

[54] **HIGH FLAVOR IMPACT, LOW SMOKE YIELD CIGARETTE MOUTHPIECE**

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[57] **ABSTRACT**

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A cigarette mouthpiece for an unfiltered cigarette in which the proportionate volume of smoke drawn from the tobacco section of the cigarette into the smoker's mouth is regulated with respect to the volume of ventilating air simultaneously drawn into the smoker's mouth where the smoke and the air are first commingled, the regulation providing precise, pre-selected control over the dilution of the smoke in the smoker's mouth. The mouthpiece comprises at least one central smoke passage and ventilation perforations around the periphery of the mouthpiece. A particular draw resistance for the smoke passage is selected to complement a particular draw resistance for the ventilation perforations, thereby regulating the respective volumes of smoke and air entering the smoker's mouth when he draws on the cigarette.

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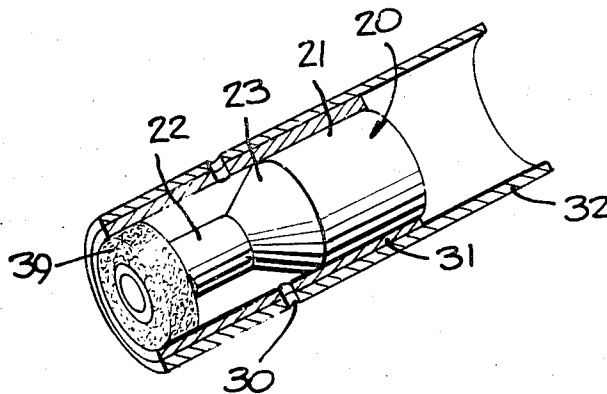
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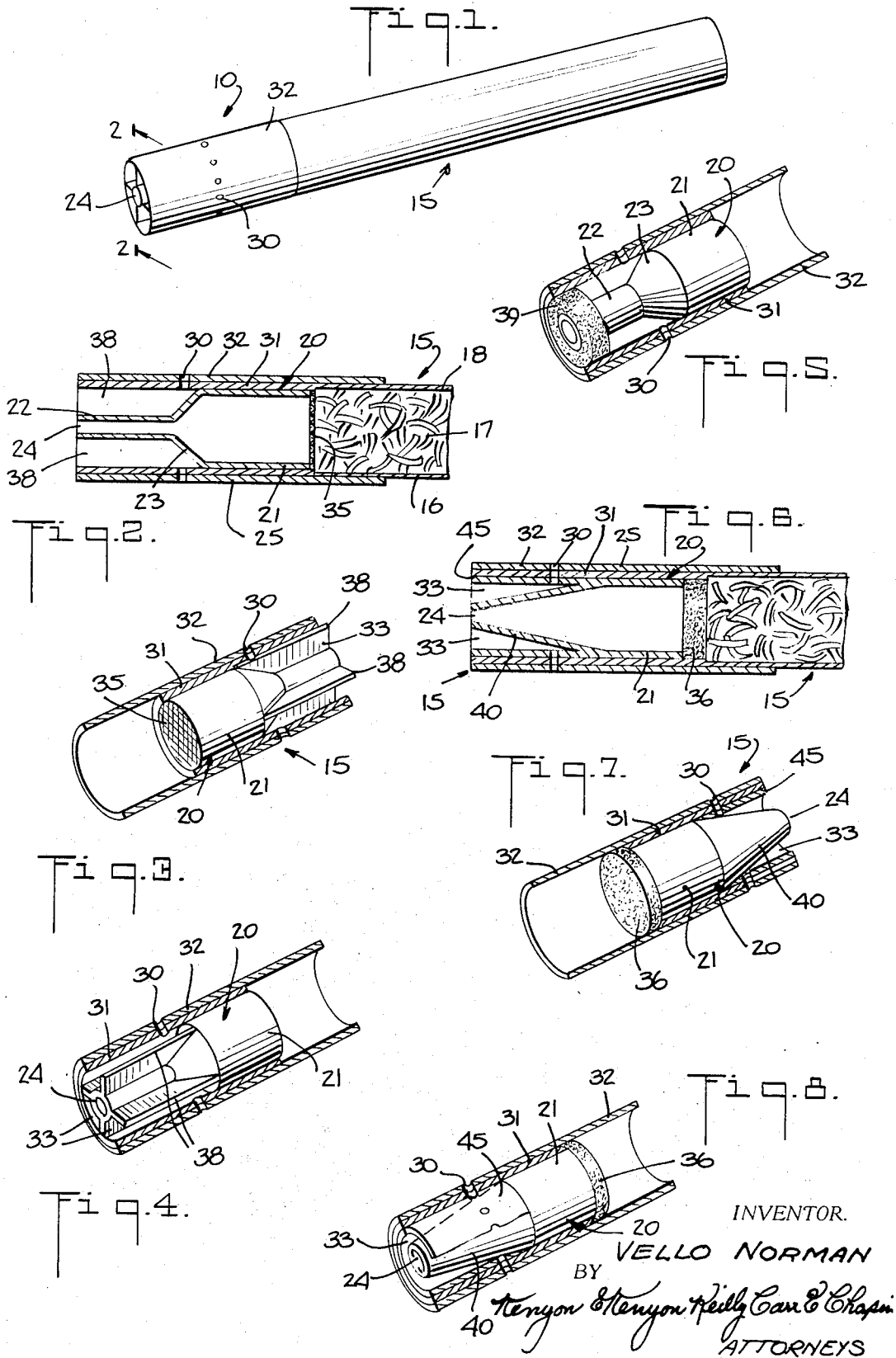
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7 Claims, 8 Drawing Figures





