SMOKABLE ARTICLE HAVING INTERNAL AIR PASSAGEWAY

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FOREIGN PATENTS OR APPLICATIONS
1,905,273 8/1970 Germany......................... 131/8 R
687,136 5/1964 Canada.......................... 131/8 R

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ABSTRACT
A smokable article, such as a cigarette, in which the wrapper surrounds both a mass of tobacco filler and a longitudinally extending tube, the latter serving as a passageway for air during smoking. The tube preferably extends for the full length of the smokable article, but air flow through it is obstructed during the initial burning of the article. The tube may be provided along its length with two or more partial obstructions to air flow, the air flow permitted by each obstruction being greater the farther it is from the burning end of the article. Preferably, the tube is formed of combustible material, such as reconstituted tobacco.

7 Claims, 4 Drawing Figures
SMOKABLE ARTICLE HAVING INTERNAL AIR PASSAGEWAY

This invention relates to smokable articles, and more particularly to such articles provided with means for diluting with air the smoke reaching the person smoking the article.

The invention is believed to be most useful with respect to cigarettes, and hence the following description refers to cigarettes. However, this is not intended to limit the scope of the invention which is applicable to smokable articles generally.

The tar delivered to the smoke by a cigarette increases puff by puff as the cigarette is consumed. This arises from three separate mechanisms, all operating in the same direction. The first relates to the fact that air enters the cigarette, during each puff, through the porous paper wrapper, thereby diluting the smoke and reducing the tar reaching the smoker. As the cigarette grows shorter, the dilution of the smoke by air is reduced since less of the porous paper wrapper is available to provide dilution.

Secondly, the tobacco rod within the wrapper serves to some extent as a filter for the smoke, and the length active in filtration is diminished as the length of the cigarette decreases. Third, the tar filtered by the tobacco during the earlier puffs adds to the richness of tar generation when the last tobacco is finally burned.

The fact that the tar "delivery profile" is uneven, i.e., tar delivery being lowest during the first few puffs and highest during the last few puffs, is unfortunate because tar delivery and fullness of taste are somewhat related. Smokers trying a "low tar" cigarette are most likely to judge the flavor critically during the first puffs, and as mentioned above, these have the fewest tars and hence are weakest in taste. On the other hand, the total tars delivered in smoking the full length of the cigarette includes the strong puffs near the butt.

Various suggestions have been made in the past for "leveling" the tar delivery profile, but all involve disadvantages either from the point of view of manufacturing cost or operability. For example, ventilation holes have been provided at the cigarette filter to provide a principal part of the dilution air, rather than relying completely on air brought in through extremely porous paper. These ventilation holes are a relatively more constant source of dilution. Another approach appears in U.S. Pat. No. 3,526,904 wherein apertures in the cigarette wrapper are initially closed by a water-soluble material. During smoking, the moisture in the tobacco smoke dissolves the material and opens the aperture to provide increased dilution.

It is an object of the present invention to provide a cigarette having a more uniform tar delivery profile than conventional cigarettes, and more specifically to provide a cigarette wherein the ratio of tar delivered during the first few puffs to total tar delivered by the complete cigarette is higher than in conventional cigarettes.

It is another object of the invention to furnish a cigarette construction by means of which the tar delivery profile can be "programmed" by providing different amounts of air-dilution during different stages as the cigarette is smoked.

It is a further object of the invention to provide such a cigarette which delivers less total tar, when the entire cigarette is smoked, than an otherwise identical conventional cigarette.

Additional objects and features of the invention will be apparent from the following description in which reference is made to the accompanying drawings.

In the drawings:

FIG. 1 is a longitudinal cross-sectional view of a cigarette made according to the present invention;

FIG. 2 is a transverse cross-sectional view taken along line 2--2 of FIG. 1;

FIG. 3 is a longitudinal cross-sectional view through an alternative form of air passageway tube; and

FIG. 4 is a longitudinal cross-sectional view through another alternative form of air passageway tube.

The smokable article chosen to illustrate the present invention, and shown in FIGS. 1 and 2, is a cigarette including a cylindrical paper wrapper 10 surrounding an elongated mass or rod of tobacco filler 11. A filter plug 12 engages one end of the wrapped tobacco rod, and is surrounded by a cylindrical mouthpiece 13.

According to the invention, the cigarette is furnished within the paper wrapper 10, and among the tobacco filler 11, with a small tube 14 extending longitudinally of the cigarette. Tube 14 serves as an internal air passageway within the cigarette. In the present example, tube 14 extends for the full length of the tobacco rod 11, and is made of combustible material. As a practical matter these two characteristics are highly desirable, but neither absolutely essential for proper functioning of the invention.

