

# United States Patent

[19]  
Summers

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[54] VENTILATED FILTER TIP CIGARETTE

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[73] Assignee: Brown & Williamson Tobacco Corporation, Louisville, Ky.

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[51] Int. Cl. .... A24d 1/04, A24f 13/06

[58] Field of Search..... 131/10 A, 11, 15 B, 10.3, 131/10 R, 90

[56] References Cited

UNITED STATES PATENTS

2,988,088 6/1961 Schur..... 131/10 A  
3,482,579 12/1969 Davis..... 131/15 B X

3,621,851 11/1971 Heskett et al..... 131/10.5

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Assistant Examiner—John F. Pitrelli

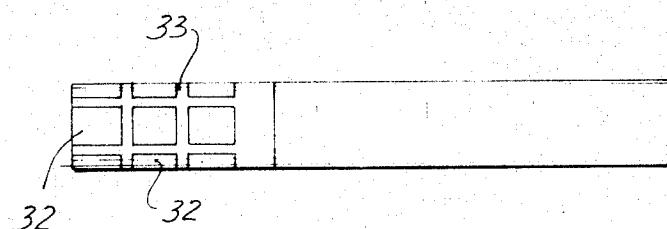
Attorney, Agent, or Firm—Finnegan, Henderson, Farabow & Garrett

[57]

## ABSTRACT

An improved ventilated filter cigarette utilizes uniformly porous plug wrap and tipping envelope to provide at least one uniformly porous ventilated region having a predetermined area about the filter. The area and porosity of the region or regions are correlated so as to provide a relationship which, when the limits thereof are observed, provides cigarettes with a more constant, reduced delivery of total particulate matter and gas phase constituents than heretofore obtained by ventilated filter tip cigarettes.

9 Claims, 7 Drawing Figures



PATENTED APR 23 1976

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FIG. 1c

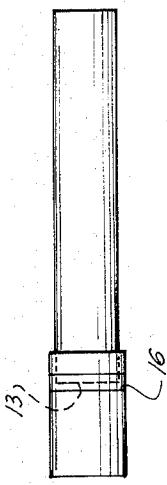


FIG. 1b

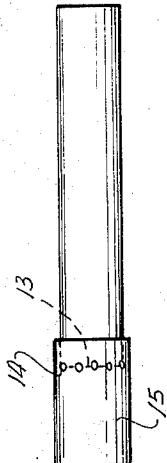


FIG. 1a

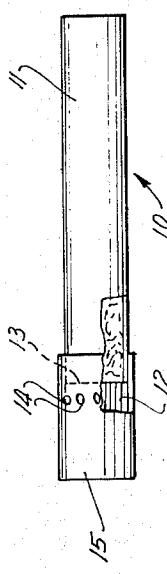


FIG. 2

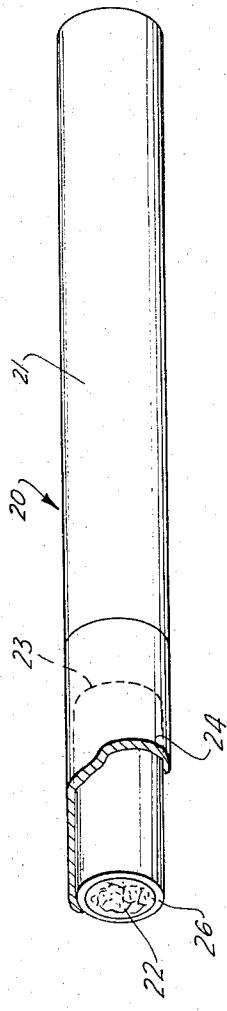


FIG. 3a



FIG. 3b

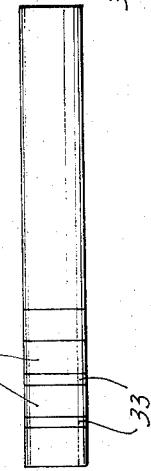
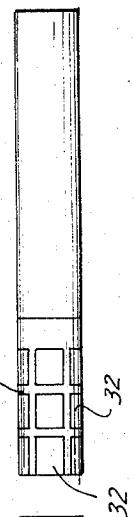


FIG. 3c



## VENTILATED FILTER TIP CIGARETTE

## FIELD OF THE INVENTION

The present invention relates to a ventilated filter tip cigarette.

