SMOKING ARTICLE WITH VENTILATED MOUTH END CAVITY

The present invention relates to a smoking article having a mouth end cavity defined by a hollow tube segment.

Filter cigarettes typically comprise a cylindrical rod of tobacco cut filler surrounded by a paper wrapper and a cylindrical filter axially aligned in an abutting end-to-end relationship with the wrapped tobacco rod. The cylindrical filter typically comprises a filtration material circumscribed by a paper plug wrap. Conventionally, the wrapped tobacco rod and the filter are joined by a band of tipping wrapper, normally formed of an opaque paper material that circumscribes the entire length of the filter and an adjacent portion of the wrapped tobacco rod. Smoking articles having a cavity at the mouth end of their filter section have also been proposed.

A number of smoking articles in which tobacco is heated rather than combusted have also been proposed in the art. In heated smoking articles, an aerosol is generated by heating an aerosol generating substrate, such as tobacco. Known heated smoking articles include, for example, smoking articles in which an aerosol is generated by electrical heating or by the transfer of heat from a combustible fuel element or heat source to an aerosol forming substrate. During smoking, volatile compounds are released from the aerosol forming substrate by heat transfer from the heat source and entrained in air drawn through the smoking article. As the released compounds cool they condense to form an aerosol that is inhaled by the consumer. Also known are smoking articles in which a nicotine-containing aerosol is generated from a tobacco material, tobacco extract or other nicotine source, without combustion and in some cases without heating, for example through a chemical reaction.

A smoking article comprising a filter having a hollow tubular element at the mouth end is known from US 2009/0293894. The hollow tubular element may be formed when the filter is attached to a rod of smokable material by tipping paper. However, the hollow tubular element preferably includes a cylindrical element, such as a carbon tube, that is overwrapped by the tipping material to provide additional strength to the filter. A method of manufacturing a smoking articles comprising a hollow tube segment defines a cavity at the mouth end of the filter is known from WO 2014/023555.

It would be desirable to provide a filtered smoking article having a mouth end cavity which is adapted to promote homogenization of the mainstream smoke prior to it reaching the mouth of the consumer.

Accordingly, the present invention provides a smoking article comprising a tobacco rod and a filter connected to the tobacco rod. The filter comprises at least a first filter segment and a hollow tube segment downstream of the first filter segment. The hollow tube segment defines a cavity at the mouth end of the filter providing an unrestricted flow channel that extends from

the downstream end of the first filter segment to the mouth end of the filter. The length of the hollow tube segment is at least about 25 percent and less than about 50 percent of the overall filter length. Further, the smoking article comprises a ventilation zone in communication with the cavity at a location along the hollow tube segment. The ventilation zone is located from about 10 mm to about 15 mm upstream from the mouth end of the filter.

As used herein, the terms "upstream" and "downstream" are used to describe the relative positions of elements, or portions of elements, of the smoking article in relation to the direction in which a consumer draws on the smoking article during use thereof. Smoking articles as described herein comprise a downstream end and an opposed upstream end. In use, a consumer draws on the downstream end of the smoking article. The downstream end, which is also described as the mouth end, is downstream of the upstream end, which may also be described as the distal end.

The expression "unrestricted flow" is used throughout this specification to indicate that the hollow tube segment internally defines a channel having a substantially constant cross-sectional area for the smoke and air to flow through. Further, the expression "unrestricted flow channel" is used throughout this specification to indicate that the hollow tube segment does not contain any object which may cause a local restriction of the flow of the smoke and air. In other words, the hollow tube segment is empty. Thus, the cross-sectional area available for the smoke and air to flow through is substantially constant along the whole length of the hollow tube segment and flow of smoke and air through the hollow tube segment is substantially unobstructed.

The expression "overall filter length" is used throughout this specification to refer to the sum of the length of the various components forming the filter. Thus, the expression "overall filter length" should be construed as referring at least to the sum of the length of the hollow tube segment and the length of the first filter segment. Similarly, if the smoking article comprises more than one filter segments upstream of the hollow tube segment, the expression "overall filter length" should be construed as referring to the sum of the length of the hollow tube segment and the length of each of the other filter segments in the smoking article.

