combustible heat source may need to be dried between successive applications of the solution or suspension.

Alternatively or in addition to drying, after application of a solution or suspension of one or more coating materials to the rear face of the combustible heat source, the coating material on the combustible heat source may be sintered in order to form the first barrier coating. Sintering of the first barrier coating is particularly preferred where the first barrier coating is a glass or ceramic coating. Preferably, the first barrier coating is sintered at a temperature of between about 500°C and about 900°C, and more preferably at about 700°C.

Where smoking articles according to the invention further comprise (ii) a non-combustible substantially air impermeable second barrier between the combustible heat source

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and the one or more airflow channels, air drawn through the aerosol-forming substrate that enters the smoking article through the one or more airflow channels does not come into direct contact with a combustible portion of the combustible heat source as it passes through the one or more airflow channels. However, in such embodiments, air drawn through the aerosol-forming substrate that enters the smoking article through the one or more airflow channels does come into direct contact with the rear face of the combustible heat source. In such embodiments, air drawn through the aerosol-forming substrate that enters the smoking article through the one or more air inlets may also come into direct contact with the rear face of the combustible heat source.

The second barrier may advantageously substantially prevent or inhibit combustion and decomposition products formed during ignition and combustion of the combustible heat source of smoking articles according to the invention from entering air drawn into smoking articles according to the invention through the one or more airflow channels as the drawn air passes through the one or more airflow channels. This is particularly advantageous where the combustible heat source comprises one or more additives to aid ignition or combustion of the combustible heat source.

Inclusion of a non-combustible substantially air impermeable second barrier between the combustible heat source and the one or more airflow channels may also advantageously substantially prevent or inhibit activation of combustion of the combustible heat source of smoking articles according to the invention 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 of smoking articles according to the invention 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 of smoking articles according to the invention may be advantageously minimised or reduced.

The second barrier may be adhered or otherwise affixed to the combustible heat source.

In certain preferred embodiments, the second barrier comprises a non-combustible substantially air impermeable second barrier coating provided on an inner surface of the one or more airflow channels. In such embodiments, preferably the second barrier comprises a second barrier coating provided on at least substantially the entire inner surface of the one or more airflow channels. More preferably, the second barrier comprises a second barrier coating provided on the entire inner surface of the one or more airflow channels.

In other embodiments, the second barrier coating may be provided by insertion of a liner into the one or more airflow channels. For example, where the one or more airflow channels

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comprise one or more enclosed airflow channels that extend through the interior of the combustible heat source, a non-combustible substantially air impermeable hollow tube may be inserted into each of the one or more airflow channels.

Depending upon the desired characteristics and performance of the smoking article, the second barrier may have a low thermal conductivity or a high thermal conductivity. Preferably, the second barrier has a low thermal conductivity.

The thickness of the second barrier may be appropriately adjusted to achieve good smoking performance. In certain embodiments, the second barrier may have a thickness of between about 30 microns and about 200 microns. In a preferred embodiment, the second barrier has a thickness of between about 30 microns and about 100 microns.

The second barrier may be formed from one or more suitable materials that are substantially thermally stable and non-combustible at temperatures achieved by the combustible heat source during ignition and combustion. Suitable materials are known in the art and include, but are not limited to, for example: clays; metal oxides, such as iron oxide, alumina, titania, silica, silica-alumina, zirconia and ceria; zeolites; zirconium phosphate; and other ceramic materials or combinations thereof.

Preferred materials from which the second barrier may be formed include clays, glasses, aluminium, iron oxide and combinations thereof. If desired, catalytic ingredients, such as ingredients that promote the oxidation of carbon monoxide to carbon dioxide, may be incorporated in the second barrier. Suitable catalytic ingredients include, but are not limited to, for example, platinum, palladium, transition metals and their oxides.

Where the second barrier comprises a second barrier coating provided on an inner surface of the one or more airflow channels, the second barrier coating may be applied to the inner surface of the one or more airflow channels by any suitable method, such as the methods described in US-A-5,040,551. For example, the inner surface of the one or more airflow channels may be sprayed, wetted or painted with a solution or a suspension of the second barrier coating. In certain preferred embodiments, the second barrier coating is applied to the inner surface of the one or more airflow channels by the process described in WO-A2-2009/074870 as the combustible heat source is extruded.

Preferably, smoking articles according to the invention comprise an outer wrapper that circumscribes the aerosol-forming substrate and at least a rear portion of the combustible heat source. The outer wrapper should grip the combustible heat source and the aerosol-forming substrate of the smoking article when the smoking article is assembled.

More preferably, smoking articles according to the invention comprise an outer wrapper that circumscribes the mouthpiece, the aerosol-forming substrate, any other components of the smoking article downstream of the aerosol-forming substrate and upstream of the mouthpiece, and at least a rear portion of the combustible heat source.

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Preferably, the outer wrapper is substantially air impermeable.

Smoking articles according to the invention may comprise outer wrappers formed from any suitable material or combination of materials. Suitable materials are well known in the art and include, but are not limited to, cigarette paper.

5 The one or more air inlets located between the rear face of the combustible heat source and the downstream end of the aerosol-forming substrate are provided in the outer wrapper and any other materials circumscribing components of smoking articles according to the invention through which air may be drawn into the one or more airflow pathways.

10 Where the one or more air inlets comprise one or more first air inlets around the periphery of the aerosol-forming substrate, the one or more first air inlets are provided in the outer wrapper and any other materials circumscribing the aerosol-forming substrate.

 Where the one or more air inlets comprise one or more second air inlets between the rear face of the combustible heat source and the aerosol-forming substrate, the one or more second air inlets are provided in the outer wrapper and any underlying materials.

15 Preferably, the combustible heat source is a carbonaceous heat source. As used herein, the term 'carbonaceous' is used to describe a combustible heat source comprising carbon. Preferably, combustible carbonaceous heat sources for use in smoking articles according to the invention have a carbon content of at least about 35 percent, more preferably of at least about 40 percent, most preferably of at least about 45 percent by dry weight of the combustible heat
20 source.

 In some embodiments, combustible heat sources according to the invention are combustible carbon-based heat sources. As used herein, the term 'carbon-based heat source' is used to describe a heat source comprised primarily of carbon.

25 Combustible carbon-based heat sources for use in smoking articles according to the invention have a carbon content of at least about 50 percent. For example, combustible carbon-based heat sources for use in smoking articles according to the invention may have a carbon content of at least about 60 percent, or at least about 70 percent, or at least about 80 percent by dry weight of the combustible carbon-based heat source.

30 Smoking articles according to the invention may comprise combustible carbonaceous heat sources formed from one or more suitable carbon-containing materials.

 If desired, one or more binders may be combined with the one or more carbon-containing materials. Preferably, the one or more binders are organic binders. Suitable known organic binders, include but are not limited to, gums (for example, guar gum), modified celluloses and cellulose derivatives (for example, methyl cellulose, carboxymethyl cellulose,
35 hydroxypropyl cellulose and hydroxypropyl methylcellulose) flour, starches, sugars, vegetable oils and combinations thereof.

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In one preferred embodiment, the combustible heat source is formed from a mixture of carbon powder, modified cellulose, flour and sugar.

Instead of, or in addition to one or more binders, combustible heat sources for use in smoking articles according to the invention may comprise one or more additives in order to improve the properties of the combustible heat source. Suitable additives include, but are not limited to, additives to promote consolidation of the combustible heat source (for example, sintering aids), additives to promote ignition of the combustible heat source (for example, oxidisers such as perchlorates, chlorates, nitrates, peroxides, permanganates, zirconium and combinations thereof), additives to promote combustion of the combustible heat source (for example, potassium and potassium salts, such as potassium citrate) and additives to promote decomposition of one or more gases produced by combustion of the combustible heat source (for example catalysts, such as CuO , Fe_2O_3 and Al_2O_3).