## BACKGROUND OF THE INVENTION

In the manufacture of cigarettes with ventilation, it is necessary to provide the cigarette with some means by which a predetermined fraction of the air drawn into the cigarette during puffing by-passes the burning zone. Ventilated cigarettes have been accepted by the general public to a limited extent. Varied ventilation techniques have been employed over the past 50 years to provide a cooler, less harsh cigarette. More recently, it has been recognized that ventilated cigarettes are another means by which the deliveries of total particulate matter and gas phase constituents may be reduced.

Ventilation mechanisms may be placed into two major categories, air channeling and perforated wrap; combinations of the two are also often employed. Air channeling has frequently been embodied in cigarettes having corrugated mouthpieces. An example of this type of ventilation is found early in the literature in U.S. Pat. No. 1,718,122, which describes a cigarette having an internally corrugated mouthpiece circumscribing one end of the tobacco column. The outer diameter of the mouthpiece being larger than the diameter of the cigarette allowed air to move along the channels provided in the corrugations and enters the smoker's mouth without first mixing with the smoke. A later U.S. Patent, No. 3,490,461, similarly describes a fluted wrap about a filter overwrapped with perforated tipping paper. Air enters through the perforations, but again does not mix with the smoke.

For economic reasons, the preferred means of ventilating cigarettes has heretofore been through perforated wrapping about some portion of the cigarette. Many publications and patents have described techniques of perforating paper about the tobacco column and/or filter.

The filter perforations usually are patterned in a circumferential line or band about the tipping paper, sometimes positioned over the junction between the tobacco column and filter. Air during puffing enters the perforations and moves into the filter through the junction. U.S. Pat. No. 3,410,274 describes this feature in detail.

A visible disadvantage of perforated cigarettes, however, was the issuance of smoke through the perforations during non-puffing intervals. The most successful attempt to prevent smoke from escaping through the perforations was accomplished when plug wrap characterized by being uniformly and highly porous became commercially available. The perforated tipping paper was positioned over the uniformly porous plug wrap. The microscopic pores of the plug wrap significantly reduced visible signs of smoke escaping. Registry problems between the perforations in the tipping paper and perforations previously required in the plug wrap were also diminished.

U.S. Pat. Nos. 2,988,088 and 3,046,994 describe uniformly porous paper which has met with some commercial success in being employed as filter plug wrap. This paper is provided with uniform porosity through the paper making process. Air readily moves through the

microscopic pores of the paper. In contrast, perforated paper is substantially non-porous except, of course, at the position of the macroscopic perforations. The terms "uniformly porous" and "uniform porosity" as used hereinafter are defined as meaning a substance which inherently has porosity distributed uniformly over its surface as distinguished from a substance given porosity by mechanical means. It follows that substances with uniform porosity are given this characteristic in the fabrication stage unlike perforated materials.

A problem which heretofore has continually plagued manufacturers of ventilated cigarettes using perforated wrappers, included those using uniformly porous plug wrap, has been large variations in harshness and pressure drop between cigarettes of an identical brand and construction. Studies made on a number of present brands have shown average variations in tar deliveries ranging from 14 to 30 percent. Other studies have also shown large variations in pressure drop. Much effort has been made to discover the source of the problem and to provide an economical solution. It is the paramount object of the present invention to provide such a solution.

## SUMMARY OF THE INVENTION

The ventilated cigarette of the present invention has a filter plug wrapped with a uniformly porous wrap and overwrapped with uniformly porous tipping envelope. The tipping envelope and plug wrap are adhered together by an adhesive along preselected portions of their contiguous surfaces. The remaining contiguous surfaces are adhesive-free. The adhered regions, due to the impermeability of the adhesive, become substantially non-porous in contrast to the adhesive-free regions of the plug wrap and tipping envelope which maintain the uniform porosity. The areas of the adhesive-free regions, "ventilation regions," and the total porosity therethrough are established to provide a "ventilation index" of about 0.5 cm/sec to 20 cm/sec. The ventilation index is defined as the volume of air entering the ventilation regions per second per (Federal Trade Commission) standard puff (hereinafter called the "ventilation rate") divided by the total area of the ventilation regions.

As will be described in more detail below, the variations in total particulate matter yield and average pressure drop are dramatically reduced by employing the teachings of the present invention.