According to the present invention, the inclusion of a filter comprising an unrestricted hollow tube segment and a ventilation zone having the features specified above advantageously enables the production of smoking articles in which an improved dispersion of air and mainstream smoke at the mouth end is achieved. Without wishing to be bound to theory, the provision of a ventilation zone in communication with the unrestricted channel internally defined by the hollow tube is understood to promote turbulent flow of air and mainstream smoke through the filter of the smoking article and, in particular, at the downstream end of the filter. As is known, turbulent flows favour the homogenization of fluid mixtures by enhancing the rates of mass, momentum and energy transports in a flow. Because the hollow segment represents at least 25 percent, and less than about 50 percent, of the overall length of the filter, the air drawn

into the filter via the ventilation zone and the mainstream smoke are provided room for intimately mixing under turbulent flow conditions prior to leaving the filter. Thus, in smoking articles in accordance with the present invention, a better dispersed flow of air and mainstream smoke advantageously reaches the mouth of the consumer.

Further, the length of the filter segment or segments upstream of the hollow tube segment thus accounts for at least about 50 percent of the overall filter length. The unrestricted, hollow tube segment does not substantially contribute to increasing the resistance to draw (RTD) of the smoking article. At most, the unrestricted, hollow tube segment contributes only marginally to increasing the RTD of the smoking article. In practice, the unrestricted, hollow tube segment may be adapted to generate a RTD in the range of approximately 1 mm H_2O (about 10 Pa) and approximately 20 mm H_2O (about 200 Pa). Preferably, the unrestricted, hollow tube segment is adapted to generate a RTD between approximately 2 mm H_2O (about 20 Pa) and approximately 10 mm H_2O (about 100 Pa). Because the filter segment or segments upstream of the unrestricted, hollow tube segment account for at least about 50 percent of the overall filter length, it is advantageously possible, by selecting filtration material or materials of appropriate density and characteristics, to adjust the overall RTD of the smoking article to satisfactory levels. In some preferred embodiments, the filter segment or segments upstream of the unrestricted, hollow tube segment account for at least about 60 percent of the overall filter length.

Preferably, the length of the hollow tube segment is less than about 25 mm. Preferably, the length of the hollow tube segment is less than about 15 mm. In addition, or as an alternative, the length of the hollow tube segment is at least about 10 mm. In some preferred embodiments, the length of the hollow tube segment is from about 10 mm to about 15 mm. This not only provides a mouth end cavity and an unrestricted flow channel of an appropriate size, but also ensures sufficient overlap between the hollow tube segment and any wrapper which may circumscribe the hollow tube segment to maintain it in axial alignment with the filter segment or with the tobacco rod or with both. Such wrappers include plug wraps and tipping paper bands.

~~Preferably, t~~The ventilation zone is located at least about ~~2~~ 10 mm upstream from the mouth end of the filter. ~~More preferably, the ventilation zone is located at least about 2 mm upstream from the mouth end of the filter.~~ This advantageously makes it less likely for the consumer to obstruct the ventilation zone when holding the smoking article with his or her lips. ~~Preferably, the ventilation zone is located at least about 10 mm upstream from the mouth end of the filter~~.

In addition, ~~or as an alternative, the ventilation zone is preferably located less than about 20 mm upstream from the mouth end of the filter. More preferably,~~ the ventilation zone is ~~preferably~~ located less than about 15 mm upstream from the mouth end of the filter. ~~In some~~

~~preferred embodiments, the ventilation zone is preferably located from about 2 mm to about 20 mm upstream from the mouth end of the filter. In some more preferred embodiments,~~ Having the ventilation zone ~~is preferably~~ located from about 10 mm to about 15 mm upstream from the mouth end of the filter~~.~~ ~~This~~ provides a highly appropriate length of unrestricted flow channel for the air and smoke to flow through under turbulent conditions and, therefore, to thoroughly mix before they reach the mouth end of the smoking article.

In addition, or as an alternative, the ventilation zone is located at least about 1 mm downstream from the downstream end of the first filter segment, preferably at least about 2 mm downstream from the downstream end of the first filter segment. More preferably, the ventilation zone is located at least about 5 mm downstream from the downstream end of the first filter segment. Even more preferably, the ventilation zone is located at least about 10 mm downstream from the downstream end of the first filter segment. Thus, the air being drawn into the cavity defined by the hollow tube segment in a substantially radial direction encounters the mainstream smoke flowing into the cavity from the first filter segment substantially along an axial direction. Without wishing to be bound to theory, this is understood to favour dragging of the air drawn into the cavity on the part of the mainstream smoke flowing in the axial direction, thus further promoting thorough mixing and homogenization of air and mainstream smoke within the cavity.

Preferably, the ventilation zone comprises at least one circumferential row of perforations provided through the hollow tube segment. In some preferred embodiments, the ventilation zone comprises two circumferential rows of perforations provided through the hollow tube segment. For example, the perforations may be formed online during manufacture of the smoking article. Preferably, each circumferential row of perforations comprises from 8 to 30 perforations.