HIGH FLAVOR IMPACT, LOW SMOKE YIELD CIGARETTE MOUTHPIECE

BACKGROUND OF THE INVENTION

It is known that certain advantages are achieved by diluting the smoke stream from a cigarette with a stream of ventilating air. The dilution of the smoke of the cigarette has the effect of reducing the quantity of particulate matter and gaseous phase components drawn into the smoker's mouth on each puff. The ventilating air also functions to cool the smoke in the smoker's mouth. Prior cigarette mouthpieces used various methods for introducing the ventilation air into the smoke stream. In particular, it is known to segregate the ventilating air stream from the smoke stream in the cigarette mouthpiece so that the two streams are first commingled in the smoker's mouth, for example, as disclosed in Osmalov Pat. No. 3,490,461.

However, prior art ventilating methods are deficient in certain respects since they do not provide effective and precise control of the amount of dilution obtained when the smoker draws on the cigarette. These ventilating methods use only the degree of tipping perforations in the cigarette mouthpiece to control the amount of ventilating air entering the smoker's mouth when he draws on the cigarette. Such methods do not provide sensitive controls of the dilution of the smoke stream since no positive control is provided to limit the amount of smoke entering the smoker's mouth. When the tip perforations of the prior cigarette mouthpieces are wide open, thereby providing their maximum dilution of the smoke stream, a significant portion of each puff, perhaps as much as one-half, is still drawn through the cigarette. Therefore, the amount of particulate matter and gas phase components in each puff cannot be reduced beyond the amount thereof contained in the significant portion of smoke drawn during each puff.

SUMMARY OF THE INVENTION

The mouthpiece of the present invention is directed to unfiltered cigarettes, and it provides all the advantages, discussed above, attendant in the known mouthpieces for such cigarettes. More importantly, the mouthpiece provides a means for precise, pre-selected control of the proportionate amounts of undiluted smoke and air entering the smoker's mouth when he draws on the cigarette. Therefore, the amount of particulate matter and gas phase components in each puff can be significantly reduced beyond the amount thereof contained in the significant portion of smoke drawn during each puff on a cigarette with a known mouthpiece. The mouthpiece comprises ventilation perforations around the periphery thereof and at least one central smoke passage for drawing ventilation air and undiluted smoke, respectively, into the smoker's mouth.