Other objects and advantages of the present invention will be apparent after a reading of the description and appended drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1(a), 1(b) and 1(c) are schematics which illustrate various prior art ventilation techniques employing either perforations or "skinned" tipping paper for ventilation;

FIG. 2 is a perspective view of a ventilated filter tip cigarette constructed in accordance with the present invention; and

FIGS. 3(a), 3(b) and 3(c) are schematics illustrating variations of adhesive patterns which may be employed with ventilated filter tip cigarettes of the present invention.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1(a), a cigarette 10 is comprised of a tobacco column 11 and filter 12, the dashed line indicating the junction 13 between column 11 and filter 12. Perforations 14 are arranged in a circumferential band in the tipping paper 15 about filter 12. The underlying plug wrap may either be porous or provided with perforations which are in registry with perforations 14. An example of the latter is found in U.K. Pat. No. 938,902 assigned to the Imperial Tobacco Company. The coinciding perforations permit ventilation.

U.K. Pat. No. 989,479, also assigned to the Imperial Tobacco Company, describes a filter tipped cigarette in which the sleeve encircling the filter stub is made from highly permeable paper which is disposed beneath a perforated encircling band.

In FIG. 1(b) another prior art variation is illustrated in which the perforations 14 in tipping paper 15 are positioned over junction 13. No adhesive is applied below tipping 15 in this region, thereby permitting air to be drawn through perforations 14 and into filter 12 via underlying junction 13.

FIG. 1(c) illustrates still another variation in which the perforations are replaced by shaving or skinning the tipping paper above junction 13 rendering the tipping paper more porous in this region. The skinned region is indicated by the shaded area 16. U.K. Pat. No. 1,039,554 describes the prior art ventilation techniques illustrated in FIGS. 1(b) and 1(c) in detail.

The underlying problem with all the above prior techniques is the inability to provide uniform pressure drop and particulate matter yield from cigarette to cigarette. As is graphically depicted in the examples below, tar deliveries, for example, vary as much as 30 percent in relative standard deviation, for cigarettes of the prior art employing perforated tipping. In contrast, filter tipped cigarettes described in relation to FIGS. 2 and 3, formed in accordance with the present invention, have markedly improved variations in pressure drop and particulate matter yields. In other words, the average measured variations of pressure drop and particulate matter yield of filter tipped cigarettes made in accordance with the present invention are significantly smaller than those measured for prior art ventilated filter tipped cigarettes, and are, in fact, equivalent to normal non-ventilated filter tipped cigarettes.

The perspective view of FIG. 2 illustrates a filter tipped cigarette 20 having a tobacco column 21 joined to a filter 22 at juncture 23. Filter 22 is enclosed by a uniformly porous plug wrap 26. Tipping envelope 24, also uniformly porous, is disposed about wrapped filter 22 and an appropriate distance over tobacco column 21. The adhesive attaching tipping envelope 24 to plug wrap 26, thereby attaching column 21 to filter 22, is applied to selected areas of the contiguous surfaces in such a manner as to provide a predetermined ventilation as described below.

In the discussion below the porosity of the various papers are given in terms of an air flow through 143.1 mm.<sup>2</sup> of paper under a head of 1 inch water gauge. The measurement generally employed for the tipping papers of the prior art is a Greiner porosity index which is the number of seconds required for the passage of 50 cubic centimeters of air through a circular sample of paper one inch in diameter, with a pressure drop of

approximately 4.5 inches of water. Such a Greiner measurement for the porous papers employed according to the present invention would be meaningless as the porosity is so high that all papers would have a Greiner porosity index below one. The value calculated as described, will be referred to as porosity.

To provide the proper combination of ventilated area (adhesive-free contiguous surfaces of tipping envelope and plug wrap) and total filter pressure drop, it is necessary to use material such as paper, for example, having a porosity of about 3 cc/sec to 40 cc/sec. By using material of the porosity above, accompanied by a ventilated region or regions having a total area of from about 0.5 cm<sup>2</sup> to about 5.0 cm<sup>2</sup>, it has been found that reduced particulate matter deliveries may be obtained which, along with pressure drop, have small variations from cigarette to cigarette.

Further investigations have uncovered a critical relationship between the total area of the ventilation region or regions and total filter pressure drop which, when held between certain limits, provides the unique characteristic of small variations. This relationship, called the ventilation index, the volume of air entering the ventilated region per second per standard puff divided by the ventilated area, necessarily must have a range of 0.5 to 20 cm/sec, and preferably between 2.0 and 6.0 cm/sec.