The end 15 of the cigarette is the one which is lit when the cigarette is smoked. Spaced from end 15, but closer to that end than to filter 12, tube 14 is deformed by a dent 16 in its side wall which at least partially, but preferably completely, obstructs the flow of air through the tube. When the cigarette is lit, and during the first few puffs, little or no air flows through tube 14 to filter 12, i.e., to the smoker. Hence, the smoke is not diluted by air flowing through tube 14, and the tar delivery is about the same as that obtained with a conventional cigarette.

However, when the burning end of the cigarette reaches and burns through dent 16, tube 14 is opened, and with each subsequent puff air flows through tube 14 to dilute the smoke. Furthermore, as tube 14 becomes shorter with each puff, the resistance which it offers to air flow diminishes. Consequently, tube 14 provides the greatest air dilution during the last puffs of the cigarette when, as mentioned above, tar delivery is greatest with a conventional cigarette.

Tube 14 can be made of a variety of materials and in a variety of ways. For example, the tube can be made of paper, or other sheet material, wound in the manner of a small diameter drinking straw. Alternatively, paper-like reconstituted tobacco, such as that described in U.S. Pat. No. 3,145,717, can be used instead of paper. Tube 14 can also be made of extruded plastic, or molded or extruded compositions including clay or chalk bonded with starch. The tube may also be formed of reconstituted tobacco, as described below in example II.

The amount of air dilution afforded by tube 14 depends primarily upon its internal diameter. However, the material of the tube should be given consideration. Tubes made of reconstituted tobacco are preferred since their use keeps the amount of non-tobacco material in the cigarette to a minimum. If tubes of paper or
plastic are used, there is necessary concern for possible acridity or other less desirable combustion products, although the particular paper used can minimize this problem. The tube material chosen preferably burns at the same rate as tobacco, since a tube which burns much more slowly, or not at all, would project out from the partially consumed cigarette and be unsightly. On the other hand, a tube which burns much faster than tobacco would tend to become closed off at its burning end after each puff, thereby greatly reducing the air drawn through the tube.

For manufacturing purposes, the tube should be one which can be made in very long lengths, or better still, in long coils. In this way, the tubular material can be fed directly into the cigarette making machine and wrapped in the paper 10 together with the tobacco. The formation of dent 16 can be accomplished by a roller synchronized with the ultimate cutting of the continuous cigarette rod into individual cigarettes, the roller operating on a portion of the tube not forming part of a cigarette rod but which will be used during the next cycle of the cigarette making machine.

In place of the dent 16, obstruction of air flow can be accomplished by cutting out a portion, say one-half, of the circumference of the tube so that when the cigarette is made, the region of the tube at the cut-out is filled with tobacco, this tobacco forming the obstruction to air flow. FIG. 4 illustrates a tube 14″ of this nature having a cut-out 17. If the cut edges of cut-out 17 are rough, they may also help to obstruct air flow. Air dilution is also reduced by virtue of the fact that some of the smoke traveling along the tobacco rod 11 toward the smoker will enter the tube through cut-out 17 and mix with the air therein. The knife for producing the cut-out can be synchronized as described above with respect to the denting roller.

Although for practical reasons, as mentioned above, tube 14 will in most cases extend for the full length of tobacco filler 11, it should be mentioned that the tube could be shorter. A tube extending only from filter 12 to the location of dent 16, or some other point along the length of the cigarette, would adequately serve the purpose of the present invention.

An advantage of the present invention is that the amount of air dilution provided as the cigarette is consumed can be caused to follow a predetermined program. For example, as shown in FIG. 3, tube 14 may be furnished not only with a dent 16′ which closes the tube completely, or obstructs its interior to a great extent, but with additional dents 18 and 19 as well, spaced apart along the length of tube 14′. In the example illustrated, dent 18 obstructs air flow to a lesser extent than dent 16′, and dent 19 obstructs air flow to a lesser extent than dent 18′; end 15′ of tube 14′ is arranged at the end of the cigarette which is lit. As many dents as desired may be provided, and each dent may obstruct air flow to a lesser or greater extent than the dent preceding it.

The following examples will help to illustrate the advantages of the present invention:

**EXAMPLE I**

A tube was prepared by spiral winding a sheet of reconstituted tobacco, around a wire mandrel, resulting in a tube of 2.3 millimeters, inside diameter. This reconstituted tobacco had a basis weight of 48 grams per square meter.