Where smoking articles according to the invention comprise a first barrier coating provided on the rear face of the combustible heat source, such additives may be incorporated in the combustible heat source prior to or after application of the first barrier coating to the rear face of the combustible heat source.

In certain preferred embodiments, the combustible heat source is a combustible carbonaceous heat source comprising carbon and at least one ignition aid. In one preferred embodiment, the combustible heat source is a combustible carbonaceous heat source comprising carbon and at least one ignition aid as described in WO-A1-2012/164077.

As used herein, the term 'ignition aid' is used to denote a material that releases one or both of energy and oxygen during ignition of the combustible heat source, where the rate of release of one or both of energy and oxygen by the material is not ambient oxygen diffusion limited. In other words, the rate of release of one or both of energy and oxygen by the material during ignition of the combustible heat source is largely independent of the rate at which ambient oxygen can reach the material. As used herein, the term 'ignition aid' is also used to denote an elemental metal that releases energy during ignition of the combustible heat source, wherein the ignition temperature of the elemental metal is below about 500 °C and the heat of combustion of the elemental metal is at least about 5 kJ/g.

As used herein, the term 'ignition aid' does not include alkali metal salts of carboxylic acids (such as alkali metal citrate salts, alkali metal acetate salts and alkali metal succinate salts), alkali metal halide salts (such as alkali metal chloride salts), alkali metal carbonate salts or alkali metal phosphate salts, which are believed to modify carbon combustion. Even when present in a large amount relative to the total weight of the combustible heat source, such alkali metal burn salts do not release enough energy during ignition of a combustible heat source to produce an acceptable aerosol during early puffs.

Examples of suitable oxidizing agents include, but are not limited to: nitrates such as, for example, potassium nitrate, calcium nitrate, strontium nitrate, sodium nitrate, barium nitrate, lithium nitrate, aluminium nitrate and iron nitrate; nitrites; other organic and inorganic nitro compounds; chlorates such as, for example, sodium chlorate and potassium chlorate; perchlorates such as, for example, sodium perchlorate; chlorites; bromates such as, for example, sodium bromate and potassium bromate; perbromates; bromites; borates such as, for example, sodium borate and potassium borate; ferrates such as, for example, barium ferrate; ferrites; manganates such as, for example, potassium manganate; permanganates such as, for example, potassium permanganate; organic peroxides such as, for example, benzoyl peroxide and acetone peroxide; inorganic peroxides such as, for example, hydrogen peroxide, strontium peroxide, magnesium peroxide, calcium peroxide, barium peroxide, zinc peroxide and lithium peroxide; superoxides such as, for example, potassium superoxide and sodium superoxide; iodates; periodates; iodites; sulphates; sulfites; other sulfoxides; phosphates; phosphinates; phosphites; and phosphanites.

While advantageously improving the ignition and combustion properties of the combustible heat source, the inclusion of ignition and combustion additives can give rise to undesirable decomposition and reaction products during use of the smoking article. For example, decomposition of nitrates included in the combustible heat source to aid ignition thereof can result in the formation of nitrogen oxides.

The inclusion of a non-combustible substantially air impermeable second barrier between the one or more airflow channels and the combustible heat source of smoking articles according to the invention may advantageously substantially prevent or inhibit such decomposition and reaction products from entering air drawn into smoking articles according to the invention through the one or more airflow channels as the drawn air passes through the one or more airflow channels.

Combustible carbonaceous heat sources for use in smoking articles according to the invention may be prepared as described in prior art that is known to persons of ordinary skill in the art.

Combustible carbonaceous heat sources for use in smoking articles according to the invention, are preferably formed by mixing one or more carbon-containing materials with one or more binders and other additives, where included, and pre-forming the mixture into a desired shape. The mixture of one or more carbon containing materials, one or more binders and optional other additives may be pre-formed into a desired shape using any suitable known ceramic forming methods such as, for example, slip casting, extrusion, injection moulding and die compaction or pressing. In certain preferred embodiments, the mixture is pre-formed into a desired shape by pressing or extrusion or a combination thereof.

Preferably, the mixture of one or more carbon-containing materials, one or more binders

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and other additives is pre-formed into an elongate rod. However, it will be appreciated that the mixture of one or more carbon-containing materials, one or more binders and other additives may be pre-formed into other desired shapes.

After formation, particularly after extrusion, the elongate rod or other desired shape is preferably dried to reduce its moisture content and then pyrolysed in a non-oxidizing atmosphere at a temperature sufficient to carbonise the one or more binders, where present, and substantially eliminate any volatiles in the elongate rod or other shape. The elongate rod or other desired shape is pyrolysed preferably in a nitrogen atmosphere at a temperature of between about 700°C and about 900°C.

In certain embodiments, at least one metal nitrate salt is incorporated in the combustible heat source by including at least one metal nitrate precursor in the mixture of one or more carbon containing materials, one or more binders and other additives. The at least one metal nitrate precursor is then subsequently converted in-situ into at least one metal nitrate salt by treating the pyrolysed pre-formed cylindrical rod or other shape with an aqueous solution of nitric acid. In one embodiment, the combustible heat source comprises at least one metal nitrate salt having a thermal decomposition temperature of less than about 600°C, more preferably of less than about 400°C. Preferably, the at least one metal nitrate salt has a decomposition temperature of between about 150°C and about 600°C, more preferably of between about 200°C and about 400°C.

In preferred embodiments, exposure of the combustible heat source to a conventional yellow flame lighter or other ignition means should cause the at least one metal nitrate salt to decompose and release oxygen and energy. This decomposition causes an initial boost in the temperature of the combustible heat source and also aids in the ignition of the combustible heat source. After decomposition of the at least one metal nitrate salt, the combustible heat source preferably continues to combust at a lower temperature.

The inclusion of at least one metal nitrate salt advantageously results in ignition of the combustible heat source being initiated internally, and not only at a point on the surface thereof. Preferably, the at least one metal nitrate salt is present in the combustible heat source in an amount of between about 20 percent by dry weight and about 50 percent by dry weight of the combustible heat source.

In other embodiments, the combustible heat source comprises at least one peroxide or superoxide that actively evolves oxygen at a temperature of less than about 600°C, more preferably at a temperature of less than about 400°C.

Preferably, the at least one peroxide or superoxide actively evolves oxygen at a temperature of between about 150°C and about 600°C, more preferably at a temperature of between about 200°C and about 400°C, most preferably at a temperature of about 350°C.

In use, exposure of the combustible heat source to a conventional yellow flame lighter or other ignition means should cause the at least one peroxide or superoxide to decompose and release oxygen. This causes an initial boost in the temperature of the combustible heat source and also aids in the ignition of the combustible heat source. After decomposition of the at least one peroxide or superoxide, the combustible heat source preferably continues to combust at a lower temperature.

The inclusion of at least one peroxide or superoxide advantageously results in ignition of the combustible heat source being initiated internally, and not only at a point on the surface thereof.

The combustible heat source preferably has a porosity of between about 20 percent and about 80 percent, more preferably of between about 20 percent and 60 percent. Where the combustible heat source comprises at least one metal nitrate salt, this advantageously allows oxygen to diffuse into the mass of the combustible heat source at a rate sufficient to sustain combustion as the at least one metal nitrate salt decomposes and combustion proceeds. Even more preferably, the combustible heat source has a porosity of between about 50 percent and about 70 percent, more preferably of between about 50 percent and about 60 percent as measured by, for example, mercury porosimetry or helium pycnometry. The required porosity may be readily achieved during production of the combustible heat source using conventional methods and technology.

Advantageously, combustible carbonaceous heat sources for use in smoking articles according to the invention have an apparent density of between about 0.6 g/cm³ and about 1 g/cm³.

Preferably, the combustible heat source has a mass of between about 300 mg and about 500 mg, more preferably of between about 400 mg and about 450 mg.

Preferably, the combustible heat source has a length of between about 7 mm and about 17 mm, more preferably of between about 7 mm and about 15 mm, most preferably of between about 7 mm and about 13 mm.