The tobacco rod typically comprises a charge of tobacco cut filler circumscribed by a paper wrapper.

The hollow tube segment and the filter segment or segments are circumscribed by a band of plug wrap. Preferably, the hollow tube segment and the filter segment or segments are circumscribed by a band of impermeable plug wrap. In an alternative embodiment, the hollow tube segment and filter segment or segments are circumscribed by a band of substantially air permeable plug wrap, more preferably a band of plug wrap having a permeability of between about 7,000 Coresta units and about 20,000 Coresta units.

The plug wrap may have a basis weight of less than about 120 gsm, preferably less than about 100 gsm, more preferably less than about 80 gsm. In addition, or as an alternative, the plug wrap may have a basis weight of at least about 20 gsm, preferably at least about 25 gsm. The combining plug wrap preferably has a basis weight of more than about 20 gsm.

The band of plug wrap may be affixed to the hollow tube segment and the filter segment or segments using, for example, an adhesive. Where the filter comprises a band of substantially air impermeable plug wrap, the ventilation zone preferably comprises at least one circumferential row of perforations provided through a portion of the plug wrap. By way of example, the perforations through the plug wrap may be formed online during manufacture of the smoking article. Preferably, the circumferential row or rows of perforations provided through a portion of the plug wrap are in substantial alignment with the corresponding row or rows of perforations provided through the hollow tube segment.

The filter comprising the band of plug wrap is preferably attached to the tobacco rod by a band of substantially impermeable tipping paper. The tipping wrapper may comprise paper having a basis weight of less than about 70 gsm, preferably less than about 50 gsm. The tipping wrapper preferably has a basis weight of more than about 20 gsm.

The band of tipping paper may extend over the whole length of the filter and over a portion of the tobacco rod. Thus, the band of tipping paper may overlap ventilation perforations provided through the hollow tube segment. As an alternative, the band of tipping paper may extend over

CLAIMS

1. A smoking article comprising:

a tobacco rod; and

a filter connected to the tobacco rod, the filter comprising:

a first filter segment; and

a hollow tube segment downstream of the first filter segment, the hollow tube segment defining a cavity at the mouth end of the filter providing an unrestricted flow channel that extends from the downstream end of the first filter segment to the mouth end of the filter,

wherein the length of the hollow tube segment is at least about 25 percent, and less than about 50 percent, of the overall filter length and wherein the smoking article comprises a ventilation zone in communication with the cavity at a location along the hollow tube segment,

wherein the ventilation zone is located from about 10 mm to about 15 mm upstream from the mouth end of the filter.

2. A smoking article according to claim 1 or 2, wherein the length of the hollow segment is less than about 25 mm.

3. A smoking article according to any one of the preceding claims, wherein the length of the hollow segment is at least about 10 mm.

~~4. A smoking article according to any one of the preceding claims, wherein the ventilation zone is located at least about 2 mm upstream from the mouth end of the filter.~~

~~5. A smoking article according to any one of the preceding claims, wherein the ventilation zone is located from about 10 mm to about 15 mm upstream from the mouth end of the filter.~~

~~6.~~4. A smoking article according to any one of the preceding claims, wherein the ventilation zone is located at least about 1 mm downstream from the downstream end of the first filter segment.

~~7.~~5. A smoking article according to any one of the preceding claims, wherein the ventilation zone comprises at least one circumferential row of perforations provided through the hollow tube segment.

8.6. A smoking article according to claim 75, wherein the at least one circumferential row of perforations comprises from 8 to 30 perforations.

9.7. A smoking article according to any one of the preceding claims, wherein the thickness of the hollow tube segment is from about 90 micrometres to about 140 micrometres.

10.8. A smoking article according to any one of the preceding claims, wherein the thickness of the hollow tube segment is from about 100 micrometres to about 130 micrometres.

11.9. A smoking article according to any one of the preceding claims, wherein the hollow tube segment is formed from a plurality of overlapping paper layers.

12.10. A smoking article according to claim 119, wherein the hollow tube segment is formed from a plurality of spirally wound paper layers.

13.11. A smoking article according to claim 11 9 or 1210, wherein adjacent paper layers of the hollow tube segment are adhered together by an intermediate layer of an adhesive.

14.12. The smoking article according to any preceding claim, wherein the difference between the ovality of the hollow tube segment after 50 percent deformation of the filter and the ovality of the hollow tube segment prior to deformation of the filter is less than 25 percent.

15.13. A smoking article according to any preceding claim, wherein the ovality of the hollow tube segment after a 50 percent deformation of the filter is less than 25 percent.