The area of the ventilated regions have upper and lower limitations for practical reasons. When the area becomes too small, the beneficial effects of ventilation become undetectable, thus approaching the results obtained for non-ventilated filter tipped cigarettes. On the other hand, the tipping paper must be securely fastened to the filter and tobacco column. These lower and upper limits have been found to be about 0.5 cm<sup>2</sup> and 5.0 cm<sup>2</sup>, respectively.

The combined or total porosity of the ventilated regions is also limited by practical considerations. Too great a porosity will not permit sufficient resistance upon puffing and it will be difficult, if not impossible, to smoke the cigarette. With too low a porosity, the results are similar to those obtained for small ventilated regions. Total or combined porosities of about 1 cc/sec to about 10 cc/sec have been found suitable.

Although the pattern of ventilated areas in the filter is not critical to the present invention, FIGS. 3(a), 3(b) and 3(c) depict various patterns of ventilated regions 30, 31, 32 formed by selectively applying the adhesive 33. FIGS. 3(a) and 3(b) respectively illustrate longitudinally and circumferentially disposed ventilated regions 30, 31. FIGS. 3(c) is a combination of the patterns of FIGS. 3(a) and 3(b), providing discrete ventilated regions in a checkerboard appearance. Although FIGS. 3(a), 3(b) and 3(c) visually show the adhered regions, it is understood that this is for purposes of illustration only and that to the eye there is no distinction between ventilated and non-ventilated areas unless otherwise desired. It should also be noted that a single ventilated region may be employed when the critical relationships described above are observed.

The mechanism by which the filter tipped cigarette of the present invention provides more constant performance between cigarettes is not completely understood. Although not to be construed as limiting, it is thought, however, that the small variations which result when utilizing the ventilated cigarettes of the present invention are due in part to the large area of the venti-

lated regions. Local imperfections in the ventilated regions, being very small when compared to the areas of the regions, do not substantially affect the performance of the ventilated regions since the imperfections are statistically averaged out. In contrast, imperfections in a band of perforations in the tipping envelope more nearly approximate the area involved in ventilating and, consequently, have a much larger effect upon the total porosity of the tipping envelope.

In addition, as two layers of inherently porous paper are employed according to the present invention, the chances of averaging out imperfections is increased.

The following examples are representative of typical test data illustrating the differences between conventional ventilated filter tipped cigarettes and those made in accordance with the present invention.

#### Example 1

Four different brands of conventional filter tipped cigarettes having perforated tipping paper as a ventilation mechanism were tested in accordance with standard procedures delineated by the Federal Trade Commission. Twenty-four cigarettes in groups of six from each brand were consumed by passing 35 cc of air per puff through the column, each puff being of 2 seconds duration, at 1 minute intervals. The cigarettes were consumed to a 33 millimeter butt. Table 1 below depicts measurements of each brand.

TABLE 1

Brand	Ventila- tion Area (mm <sup>2</sup> )	Average Tar (mg)	Average Tar RSD (%)	Average Pressure Drop (of ventilation area) [in.]	Average Pressure Drop RSD (%)
A	2.5	13.1	14	34.0	29
B	4.1	15.6	18	16.4	38
C	10.8	1.2	30	3.6	27
D	1.6	18.2	18	15.3	33

With the exception of brand C (70 mm) all other brands were 85 mm cigarettes. For comparison with other examples below, it should be noted that the relative standard deviations (RSD) varied from 14 to 30 percent in average tar yield and 27 to 38 percent in average pressure drop of the ventilation area. The ventilation index of brands A, B, C and D were calculated to be 180 cm/sec, 110 cm/sec, 160 cm/sec and 370 cm/sec, respectively.

#### Example 2

Conventional techniques were employed to construct the ventilated filter tipped cigarettes of the present invention, except that the profile of the tipping glue roller was cut so as to leave bands of unglued regions having ventilation areas of 200 mm<sup>2</sup> and 250 mm<sup>2</sup> circumferentially about the filter tip. The porosities of the paper used as the plug wrap and tipping envelope were 8 cc/sec and 4 cc/sec, respectively. Such is commercially available. Using the same test procedures as employed in Example 1, the results of Table 2 were obtained.