Preferably, the combustible heat source has a diameter of between about 5 mm and about 9 mm, more preferably of between about 7 mm and about 8 mm.

Preferably, the combustible heat source is of substantially uniform diameter. However, the combustible heat source may alternatively be tapered so that the diameter of a rear portion of the combustible heat source is greater than the diameter of a front portion thereof. Particularly preferred are combustible heat sources that are substantially cylindrical. The combustible heat source may, for example, be a cylinder or tapered cylinder of substantially circular cross-section or a cylinder or tapered cylinder of substantially elliptical cross-section.

Smoking articles according to the invention preferably comprise an aerosol-forming substrate comprising at least one aerosol-former and a material capable of releasing volatile

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compounds in response to heating. The aerosol-forming substrate may comprise other additives and ingredients including, but not limited to, humectants, flavourants, binders and mixtures thereof.

Preferably, the aerosol-forming substrate comprises nicotine. More preferably, the
5 aerosol-forming substrate comprises tobacco.

The at least one aerosol-former may be any suitable known compound or mixture of compounds that, in use, facilitates formation of a dense and stable aerosol and that is substantially resistant to thermal degradation at the operating temperature of the smoking article. Suitable aerosol-formers are well known in the art and include, for example, polyhydric
10 alcohols, esters of polyhydric alcohols, such as glycerol mono-, di- or triacetate, and aliphatic esters of mono-, di- or polycarboxylic acids, such as dimethyl dodecanedioate and dimethyl tetradecanedioate. Preferred aerosol formers for use in smoking articles according to the invention are polyhydric alcohols or mixtures thereof, such as triethylene glycol, 1,3-butanediol and, most preferred, glycerine.

15 The material capable of emitting volatile compounds in response to heating may be a charge of plant-based material. The material capable of emitting volatile compounds in response to heating may be a charge of homogenised plant-based material. For example, the aerosol-forming substrate may comprise one or more materials derived from plants including, but not limited to: tobacco; tea, for example green tea; peppermint; laurel; eucalyptus; basil;
20 sage; verbena; and tarragon.

Preferably, the material capable of emitting volatile compounds in response to heating is a charge of tobacco-based material, most preferably a charge of homogenised tobacco-based material.

The aerosol-forming substrate may be in the form of a plug or segment comprising a
25 material capable of emitting volatile compounds in response to heating circumscribed by a paper or other wrapper. As stated above, 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.

Preferably, the aerosol-forming substrate has a length of between about 5 mm and
30 about 20 mm, more preferably of between about 8 mm and about 12 mm.

In preferred embodiments, the aerosol-forming substrate comprises a plug of tobacco-based material wrapped in a plug wrap. In particular preferred embodiments, the aerosol-forming substrate comprises a plug of homogenised tobacco-based material wrapped in a plug wrap.

35 Preferably, smoking articles according to the invention further comprise a heat-conducting element around a rear portion of the combustible heat source and at least a front portion of the aerosol-forming substrate. The heat-conducting element is preferably combustion

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resistant. In certain embodiments, the heat conducting element is oxygen restricting. In other words, the heat-conducting element inhibits or resists the passage of oxygen through the heat-conducting element to the combustible heat source.

5 In certain embodiments, the heat-conducting element may be in direct contact with both the rear portion of the combustible heat source and the aerosol-forming substrate. In such embodiments, the heat-conducting element provides a thermal link between the combustible heat source and the aerosol-forming substrate of smoking articles according to the invention.

10 In other embodiments, the heat-conducting element may be spaced apart from one or both of the rear portion of the combustible heat source and the aerosol-forming substrate, such that there is no direct contact between the heat-conducting element and one or both of the rear portion of the combustible heat source and the aerosol-forming substrate.

Suitable heat-conducting elements for use in smoking 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
15 wrappers.

Preferably, the rear portion of the combustible heat source surrounded by the heat-conducting element is between about 2 mm and about 8 mm in length, more preferably between about 3 mm and about 5 mm in length.

20 Preferably, the front portion of the combustible heat source not surrounded by the heat-conducting element is between about 4 mm and about 15 mm in length, more preferably between about 5 mm and about 8 mm in length.

In certain embodiments, the entire length of the aerosol-forming substrate may be surrounded by the heat-conducting element.

25 In other embodiments, the heat-conducting element may surround only a front portion of the aerosol-forming substrate. In such embodiments, the aerosol-forming substrate extends downstream beyond the heat-conducting element.

In embodiments in which the heat-conducting element surrounds only a front portion of the aerosol-forming substrate, the aerosol-forming substrate preferably extends at least about 3 mm downstream beyond the heat-conducting element. More preferably, the aerosol-forming
30 substrate extends between about 3 mm and about 10 mm downstream beyond the heat-conducting element. However, the aerosol-forming substrate may extend less than 3 mm downstream beyond the heat-conducting element.

35 Preferably, the front portion of the aerosol-forming substrate surrounded by the heat-conducting element is between about 1 mm and about 10 mm in length, more preferably between about 2 mm and about 8 mm in length, most preferably between about 2 mm and about 6 mm in length.

Smoking articles according to the invention comprise a mouthpiece downstream of the

aerosol-forming substrate.

Preferably, the mouthpiece is of low filtration efficiency, more preferably of very low filtration efficiency. The mouthpiece may be a single segment or component mouthpiece. Alternatively, the mouthpiece may be a multi-segment or multi-component mouthpiece.

5 The mouthpiece may comprise a filter comprising one or more segments comprising suitable known filtration materials. Suitable filtration materials are known in the art and include, but are not limited to, cellulose acetate and paper. Alternatively or in addition, the mouthpiece may comprise one or more segments comprising absorbents, adsorbents, flavourants, and other aerosol modifiers and additives or combinations thereof.

10 Smoking articles according to the element preferably further comprise a transfer element or spacer element between the aerosol-forming substrate and the mouthpiece.

The transfer element may abut one or both of the aerosol-forming substrate and the mouthpiece. Alternatively, the transfer element may be spaced apart from one or both of the aerosol-forming substrate and the mouthpiece.

15 The inclusion of a transfer element advantageously allows cooling of the aerosol generated by heat transfer from the combustible heat source to the aerosol-forming substrate. The inclusion of a transfer element also advantageously allows the overall length of smoking articles according to the invention to be adjusted to a desired value, for example to a length similar to that of conventional cigarettes, through an appropriate choice of the length of the
20 transfer element.

The transfer element may have a length of between about 7 mm and about 50 mm, for example a length of between about 10 mm and about 45 mm or of between about 15 mm and about 30 mm. The transfer element may have other lengths depending upon the desired overall length of the smoking article, and the presence and length of other components within the
25 smoking article.

Preferably, the transfer element comprises at least one open-ended tubular hollow body. In such embodiments, in use, the air drawn into the smoking article through the one or more air inlets passes through the at least one open-ended tubular hollow body as it passes downstream through the smoking article from the aerosol-forming substrate to the mouthpiece.

30 The transfer element may comprise at least one open-ended tubular hollow body formed from one or more suitable materials that are substantially thermally stable at the temperature of the aerosol generated by the transfer of heat from the combustible heat source to the aerosol-forming substrate. Suitable materials are known in the art and include, but are not limited to, paper, cardboard, plastics, such a cellulose acetate, ceramics and combinations thereof.

35 Alternatively or in addition, smoking articles according to the invention may comprise an aerosol-cooling element or heat exchanger between the aerosol-forming substrate and the mouthpiece. The aerosol-cooling element may comprise a plurality of longitudinally extending

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channels.

The aerosol-cooling element may comprise a gathered sheet of material selected from the group consisting of metallic foil, polymeric material, and substantially non-porous paper or cardboard. In certain embodiments, the aerosol-cooling element may comprise a gathered
5 sheet of material selected from the group consisting of polyethylene (PE), polypropylene (PP), polyvinylchloride (PVC), polyethylene terephthalate (PET), polylactic acid (PLA), cellulose acetate (CA), and aluminium foil.