The flow rates of the air through the ventilation perforations and the smoke through the smoke passage is proportional to the pressure drop across each and inversely proportional to their respective draw resistances. When the smoker draws on the cigarette, he creates a pressure drop across the perforations and the passage of the mouthpiece. For this pressure drop, the flow rates of the air and the smoke into the smoker's mouth are inversely proportional to the draw resistances of the ventilation perforations and the smoke

passage. Therefore, an increase in the draw resistance of the smoke passage, or a decrease in the draw resistance of the ventilation perforations, would decrease the proportion of smoke to air entering the smoker's mouth. The converse would increase the proportion of smoke to air.

By preselecting the appropriate draw resistances for the ventilation perforations and the smoke passage of the mouthpiece, precise control over the dilution of the smoke entering the smoker's mouth is provided. In the ultimate, the draw resistance of the smoke passage can be increased to a point where little or no smoke enters the smoker's mouth during each puff.

The mouthpiece of the present invention provides the added advantage of having the smoke stream issue from the smoke passage at a relatively high velocity compared with smoke velocities of known mouthpieces. A superior flavor impact is provided when the high velocity smoke stream from the mouthpiece impinges on the smoker's mouth and/or tongue, prior to commingling with the ventilation air.

Essentially, the cigarette mouthpiece of this invention comprises at least one ventilation perforation formed in the body of the mouthpiece at or adjacent the periphery thereof. Each ventilation perforation is in communication with the surrounding atmosphere and is provided to deliver ventilating air directly into the smoker's mouth. The mouthpiece also has at least one central smoke passage positioned in the interior of the body of the mouthpiece for drawing undiluted smoke from the cigarette directly into the smoker's mouth so that the smoke stream and air stream are each delivered separately thereto. The total cross-sectional area of the smoke passage decreases from a maximum total area adjacent an inlet opening in the end of the mouthpiece joined to the tobacco section to a minimum total area adjacent an outlet opening in the other end.

The smoke passage of the mouthpiece comprises a cylinder having a first cylindrical portion at the end of the mouthpiece adjacent the tobacco section of the cigarette having a diameter substantially equal to the diameter of the tobacco section and a second cylindrical portion, having a reduced diameter, at the other end. The first cylindrical portion is aligned with the tobacco section of the cigarette. The second cylindrical portion has an opening for communicating with the smoker's mouth. The diameter of the smoke passage decreases smoothly and continuously from the diameter of the first cylindrical portion to the diameter of the second cylindrical portion.

As noted above, the desired amount of dilution of the smoke entering the smoker's mouth is controlled by preselecting the appropriate draw resistances for the ventilation perforations and the smoke passage. The draw resistance of the ventilation perforations can be controlled, for example, by changing the number and/or size of the perforations and the draw resistance of the smoke passage can be adjusted, for example, by varying the diameter of the second cylindrical portion thereof.

The above advantages of the cigarette mouthpiece of the present invention will become more apparent from the following description, when read in conjunction with the accompanying drawings, wherein corresponding parts of each figure have corresponding numbers.

FIG. 1 is a view of one embodiment of the mouthpiece of the present invention joined to a cigarette.

FIG. 2 is a cross-sectional view of one embodiment of the mouthpiece of the present invention joined to a cigarette.

FIG. 3 is a perspective view of the mouthpiece of FIG. 2 from the end thereof adjacent the tobacco section of the cigarette.

FIG. 4 is a perspective view of the mouthpiece of FIG. 2 from the other end thereof.

FIG. 5 is a perspective view of another embodiment of the mouthpiece.

FIG. 6 is a cross-sectional view of still another embodiment of the mouthpiece of the present invention joined to a cigarette.

FIG. 7 is a perspective view of the mouthpiece of FIG. 6 from the end thereof adjacent the tobacco section of the cigarette.