TABLE 2

Ventilation Area (mm <sup>2</sup> )	Average Tar (mg)	Average Tar RSD (%)	Average Pressure Drop (of ventilation area) [in.]	Average Pressure Drop RSD (%)
200	11.3	8.4	9.6	17
250	9.5	6.7	8.1	10

The ventilation index was calculated to be 3.0 cm/sec and 3.2 cm/sec, respectively. It should be noted that both average tar RSD and average pressure drop RSD in Table 2 are substantially less than any values shown in Table 1, showing a much more consistent product. It should be noted that the average tar RSD above is equal to or less than the average tar RSD for non-ventilated filter tip cigarettes, that value being about 9 percent. The ventilation index of each prior art brand, shown in Example 1, is an order of magnitude greater than those depicted in Table 2.

#### Example 3

Reference is made to Table 3 in which comparisons are made of the yields of selected particulate material and gas phase constituents between a conventional non-ventilated filter tipped cigarette and those constructed in accordance with the present invention. Test procedures identical to those used in Example 1 were employed.

TABLE 3

	Ventilated area (mm <sup>2</sup> )	Puff No.	Tar (mg)	Nico- tine (mg)	CO (mg)	Pres- sure drop (in.)
Control.....		7.3	14.4	1.19	14	4.0
Porous tipping.....	150	8.2	9.6	0.86	10	3.0

The tar, nicotine, and carbon monoxide yields of the control cigarettes were substantially higher than the porous tipped cigarettes of the present invention.

In summary, it may be seen that the porous filter tipped cigarettes provide a means through which reduced and consistent deliveries of total particulate matter and gas phase constituents are obtained, thus fulfilling the objective as set forth hereinbefore.

The particular type of filter material employed is not a limiting factor since the porous tipping as described and claimed herein may be employed with cellulose acetate, activated carbon granules, and other materials equally well. Although the descriptive matter generally describes the filter as being unitary, this is also not to be construed as a limitation since multi-section filters function well in cooperation with porous tipping according to the present invention.

The term "cigarette" as used throughout the description and claims is meant to include not only cigarettes but any tobacco product smoked in the conventional sense such as, for example, a cigar or a cigarette with a filter tip attached thereto.

Having read and viewed the description and accompanying drawings, modifications, alterations, and variations will occur to those skilled in the art which do not depart from the scope of the invention as defined in the appended claims.

What is claimed is:

1. A ventilated filter tip cigarette comprising:
  - a. a tobacco column;
  - b. a filter enclosed by a porous air permeable wrapper characterized by substantially uniform porosity;
  - c. an envelope characterized by substantially uniform porosity enclosing at least a portion of said enclosed filter, said envelope and wrapper being adhered together along at least one but not over the entire area of preselected regions of their contiguous surfaces, the remainder of said contiguous sur-

faces being adhesive-free, said envelope being air permeable to permit ambient air flow through the remainder area of said envelope and wrapper whereby said filter has a ventilation index of from about 0.5 to 20 cm/sec.

2. The filter of claim 1 wherein the total area of said remainder is from about 0.5 to 5.0 cm<sup>2</sup>.

3. The filter of claim 1 wherein the ventilation index is from about 2.0 to 6.0 cm/sec.

4. The filter tip cigarette of claim 1 in which said remainder consists of a band circumferentially about the filter.

5. The filter tip cigarette of claim 4 in which said remainder consists of a plurality of bands about the filter.

6. The filter tip cigarette of claim 1 in which said remainder consists of at least one band disposed longitudinally along said filter.

7. The filter tip cigarette of claim 6 in which said remainder consists of a plurality of discrete regions about

the filter.

8. An improved ventilated filter tip cigarette comprising:

a. tobacco column;

b. a filter enclosed by a porous air permeable wrapper characterized by substantially uniform porosity; and

c. porous, air permeable, tipping paper characterized by substantially uniform porosity, said tipping paper and wrapper being adhered together so as to form at least one region, between said wrapper and tipping paper, which is adhesive-free to permit ambient air flow therethrough wherein the area of the at least one said region is about 0.5 to 5.0 cm<sup>2</sup> and the ventilation index is about 0.5 to 20 cm/sec.

9. The filter tip cigarette of claim 8 wherein the combined porosity of said wrapper and said tipping paper is from about 1 to 10 cc/sec.

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