In certain preferred embodiments, the aerosol-cooling element may comprise a gathered sheet of biodegradable polymeric material, such as polylactic acid (PLA) or a grade of Mater-Bi®
10 (a commercially available family of starch based copolyesters).

Smoking articles according to the invention may comprise one or more aerosol modifying agents downstream of the aerosol-forming substrate. For example, one or more of the mouthpiece, transfer element and aerosol-cooling element of smoking articles according to the invention may comprise one or more aerosol modifying agents.

15 Suitable aerosol-modifying agents include, but are not limited to: flavourants; and chemesthetic agents.

As used herein, the term 'flavourant' is used to describe any agent that, in use, imparts one or both of a taste or aroma to an aerosol generated by the aerosol-forming substrate of the smoking article.

20 As used herein, the term 'chemesthetic agent' is used to describe any agent that, in use, is perceived in the oral or olfactory cavities of a user by means other than, or in addition to, perception via taste receptor or olfactory receptor cells. Perception of chemesthetic agents is typically via a "trigeminal response," either via the trigeminal nerve, glossopharyngeal nerve, the vagus nerve, or some combination of these. Typically, chemesthetic agents are perceived as
25 hot, spicy, cooling, or soothing sensations.

Smoking articles according to the invention may comprise one or more aerosol modifying agents that are both a flavourant and a chemesthetic agent downstream of the aerosol-forming substrate. For example, one or more of the mouthpiece, transfer element and aerosol-cooling element of smoking articles according to the invention may comprise menthol or
30 another flavourant that provides a cooling chemesthetic effect.

Smoking articles according to the invention may be assembled using known methods and machinery.

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

35 Figure 1a) shows an exploded view of a smoking article according to a first embodiment of the invention;

Figure 1b) shows an exploded view of a smoking article according to a second

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embodiment of the invention;

Figure 1c) shows an exploded view of a smoking article according to a fourth embodiment of the invention;

5 Figure 1d) shows an exploded view of a smoking article according to a fifth embodiment of the invention;

Figure 1e) shows an exploded view of a smoking article according to a seventh embodiment of the invention;

Figure 1f) shows an exploded view of a smoking article according to an eighth embodiment of the invention;

10 Figure 2 shows a schematic longitudinal cross-section of the smoking article according to the first embodiment of the invention shown in Figure 1a); and

Figure 3 shows a schematic longitudinal cross-section of the smoking article according to the second embodiment of the invention shown in Figure 1b).

15 The smoking article 2 according to the first embodiment of the invention shown in Figures 1a) and 2 comprises a combustible heat source 4 having a front face 6 and an opposed rear face 8, an aerosol-forming substrate 10, a transfer element 12 and a mouthpiece 14 in abutting coaxial alignment. As shown in Figure 2, the aerosol-forming substrate 10, transfer element 12 and mouthpiece 14 and a rear portion of the combustible heat source 4 are wrapped in an outer wrapper 16 of sheet material such as, for example, cigarette paper, of low air permeability.

20 The combustible heat source 4 comprises a central airflow channel 18 (shown by dotted lines in Figure 1a)) that extends from the front face 6 to the rear face 8 of the combustible heat source 4.

25 The aerosol-forming substrate 12 is located immediately downstream of the rear face 8 of the combustible heat source 4. The aerosol-forming substrate 12 comprises a cylindrical plug of homogenised tobacco-based material 20 including an aerosol former such as, for example, glycerine, wrapped in plug wrap 22.

30 The transfer element 12 is located immediately downstream of the aerosol-forming substrate 12 and comprises a cylindrical open-ended hollow tube 24 of suitable material such as, for example, paper, cardboard or cellulose acetate tow.

The mouthpiece 14 is located immediately downstream of the transfer element 12 at the proximal end of the smoking article 2. The mouthpiece 14 comprises a cylindrical plug of suitable filtration material 26 such as, for example, cellulose acetate tow of very low filtration efficiency, wrapped in filter plug wrap 28.

35 The smoking article may further comprise a band of tipping paper (not shown) circumscribing a downstream end portion of the outer wrapper 16.

As shown in Figure 2, the smoking article 2 further comprises a heat-conducting element

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30 of suitable material such as, for example, aluminium foil, around and in contact with a rear portion 4b of the combustible carbonaceous heat source 4 and an abutting front portion 10a of the aerosol-forming substrate 10. In the smoking article 2 according to the first embodiment of the invention shown in Figure 2, the aerosol-forming substrate extends downstream beyond the heat-conducting element 30. That is, the heat-conducting element 30 is not around and in contact with a rear portion of the aerosol-forming substrate 10. However, it will be appreciated that in other embodiments of the invention (not shown), the heat-conducting element 30 may be around and in contact with the entire length of the aerosol-forming substrate 10.

The smoking article 2 according to the first embodiment of the invention comprises one or more air inlets located downstream of the rear face 8 of the combustible heat source 4 and upstream of the mouthpiece 14. The one or more air inlets are located between the rear face 8 of the combustible heat source 4 and a downstream end of the aerosol-forming substrate 10 and comprise one or more first inlets 32 located around the periphery of the aerosol-forming substrate 10.

As shown in Figure 2, a circumferential arrangement of first air inlets 32 is provided in the plug wrap 22 of the aerosol-forming substrate 10 and the overlying outer wrapper 16 to admit cool air (shown by dotted arrows in Figures 1a) and 2) into the aerosol-forming substrate 10. It will be appreciated that in other embodiments of the invention (not shown) in which the heat-conducting element 30 is around and in contact with the entire length of the aerosol-forming substrate 10, a circumferential arrangement of first air inlets 32 may be provided in the plug wrap 22 of the aerosol-forming substrate 10, the overlying heat-conducting element 30 and the overlying outer wrapper 16 to admit cool air into the aerosol-forming substrate 10.

In use, a user ignites the combustible heat source 4 of the smoking article 2 according to the first embodiment of the invention and then draws on the mouthpiece 14. When a user draws on the mouthpiece 14, air (shown by dotted arrows in Figures 1a) and 2) is drawn into the smoking article 2 through the central airflow channel 18 of the combustible heat source 4 and heated as it passes through the central airflow channel 18 of the combustible heat source 4. When a user draws on the mouthpiece 14, cool air (shown by dotted arrows in Figures 1a) and 2) is also drawn into the aerosol-forming substrate 10 of the smoking article 2 through the first air inlets 32.

The heated air drawn through the central airflow channel 18 of the combustible heat source 4 heats the aerosol-forming substrate 10 by forced convection as it passes downstream through the aerosol-forming substrate 10 towards the mouthpiece 14 of the smoking article 2. The front portion 10a of the aerosol-forming substrate 10 is also heated by conduction through the abutting rear face 8 of the combustible heat source 4 and the heat-conducting element 28.

The heating of the aerosol-forming substrate 10 by conduction and forced convection releases glycerine and other volatile and semi-volatile compounds from the plug of

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homogenised tobacco-based material 20. The compounds released from the aerosol-forming substrate 10 form an aerosol that is entrained in the air drawn through the central airflow channel 18 of the combustible heat source 4 and the air drawn into the aerosol-forming substrate 10 of the smoking article 2 through the first air inlets 32 as it flows through the aerosol-forming substrate 10. The drawn air and entrained aerosol (shown by dashed arrows in Figures 1a) and 2) pass downstream through the transfer element 12, where they cool and condense. The cooled drawn air and entrained aerosol pass downstream through the mouthpiece 14 and are delivered to the user through the proximal end of the smoking article 2 according to the first embodiment of the invention.