FIG. 8 is a perspective view of the mouthpiece of FIG. 6 from the other end thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1-4, one preferred embodiment of the mouthpiece 10 is shown joined, in a conventional manner, to an unfiltered cigarette 15 having a tobacco section 16 comprised of tobacco 17 and a paper wrapper 18. The mouthpiece 10, conveniently formed as a cylindrical body, is aligned with the tobacco 17. The mouthpiece 10 comprises a central smoke passage 20 positioned within the interior of the mouthpiece 10 and aligned with the tobacco 17 of the cigarette 15. The smoke passage 20 has a circular cross-section and comprises a first cylindrical portion 21 at the end of the mouthpiece 10 adjacent the tobacco section 16, a second cylindrical portion 22 at the other end, and an intermediate portion 23 therebetween. The diameter of the intermediate portion 23 continuously decreases from the diameter of the first cylindrical portion 21 at one end to the diameter of the second cylindrical portion 22 at the other end. Preferably, the diameter of the first cylindrical portion 21 is substantially equal to the diameter of the tobacco section 16. When the smoker draws on the cigarette, undiluted smoke from the tobacco section 16 travels through the smoke passage 20 and into the smoker's mouth via a circular opening 24 at the smoker's end of the mouthpiece 10.

Smoke passage 20 functions to control or regulate the amount of undiluted smoke that can enter the smoker's mouth for any given draw or puff on the cigarette 15. When the smoker draws on the cigarette 15, he creates a pressure drop across the smoke passage 20. The flow rate of undiluted smoke through the smoke passage 20 is proportional to this pressure drop and inversely proportional to the draw resistance of the passage 20. Therefore, for a given pressure drop, the flow rate decreases as the draw resistance increases. The draw resistance of the smoke passage 20 is preferably adjusted by changing the cross-sectional area of the second cylindrical portion 22 or the diameter of the opening 24. A particular draw resistance of the smoke passage 20 is selected depending upon the amount of undiluted smoke desired to enter the smoker's mouth for any given draw on the cigarette 15.

The shape of the smoke passage is not critical; however, it is important that all the smoke from the tobacco section 16 be drawn through the smoke passage 20 and

that the smoke passage 20 has a constricted portion therein to restrict the amount of undiluted smoke drawn into the smoker's mouth during each puff.

The peripheral portion 25 of the mouthpiece 10 is formed to provide ventilation perforations 30 to permit ventilating air to enter the smoker's mouth. The peripheral portion 25 is cylindrical in shape and is comprised of an inner cylinder of mouthpiece paper 31 and an outer cylinder of tipping paper 32. The mouthpiece paper 31 encircles the first cylindrical portion 21 of the smoke passage 20 so that all the smoke is drawn through the smoke passage 20. The tipping paper 32 joins the mouthpiece 10 to the tobacco section 16 of the cigarette 15.

A plurality of spaced apart ventilation perforations 30 are disposed around the peripheral portion 25 of the mouthpiece 10. The position of the ventilating perforations 30 is not critical as long as each perforation 30 is in communication between the air surrounding the cigarette 15 when the cigarette is in the smoker's mouth and the space 33 between the smoke passage 20 and the peripheral portion 25 of the mouthpiece 10. When the smoker draws on the cigarette, streams of ventilating air pass through the ventilating perforations 30 into the space 33 surrounding the smoke passage 20 and hence into the smoker's mouth where the air is first commingled with the smoke stream from the smoke passage 20.

The ventilation perforations 30 also have a draw resistance which can be varied by changing the size and/or number of the perforations 30. A particular draw resistance of the ventilation perforations 30 is selected to complement the draw resistance of the smoke passage 20 so that, for a given draw on the cigarette 15, a desired amount of ventilation air enters the smoker's mouth.

Although the total volume drawn into the smoker's mouth remains substantially the same, the ventilating air serves to diminish the amount of undiluted smoke entering the smoker's mouth. A reduction in the amount of smoke for a particular draw provides a reduction in the particulate matter and gas phase components entering the smoker's mouth for that draw. The mouthpiece 10 provides a means for finely controlling the proportionate amounts of undiluted smoke and ventilating air entering the smoker's mouth when he draws on the cigarette. By increasing the draw resistance of the smoke passage 20 with respect to the draw resistance of the ventilating perforations 30, the proportionate amount of undiluted smoke is decreased.