Cigarettes were made, 70 millimeters long, using conventional cigarette filler tobacco blend. These cigarettes were of three types, as follows:

A. A tube, open throughout its length, with 0.86 gram of tobacco was wrapped in cigarette paper;

B. The cigarette was similar to that in A, above, except that before assembly the tube was indented at a point 20 millimeters from what was to be the lighting end of the cigarette;

C. As a control, a conventional cigarette was made with 1 gram of tobacco and no tube was included.

These cigarettes were evaluated for tar delivery using a variation of the accepted FTC procedure. The tar of the first three puffs of each cigarette was collected on a separate filter and weighed separately. The puffing was continued and at a time when no more than four puffs remained, the tar delivery in the next three puffs was determined, and this value was designated as the tar from the "last three puffs." The tar of the last three puffs was collected and its weight determined separately. The tar delivery of the total cigarette was determined separately on additional cigarettes. The results of these tests are given below:

<table>
<thead>
<tr>
<th>Example</th>
<th>First 3 Puffs</th>
<th>Last 3 Puffs</th>
<th>Complete Cigarette</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Open Tube</td>
<td>3.9</td>
<td>4.2</td>
<td>14.3</td>
</tr>
<tr>
<td>B. Tube with Obstruction</td>
<td>5.9</td>
<td>3.8</td>
<td>15.2</td>
</tr>
<tr>
<td>C. Without Tube</td>
<td>6.2</td>
<td>10.2</td>
<td>29.1</td>
</tr>
</tbody>
</table>

**EXAMPLE II**

To prepare extruded tubes of reconstituted tobacco, a mixture was prepared of 70 percent dry ground tobacco and 30 percent powdered cellulose acetate. A solvent mixture of one part methanol and three parts isopropanol was added with mixing to bring the mass to a consistency of a stiff putty. Tubes were prepared by extruding this mixture through a macaroni die with a laboratory press. After drying, these tubes had an inside diameter of 2.1 millimeters.

Two types of cigarettes were prepared as follows:

A. A completely open tube was included in a cigarette made with 0.91 gram of filler tobacco;

B. Cigarettes were made as described above, except that prior to the assembly of the cigarette, one-half of the circumference of the tube was cut away at a point 20 millimeters from the end to be lit, as shown in FIG. 4. The remainder of the tube was not collapsed by this cutting. These cigarettes were evaluated in the same manner as those in Example I, and the results are given below together with the results obtained with the control cigarettes described in Example I:

<table>
<thead>
<tr>
<th>Example</th>
<th>First 3 Puffs</th>
<th>Last 3 Puffs</th>
<th>Complete Cigarette</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Open Tube</td>
<td>4.6</td>
<td>5.5</td>
<td>18.2</td>
</tr>
<tr>
<td>B. Tube Opened 20 mm. from End</td>
<td>7.8</td>
<td>4.9</td>
<td>17.8</td>
</tr>
<tr>
<td>C. Without Tube</td>
<td>6.2</td>
<td>10.2</td>
<td>29.1</td>
</tr>
</tbody>
</table>

It will be seen from these examples that when a tube having an obstruction is employed, the first few puffs deliver virtually the same amount of tar as conventional cigarettes. However, the tar in the last few puffs, and the total tar delivered by the cigarette is greatly reduced. Furthermore, when the tube is unobstructed, little or no "profiling" of tar delivery is achieved. It is only when the tube is obstructed that tar delivery dur-
ing the initial puffs is virtually the same as that obtained with a conventional cigarette, but tar delivery during the last puffs is greatly reduced as compared to a conventional cigarette. In addition, it is clear that use of the tube greatly reduces the total tar delivered by the cigarette, only a part of the reduction being accounted for by the fact that the tube-containing cigarette includes less tobacco than the conventional cigarette.

The invention has been shown and described in preferred form only, and by way of example, and many variations may be made in the invention which will still be comprised within its spirit. It is understood, therefore, that the invention is not limited to any specific form or embodiment except insofar as such limitations are included in the appended claims.

What is claimed is:

1. A smokable article comprising a wrapper surrounding both an elongated mass of tobacco filler and a tube extending longitudinally of the article, said tube being empty for at least a portion of its length so that said empty portion serves as an unobstructed flow passageway for air during smoking of the article, and means spaced apart along the length of said tube for at least partially obstructing air flow through said tube, each of said obstructing means being formed to permit greater air flow than the next preceding obstructing means closer to the end of the article which is first burned when the article is smoked.

2. A smokable article as defined in claim 1 wherein said tube is formed of reconstituted tobacco.

3. A smokable article as defined in claim 1 wherein each said obstructing means is a dent in said tube at least partially closing the tube interior in the vicinity of said dent.

4. A smokable article as defined in claim 1 wherein said obstructing means is a cut-out in said tube between its ends, said cut-out permitting tobacco filler to enter said tube in the region of said cut-out.

5. A smokable article as defined in claim 1 wherein each of said obstructing means is a dent in the side of said tube.

6. A smokable article as defined in claim 1 wherein said obstructing means closest to the end of the article which is first burned completely obstructs air flow through said tube during the initial burning of the smokable article.

7. A smokable article as defined in claim 1 wherein said tube is formed of combustible material.