The smoking article 34 according to the second embodiment of the invention shown in Figures 1b) and 3 is of largely identical construction to the smoking article according to the first embodiment of the invention shown in Figures 1a) and 2. However, in the smoking article 34 according to the second embodiment of the invention the combustible heat source 4 and the aerosol-forming substrate 10 are spaced apart from one another and the one or more air inlets located between the rear face 8 of the combustible heat source 4 and the downstream end of the aerosol-forming substrate 10 comprise one or more second inlets 36 located between the rear face 8 of the combustible heat source 4 and the aerosol-forming substrate 10.

As shown in Figure 3, a circumferential arrangement of second air inlets 36 is provided in the heat-conducting element 30 and the overlying outer wrapper 16 between the rear face 8 of the combustible heat source 4 and the upstream end of the aerosol-forming substrate 10 to admit cool air (shown by dotted arrows in Figures 1b) and 3) into the space between the combustible heat source 4 and the aerosol-forming substrate 10.

In use when a user draws on the mouthpiece 14 of the smoking article 34 according to the second embodiment of the invention, air (shown by dotted arrows in Figures 1b) and 3) is drawn into the smoking article 34 through the central airflow channel 18 of the combustible heat source 4 and cool air is also drawn into the space between the combustible heat source 4 and the aerosol-forming substrate 10 through the second air inlets 36.

The heated air drawn through the central airflow channel 18 of the combustible heat source 4 heats the aerosol-forming substrate 10 by convection as it passes downstream through the aerosol-forming substrate 10 towards the mouthpiece 14 of the smoking article 34. The front portion 10a of the aerosol-forming substrate 10 is also heated by conduction through the heat-conducting element 28.

The heating of the aerosol-forming substrate 10 by conduction and convection releases glycerine and other volatile and semi-volatile compounds from the plug of homogenised tobacco-based material 20. The compounds released from the aerosol-forming substrate 10 form an aerosol that is entrained in the air drawn through the central airflow channel 18 of the combustible heat source 4 and the air drawn into the space between the combustible heat

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source 4 and the aerosol-forming substrate 10 through the second air inlets 36 as it flows through the aerosol-forming substrate 10. The drawn air and entrained aerosol (shown by dashed arrows in Figures 1b) and 3) pass downstream through the transfer element 12, where they cool and condense. The cooled drawn air and entrained aerosol pass downstream through the mouthpiece 14 and are delivered to the user through the proximal end of the smoking article 34 according to the second embodiment of the invention.

A smoking article according to a third embodiment of the invention (not shown) is of largely identical construction to the smoking article according to the second embodiment of the invention shown in Figures 1b) and 3. However, in the smoking article according to the third embodiment of the invention the one or more air inlets located between the rear face of the combustible heat source and the downstream end of the aerosol-forming substrate comprise one or more second inlets located between the rear face of the combustible heat source 4 and the aerosol-forming substrate 10 as in the smoking article according to the second embodiment of the invention shown in Figures 1b) and 3 and also one or more first inlets located around the periphery of the aerosol-forming substrate as in the smoking article according to the first embodiment of the invention shown in Figures 1a) and 2.

In use when a user draws on the mouthpiece of the smoking article according to the third embodiment of the invention, air is drawn into the smoking article through the central airflow channel of the combustible heat source and cool air is also drawn into the space between the combustible heat source and the aerosol-forming substrate through the second air inlets and into the aerosol-forming substrate of the smoking article through the first air inlets.

Combustible carbonaceous heat sources for use in smoking articles according to the first, second and third embodiments of the invention may be produced in accordance with Example 1 below by omitting the second barrier coating of clay.

Air drawn through the aerosol-forming substrates of the smoking articles according to the first, second and third embodiments of the invention that enters the smoking articles through the central airflow channel of the combustible heat source comes into direct contact with a combustible portion of the combustible heat source as it passes through the central airflow channel. Air drawn through the aerosol-forming substrates of the smoking articles according to the first, second and third embodiments of the invention that enters the smoking articles through the central airflow channel also comes into direct contact with the rear face of the combustible heat source.

The smoking article 38 according to the fourth embodiment of the invention shown in Figures 1c) is of largely identical construction to the smoking article according to the first embodiment of the invention shown in Figures 1a) and 2. However, in the smoking article 38 according to the fourth embodiment of the invention a non-combustible substantially air impermeable first barrier 40 is provided between the rear face 8 of the combustible heat source

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4 and the aerosol-forming substrate 10. As shown in Figure 1c), the first barrier 40 comprises a non-combustible substantially air impermeable first barrier coating provided on the entire rear face 8 of the combustible heat source 4 and the central airflow channel 18 of the combustible heat source 4 extends through the first barrier coating.

5 As a result of inclusion of the first barrier coating, the aerosol-forming substrate 10 of the smoking article 38 according to the fourth embodiment of the invention is not in direct contact with the rear face 8 of combustible carbonaceous heat source 4.

As a result of inclusion of the first barrier coating, in use, air drawn through the smoking article 38 according to the fourth embodiment of the invention through the central airflow channel 18 of the combustible heat source 4 also does not directly contact the rear face 8 of combustible carbonaceous heat source 4. In addition, as a result of inclusion of the first barrier coating, in use, cool air drawn into the aerosol-forming substrate 10 of the smoking article 38 according to the fourth embodiment of the invention through the first air inlets 32 does not directly contact the rear face 8 of combustible carbonaceous heat source 4.

15 However, air drawn through the aerosol-forming substrate 10 of the smoking article 38 according to the fourth embodiment of the invention that enters the smoking article 38 through the central airflow channel 18 of the combustible heat source 4 comes into direct contact with a combustible portion of the combustible heat source as it passes through the central airflow channel 18.

20 The smoking article 42 according to the fifth embodiment of the invention shown in Figures 1d) is of largely identical construction to the smoking article according to the second embodiment of the invention shown in Figures 1b) and 3. However, in the smoking article 42 according to the fifth embodiment of the invention a non-combustible substantially air impermeable first barrier 40 is provided between the rear face 8 of the combustible heat source 4 and the aerosol-forming substrate 10. As shown in Figure 1d), the first barrier 40 comprises a non-combustible substantially air impermeable first barrier coating provided on the entire rear face 8 of the combustible heat source 4 and the central airflow channel 18 of the combustible heat source 4 extends through the first barrier coating.

As a result of inclusion of the first barrier coating, in use, air drawn into the smoking article 42 according to the fifth embodiment of the invention through the central airflow channel 18 of the combustible heat source 4 does not directly contact the rear face 8 of combustible carbonaceous heat source 4. In addition, as a result of inclusion of the first barrier coating, in use, cool air drawn into the space between the combustible heat source 4 and the aerosol-forming substrate 10 of the smoking article 42 according to the fifth embodiment of the invention through the second air inlets 36 does not directly contact the rear face 8 of combustible carbonaceous heat source 4.

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However, air drawn through the aerosol-forming substrate 10 of the smoking article 42 according to the fifth embodiment of the invention that enters the smoking article 42 through the central airflow channel 18 of the combustible heat source 4 comes into direct contact with a combustible portion of the combustible heat source as it passes through the central airflow channel 18.

A smoking article according to a sixth embodiment of the invention (not shown) is of largely identical construction to the smoking article according to the third embodiment of the invention (not shown). However, in the smoking article according to the sixth embodiment of the invention a non-combustible substantially air impermeable first barrier is provided between the rear face of the combustible heat source and the aerosol-forming substrate. The first barrier comprises a non-combustible substantially air impermeable first barrier coating provided on the entire rear face of the combustible heat source and the central airflow channel of the combustible heat source extends through the first barrier coating.

As a result of inclusion of the first barrier coating, in use, air drawn into the smoking article according to the sixth embodiment of the invention through the central airflow channel of the combustible heat source does not directly contact the rear face of combustible carbonaceous heat source. In addition, as a result of inclusion of the first barrier coating, in use, cool air drawn into the space between the combustible heat source and the aerosol-forming substrate of the smoking article according to the sixth embodiment of the invention through the second air inlets and into the aerosol-forming substrate of the smoking article according to the sixth embodiment of the invention through the first air inlets does not directly contact the rear face of combustible carbonaceous heat source.