It is desirable to provide a means for preventing particles of tobacco from the tobacco section 16 from entering the smoke passage 20 and clogging the opening 24. One such means is conveniently shown in FIGS. 2-3 as a fine mesh screen or grid 35 positioned across the end of the smoke passage 20 adjacent the tobacco section 16. It will be understood that other means would suffice equally as well. For example, as shown in FIG. 6, a short, cylindrical segment of low pressure drop fibrous material 36 could be placed between the smoke passage 20 and the tobacco cylinder 17 of the cigarette 15. Further, a thin, circular plate (not shown) having a plurality of small inlets or perforations therein could be positioned across the end of the smoke passage adjacent the tobacco section to keep the tobacco out of the smoke passage but still allow smoke to pass through the passage.

It is also desirable to provide a means for supporting the peripheral portion 25 of the mouthpiece 10 containing the ventilation perforations 30 to prevent it from collapsing under the pressure exerted by the smoker's lips and/or fingers on the mouthpiece. One such means is conveniently shown in FIGS. 2-3 as a plurality of radially extending, equally spaced supporting rib sections 38 positioned between the outer surface of the smoke passage 20 and the inner surface of the peripheral portion 25 of the mouthpiece 10. An alternative means for support is shown in FIG. 5 as a short, rigid, annular member 39 such as a low pressure drop filler which is pervious to air positioned, as above, between smoke passage 20 and the peripheral portion 25 at the smoker's end of the mouthpiece.

Another embodiment of the mouthpiece 10 of the present invention is shown in FIGS. 6-8. The mouthpiece 10 comprises a plurality of ventilation perforations 30, similar to the ventilation perforation 30 described with reference to FIGS. 2-4. The central smoke passage 20 comprises a cylindrical portion 21, at the end of the mouthpiece 10 adjacent the tobacco section 16 and a conical portion 40 extending therefrom and having a circular opening 24 at the other end of the mouthpiece 10. The diameter of the conical portion 40 decreases linearly from the diameter of the cylindrical portion 21 at one end to the diameter of the circular opening 24 at the other end. As discussed above, the cylindrical fibrous material 36 prevents tobacco from entering the smoke passage 20. FIGS. 6-8 show still another means for supporting the peripheral portion 25 of the mouthpiece 10 containing the ventilation perforations 30. A thin, rigid sleeve 45 extends coaxially between the smoke passage 20 and the peripheral portion 25 of the mouthpiece 10 along the length thereof.

Preferably, the particular draw resistance, as discussed above, of the smoke passage 20 is obtained by changing the diameter of the circular opening 24 so that the desired amount of undiluted smoke enters the smoker's mouth on any given draw on the cigarette 15.

The following example will serve to illustrate the precise control over the proportionate amounts of undiluted smoke and ventilating air obtainable with the mouthpiece 10 of the present invention. Mouthpieces of the type shown in FIG. 2 were attached to unfiltered cigarettes. The amount of ventilation perforations and the diameter of the opening in the smoke passage were separately varied to change the proportionate amount of ventilation air to undiluted smoke passing through the mouthpieces. The cigarettes were then smoked and the following results were obtained.

The above results show a significant reduction in the particulate matter and gas phase components that would be drawn into the smoker's mouth when he puffs on the cigarette compared to the results obtained when an unfiltered, control cigarette having a similar tobacco section was smoked.

The data in Table 1 indicate that there are some differences as to how various smoke components are affected by changes in the controlling parameters of the mouthpiece. Generally, at a given smoke passage resistance (and especially at relatively low smoke passage resistance) a change in the resistance of the ventilation perforations has a much more profound effect on gas phase components (HCN, Organic Gas Phase) than on particulate phase components (cf. the yields of HCN and NFDS for Samples A, B and C versus D, E and F).

At a given low ventilation perforation resistance changes in the resistance of the smoke passage have generally a sharper effect of particulate phase than on gas phase yields (cf. the trend in yields of HCN and NFDS for Samples A, B and C).

At high ventilation perforation resistances the yields of all smoke components are relatively insensitive to changes in smoke passage resistance (cf. Samples I and J).

Thus by choosing the mouthpiece parameters properly, a certain amount of selectivity can be exercised in the reduction of various smoke components.