However, air drawn through the aerosol-forming substrate of the smoking article according to the sixth embodiment of the invention that enters the smoking article through the central airflow channel of the combustible heat source comes into direct contact with a combustible portion of the combustible heat source as it passes through the central airflow channel.

Combustible carbonaceous heat sources for use in smoking articles according to the fourth, fifth and sixth embodiments of the invention may be produced in accordance with Examples 2, 3 and 4 below.

The smoking article 44 according to the seventh embodiment of the invention shown in Figures 1e) is of largely identical construction to the smoking article according to the first embodiment of the invention shown in Figures 1a) and 2. However, in the smoking article 44 according to the seventh embodiment of the invention a non-combustible substantially air impermeable second barrier 46 (shown by dashed lines in Figure 1e)) is provided between the combustible heat source 4 and the central airflow channel 18. The second barrier 46 comprises

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a non-combustible substantially air impermeable second barrier coating provided on the entire inner surface of the central airflow channel 18.

As a result of inclusion of the second barrier coating, in use, air drawn into the smoking article 38 according to the seventh embodiment of the invention through the central airflow channel 18 of the combustible heat source 4 does not directly contact a combustible portion of the combustible carbonaceous heat source 4 as it passes through the central airflow channel 18.

However, air drawn through the aerosol-forming substrate 10 of the smoking article 44 according to the seventh embodiment of the invention that enters the smoking article 44 through the central airflow channel 18 of the combustible heat source 4 comes into direct contact with the rear face 8 of the combustible heat source 4.

The smoking article 48 according to the eighth embodiment of the invention shown in Figures 1f) is of largely identical construction to the smoking article according to the second embodiment of the invention shown in Figures 1b) and 3. However, in the smoking article 48 according to the eighth embodiment of the invention a non-combustible substantially air impermeable second barrier 46 (shown by dashed lines in Figure 1f)) is provided between the combustible heat source 4 and the central airflow channel 18. The second barrier 46 comprises a non-combustible substantially air impermeable second barrier coating provided on the entire inner surface of the central airflow channel 18.

As a result of inclusion of the second barrier coating, in use, air drawn into the smoking article 48 according to the eighth embodiment of the invention through the central airflow channel 18 of the combustible heat source 4 does not directly contact the combustible carbonaceous heat source 4 as it passes through the central airflow channel 18.

However, air drawn through the aerosol-forming substrate 10 of the smoking article 48 according to the eighth embodiment of the invention that enters the smoking article 48 through the central airflow channel 18 of the combustible heat source 4 comes into direct contact with the rear face 8 of the combustible heat source 4. In addition, cool air drawn into the space between the combustible heat source 4 and the aerosol-forming substrate 10 of the smoking article 48 according to the eighth embodiment of the invention through the second air inlets 36 also comes into direct contact with the rear face 8 of the combustible heat source 4.

A smoking article according to a ninth embodiment of the invention (not shown) is of largely identical construction to the smoking article according to the third embodiment of the invention (not shown). However, in the smoking article according to the ninth embodiment of the invention a non-combustible substantially air impermeable second barrier is provided between the combustible heat source and the central airflow channel. The second barrier comprises a non-combustible substantially air impermeable second barrier coating provided on the entire inner surface of the central airflow channel.

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As a result of inclusion of the second barrier coating, in use, air drawn into the smoking article according to the ninth embodiment of the invention through the central airflow channel of the combustible heat source does not directly contact the combustible carbonaceous heat source as it passes through the central airflow channel.

5 However, air drawn through the aerosol-forming substrate of the smoking article according to the ninth embodiment of the invention that enters the smoking article through the central airflow channel of the combustible heat source comes into direct contact with the rear face of the combustible heat source. In addition, cool air drawn into the space between the combustible heat source and the aerosol-forming substrate of the smoking article according to
10 the ninth embodiment of the invention through the second air inlets also comes into direct contact with the rear face of the combustible heat source.

Combustible carbonaceous heat sources for use in smoking articles according to the seventh, eighth and ninth embodiments of the invention may be produced in accordance with Example 1 below.

15 **EXAMPLE 1 - Preparation of a combustible carbonaceous heat source comprising a second barrier coating of clay**

Combustible cylindrical carbonaceous heat sources for use in smoking articles according to the invention may be prepared as described in WO-A2-2009/074870 A2 or any other prior art
20 that is known to persons of ordinary skill in the art. An aqueous slurry, as described in WO-A2-2009/074870 A2, is extruded through a die having a central die orifice of circular cross-section to make the combustible heat source. The die orifice has a diameter of 8.7 mm so as to form cylindrical rods, having a length of between about 20 cm and about 22 cm and a diameter of between about 9.1 cm and about 9.2 mm. A single longitudinal airflow channel is formed in
25 the cylindrical rods by a mandrel mounted centrally in the die orifice. The mandrel preferably has a circular cross-section with an outer diameter of approximately 2 mm or approximately 3.5 mm. Alternatively, three airflow channels are formed in the cylindrical rods using three mandrels of circular cross-section with an outer diameter of approximately 2 mm mounted at regular angles in the die orifice. During extrusion of the cylindrical rods, a clay-based coating
30 slurry (made using clay, such as natural green clay) is pumped through a feed passageway extending through the centre of the mandrel or mandrels to form a thin second barrier coating of about 150 microns to about 300 microns on the inner surface of the airflow channel or channels. The cylindrical rods are dried at a temperature of about 20°C to about 25°C under about 40% to about 50% relative humidity for between approximately 12 hours to approximately 72 hours and
35 then pyrolysed in a nitrogen atmosphere at about 750°C for approximately 240 minutes. After pyrolysis, the cylindrical rods are cut and shaped to a defined diameter using a grinding

machine to form individual combustible-carbonaceous heat sources. The rods after cutting and shaping have a length of about 11 mm, a diameter of about 7.8 mm and a dry mass of about 400 mg. The individual combustible carbonaceous heat sources are subsequently dried at about 130°C for approximately 1 hour.

5

EXAMPLE 2 – Preparation of a combustible carbonaceous heat source comprising a first barrier coating of bentonite/kaolinite

A non-combustible substantially air impermeable first barrier coating of bentonite/kaolinite is provided on the rear face of a combustible carbonaceous heat source prepared as described in Example 1 but without a second barrier coating of clay. The first barrier coating is provided by dipping, brushing or spray coating. Dipping involves inserting the rear face of the combustible carbonaceous heat source into a concentrated bentonite/kaolinite solution. The bentonite/kaolinite solution for dipping contains 3.8% bentonite, 12.5% kaolinite and 83.7 % H₂O [m/m]. The rear face of the combustible carbonaceous heat source is dipped into the bentonite/kaolinite solution for about 1 second and the meniscus allowed to disappear as the result of penetration of the solution into the carbon pores at the surface of the rear face of the combustible carbonaceous heat source. Brushing involves dipping a brush into a concentrated bentonite/kaolinite solution and applying the concentrated bentonite/kaolinite solution on the brush to the surface of the rear face of the combustible carbonaceous heat source until covered. The bentonite/kaolinite solution for brushing contains 3.8% bentonite, 12.5% kaolinite and 83.7 % H₂O [m/m].

After application of the non-combustible substantially air impermeable first barrier coating by dipping or brushing, the combustible carbonaceous heat source is dried in an oven at about 130°C for approximately 30 minutes and placed in a desiccator under about 5% relative humidity overnight.

Spray-coating involves a suspension solution, preferably containing 3.6% bentonite, 18.0% kaolinite and 78.4% H₂O [m/m] and having a viscosity of around 50 mPa·s at a shear rate of about 100 s⁻¹ as measured with a rheometer (Physica MCR 300, coaxial cylinder arrangement). Spray-coating is done with a Sata MiniJet 3000 spray gun using spray nozzles of 0.5 mm, 0.8 mm or 1 mm on a SMC E-MY2B linear actuator at a velocity of about 10 mm/s to about 100 mm/s. The following spray parameters are used: distance sample-pistol 15 cm; sample velocity 10 mm/s; spray nozzle 0.5 mm; spray jet flat and spray pressure 2.5 bar. In a single spray-coating event, a coating thickness of about 11 microns is typically obtained. Spraying is repeated three times. Between each spray-coating, the combustible carbonaceous heat source is dried at room temperature for about 10 minutes. After application of the non-

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combustible substantially air impermeable first barrier coating, the combustible carbonaceous heat source is pyrolysed at about 700°C for approximately 1 hour.

EXAMPLE 3 - Preparation of a combustible carbonaceous heat source comprising a first barrier coating of glass

A non-combustible substantially air impermeable first barrier coating of glass is provided on the rear face of a combustible carbonaceous heat-source prepared as described in Example 1 but without a second barrier coating of clay. The first barrier coating is provided by spray coating. Spray-coating with glass is performed with a suspension of ground glass using a fine powder. For example, a spray-coating suspension containing either 37.5% glass powder (3µm), 2.5% methylcellulose and 60% water with a viscosity of 120 mPa·s, or 37.5% glass powder (3µm), 3.0% bentonite powder, and 59.5% water with a viscosity of 60 to 100 mPa·s, is used. Glass powder having the compositions and physical properties corresponding to Glass 1, 2, 3 and 4 in Table 3 may be used.

Spray-coating is done with a Sata MiniJet 3000 spray gun using spray nozzles of 0.5 mm, 0.8 mm or 1 mm on a SMC E-MY2B linear actuator at a velocity of about 10 mm/s to about 100 mm/s. Spraying is preferably repeated several times. After the spraying is completed, the combustible carbonaceous heat source is pyrolysed at about 700°C for approximately 1 hour.

	Glass 1	Glass 2	Glass 3	Glass 4
SiO ₂	70	70	65	60
Na ₂ O	20	15	20	20
K ₂ O				5
CaO	10	8	10	10
MgO		4	5	5
Al ₂ O ₃		3		
T _g (°C)	517	539	512	465
A ₂₀₋₃₀₀ (10 ⁻⁶ K ⁻¹)	10.9	9.3	10.2	12.1
KI-value	30	21	35	40

Table 3: Composition of glasses in weight percent, transformation temperature T_g, coefficient of thermal expansion A₂₀₋₃₀₀ and KI-value calculated from composition

EXAMPLE 4 - Preparation of a combustible carbonaceous heat source comprising a first barrier coating of aluminium

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A non-combustible, substantially air impermeable, first barrier coating of aluminium is provided on the rear face of a combustible carbonaceous heat-source prepared as described in Example 1 but without a second barrier coating of clay. The first barrier coating is provided by laser cutting an aluminium barrier from aluminium bobbin bands having a thickness of about 20
5 microns. The aluminium barrier has a diameter of about 7.8 mm and a single hole having an outer diameter of about 1.8 mm in the centre thereof to match the cross section of the combustible carbonaceous heat source of Example 1. In an alternative embodiment, the aluminium barrier has three holes, which are positioned to be aligned with three airflow channels provided in the combustible carbonaceous heat-source. The aluminium barrier
10 coating is formed by attaching the aluminium barrier to the rear face of the combustible carbonaceous heat source using any suitable adhesive.

In use, the cool air drawn into the one or more air inlets located between the rear face of the combustible heat source and a downstream end of the aerosol-forming substrate reduces the temperature of the aerosol-forming substrate 10 of the smoking articles 2, 34, 38, 42, 44, 48
15 according to the first to ninth embodiments of the invention during puffing by a user.

This advantageously prevents or inhibits spikes in the temperature of the aerosol-forming substrate 10 during puffing by a user and advantageously minimises or reduces the impact of a user's puffing regime on the composition of the mainstream aerosol of the smoking articles 2, 34, 38, 42, 44, 48 according to the first to ninth embodiments of the invention.

20 The specific embodiments described above are intended to illustrate the invention. However, other embodiments may be made without departing from the spirit and scope of the invention as defined in the claims, and it is to be understood that the specific embodiments described above are not intended to be limiting.

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CLAIMS:

1. A smoking article comprising:
 - a combustible heat source having opposed front and rear faces;
 - 5 one or more airflow channels extending from the front face to the rear face of the combustible heat source;
 - an aerosol-forming substrate downstream of the rear face of the combustible heat source;
 - a mouthpiece downstream of the aerosol-forming substrate; and
 - 10 one or more air inlets located downstream of the rear face of the combustible heat source and upstream of the mouthpiece wherein the one or more air inlets are located between the rear face of the combustible heat source and a downstream end of the aerosol-forming substrate,
 - wherein, in use, air drawn through the aerosol-forming substrate enters the smoking
 - 15 article through the one or more airflow channels and the one or more air inlets and at least some of the air drawn through the aerosol-forming substrate comes into direct contact with a combustible portion of the combustible heat source.
2. A smoking article according to claim 1 further comprising an outer wrapper
- 20 circumscribing the aerosol-forming substrate and at least a rear portion of the combustible heat source.
3. A smoking article according to claim 1 further comprising one of: (i) a non-combustible substantially air impermeable first barrier between the rear face of the combustible heat source
- 25 and the aerosol-forming substrate; and (ii) a non-combustible substantially air impermeable second barrier between the combustible heat source and the one or more airflow channels.
4. A smoking article according to claim 1 comprising (i) a non-combustible substantially air impermeable first barrier between the rear face of the combustible heat source and the aerosol-
- 30 forming substrate, wherein the first barrier comprises a first barrier coating provided on the rear face of the combustible heat source.
5. A smoking article according to claim 1 comprising (ii) a non-combustible substantially air impermeable second barrier between the combustible heat source and the one or more airflow
- 35 channels, wherein the second barrier comprises a second barrier coating provided on an inner surface of the one or more airflow channels.

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6. A smoking article according to any preceding claim wherein the one or more air inlets comprise one or more first air inlets around the periphery of the aerosol-forming substrate.

7. A smoking article according to any preceding claim wherein the aerosol-forming substrate abuts the rear face of the combustible heat source.

8. A smoking article according to any one of claims 1-6 wherein the aerosol-forming substrate is spaced apart from the rear face of the combustible heat source.

9. A smoking article according to claim 8 wherein the one or more air inlets comprise one or more second air inlets between the rear face of the combustible heat source and the aerosol-forming substrate.

10. A smoking article according to any preceding claim further comprising:
a heat-conducting element around a rear portion of the combustible heat source and at least a front portion of the aerosol-forming substrate.

11. A smoking article according to any preceding claim wherein the aerosol-forming substrate comprises a tobacco-based material and at least one aerosol former.

12. A smoking article according to any preceding claim wherein the combustible heat source is a combustible carbonaceous heat source.

13. A smoking article according to claim any preceding claim wherein the combustible heat source comprises an ignition aid.

14. A smoking article according to any preceding claim further comprising:
a transfer element between the aerosol-forming substrate and the mouthpiece.

15. A smoking article according to any preceding claim further comprising one or more aerosol modifying agents downstream of the aerosol-forming substrate.