The embodiments of the cigarette mouthpiece shown in FIGS. 2 and 6 can be made from a variety of materials known to the art, such as thermoplastics and corrugated paper. It is preferable that the smoke passages 20 be constructed from a rigid material so that they will provide internal support for the peripheral portion 25 of mouthpiece 10.

The embodiments of the mouthpiece of the present invention described above are intended to illustrate the broader aspects of the invention as described above, and the advantages attendant therein, and are not to be construed in a limiting sense.

What is claimed is:

1. The combination of a cigarette tobacco section, a cigarette mouthpiece and a cylinder of tipping paper joining said mouthpiece to said tobacco section; said cigarette mouthpiece comprising

a smoke passage aligned with said cigarette tobacco section and having a draw resistance for controlling the amount of undiluted and unfiltered smoke entering a smoker's mouth for a given draw, said passage having a first cylindrical portion adjacent said tobacco section to receive smoke, a second portion

TABLE 1.—SUMMARY OF EXPERIMENTAL DATA

Sample cigarette ¹	A	B	C	D	E	F	G	H	I	J	Control "no filter"
Mouthpiece data:											
P.D. of perforations ¹	5.9	5.9	5.9	8.7	8.7	8.7	11.5	11.5	13.5	13.5	
R of perforations ²	0.337	0.337	0.337	0.497	0.497	0.497	0.657	0.657	0.772	0.772	
P.D. of smoke passage ¹	2.9	6.0	10.2	3.0	5.2	8.9	12.7	18.1	20	30	
R of smoke passage ²	0.166	0.342	0.582	0.171	0.297	0.508	0.726	1.03	1.14	1.71	
P.D. of mouthpiece ¹	1.1	1.5	1.9	1.3	2.2	3.2	4.2	5.6	5.9	7.4	
Yields (mg./cig.):											
Water	2.6	1.7	1.3	2.6	2.0	2.5	2.0	1.8	3.3	3.2	10.2
Nicotine	1.05	0.90	0.78	0.98	0.90	0.92	1.12	1.08	1.3	1.2	1.66
NFDS ³	14.1	11.8	9.1	14.2	13.5	11.4	14.3	13.2	18.3	18.8	27.1
Gas phase (μg./puff):											
HCN	8.4	7.0	5.9	14.9	12.5	11.6	15.0	13.5	20.3	16.7	26.7
Organic ⁴	106	100	90	172	162	133	165	150	187	194	297

¹ Pressure drop in cms. H₂O measured at a flow rate of 17.5 cc./sec.

² Resistance = $\frac{\text{P.D.}}{\text{Flow Rate}}$

³ NFDS=nicotine free dry smoke.

⁴ Sum of acetaldehyde, isoprene, propionaldehyde, furan, acetone and acrolein.

⁵ The same length tobacco column was smoked for each Sample A-J and the Control cigarette.

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at the opposite end and an intermediate portion of decreasing cross-sectional area from said first portion to said second portion;

a cylindrical peripheral portion about said smoke passage, said peripheral portion including an inner cylinder of mouthpiece paper forming an annular space with said intermediate and said second portions of said smoke passage, a plurality of perforations in said cylinders of mouthpiece paper and tipping paper communicating said space radially with the surrounding air, said perforations having a draw resistance to complement said draw resistance of said smoke passage whereby for a given draw a desired amount of ventilation air enters the smoker's mouth through said annular space.

2. The combination as set forth in claim 1 wherein said second portion of said smoke passage is a circular opening.

3. The combination as set forth in claim 2 wherein said intermediate portion is conical with a diameter decreasing linearly from said first cylindrical portion to said circular opening.

4. The combination as set forth in claim 1 which further comprises a means between said tobacco section and said first portion for preventing tobacco from entering said smoke passage.

5. The combination as set forth in claim 1 which further comprises means for supporting said peripheral portion against collapsing.

6. The combination as set forth in claim 5 wherein said means includes radially extending ribs between said smoke passage and said peripheral portion.

7. The combination as set forth in claim 5 wherein said means comprises a short, annular member positioned between the second portion of said smoke passage and the peripheral portion.

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