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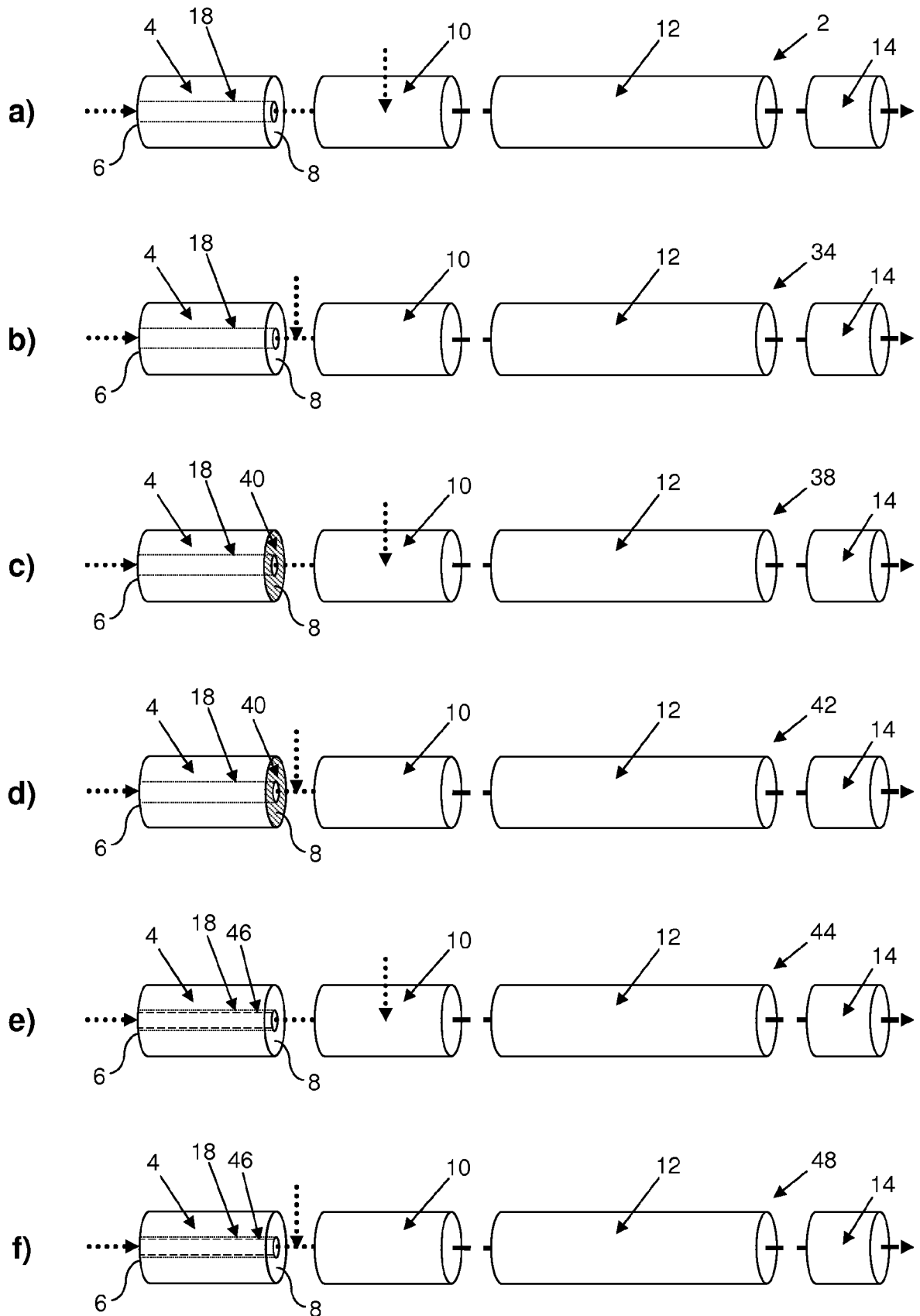


Figure 1

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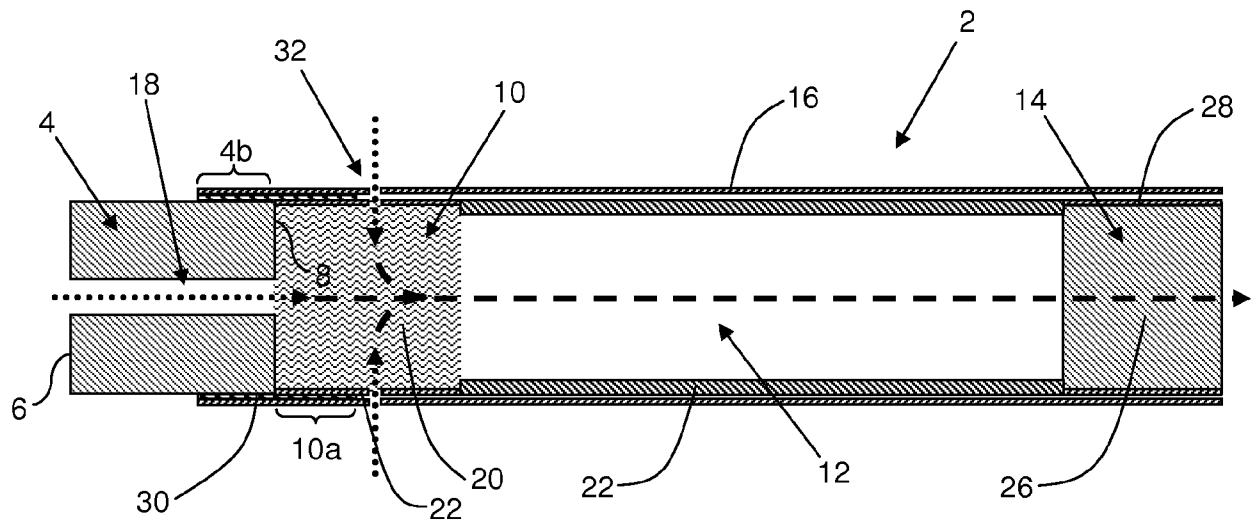


Figure 2

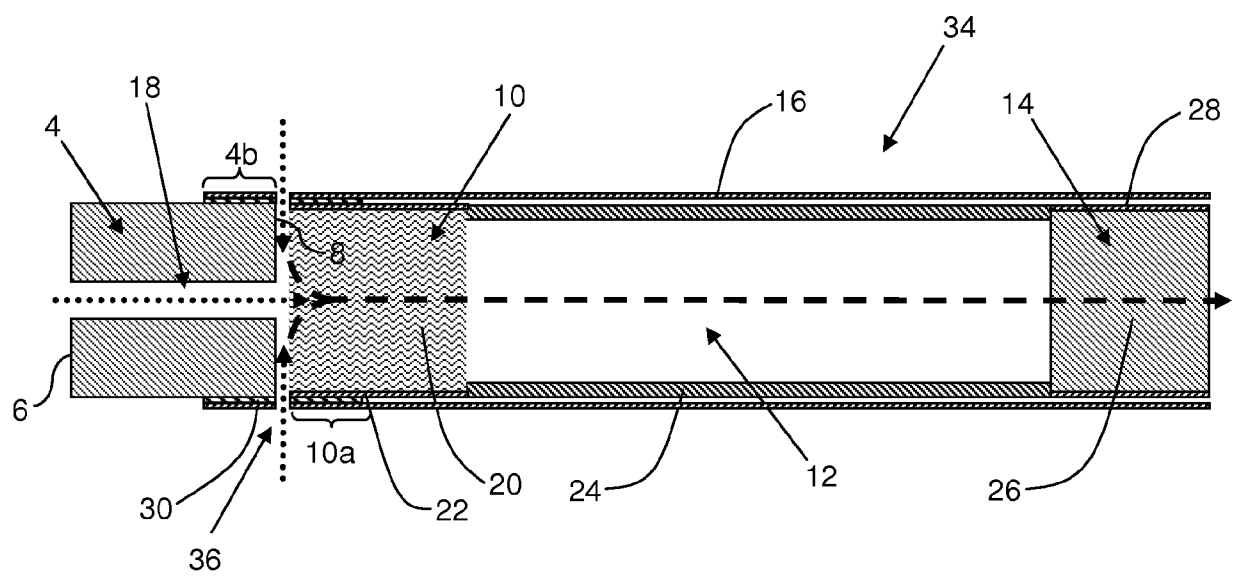


Figure 3

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2014/067235

A. CLASSIFICATION OF SUBJECT MATTER

INV. A24F47/00

ADD.

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)

A24F

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)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.



See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

22 September 2014

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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