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[54] **VENTILATED SMOKING ARTICLE**
5 Claims, 4 Drawing Figs.

[52] **U.S. Cl.**..... **131/10 A,**
131/10.7
 [51] **Int. Cl.**..... **A24d 01/04,**
A24f 13/06
 [50] **Field of Search**..... **131/10, 10**
A, 9, 198, 198 A, 15 B

ABSTRACT: The admission of outside air to a tobacco smoke filter is enhanced by providing a corrugated wrapper around the filter plug, thereby to define a multiplicity of passages for conducting air admitted through the tipping paper over a relatively large portion of the surface of the filter plug.

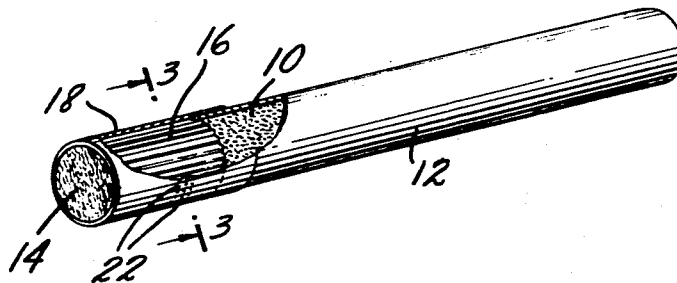


FIG. 1

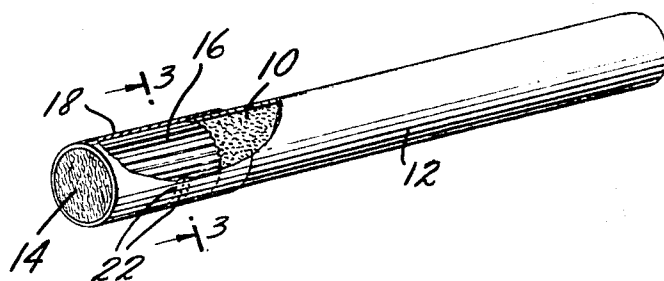


FIG. 2

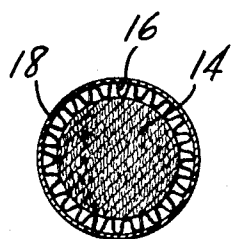
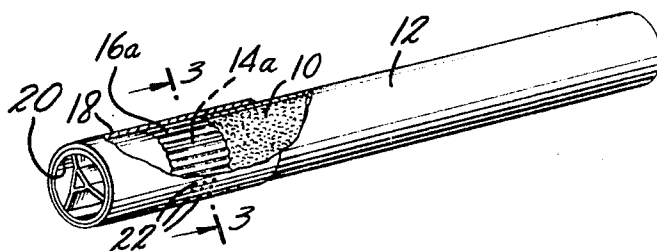


FIG. 3

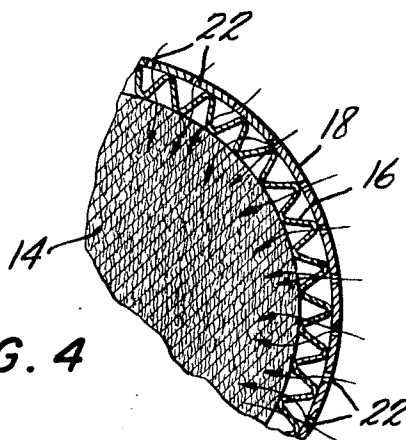


FIG. 4

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VENTILATED SMOKING ARTICLE

BACKGROUND OF THE INVENTION

This invention relates to tobacco smoke filters of the ventilated type and, in particular, to ventilated filters for use in cigarettes.

A relatively recent development in the cigarette industry is the so-called ventilated filter. A ventilated filter may be defined as a filter which is constructed in a manner such that outside air is drawn in through the filter and blended with the smoke for admission to the smoker's mouth. The ventilated filter makes it possible to use a higher density filtering medium for removal of greater quantities of smoke while not reducing the draw that the smoker expects.

The usual form of ventilated filter comprises one or more rows of tiny holes in the tipping paper located in a region overlying the filter plug. Ordinarily, the filter plug in both conventional and ventilated filters, is enclosed in a paper wrapper, and in the case of ventilated filters, the wrapper is either perforated or is formed of a porous paper so that air admitted through the small holes in the tipping paper can pass through the wrapper to the filter plug.

It is apparent that ventilated filters of the construction described above provide a relatively high restriction to the entry of air to the filter. First of all, the admission of air is limited to the holes through the tipping paper. Secondly, by reason of the tight wrapping of the tipping paper around the filter-plug wrapper and the wrapper around the filter plug, the admission of air is limited to a relatively small portion of the surface area of the filter plug, such portion of the surface area of the filter plug, such portion being not much greater than the total area of the holes.

SUMMARY OF THE INVENTION

There is provided, in accordance with the invention, a ventilated filter that significantly reduces the restriction of the passage of air to the filtering medium. More particularly, a ventilated filter, according to the invention, comprises a filter plug, which may be fibrous or particulate material or may be a composite or combination of fibrous and particulate material, and will usually have a porous filter wrapper around it. A tipping paper is wrapped around the filter plug and a portion of the tobacco body of the cigarette to join the filter plug to the cigarette body. The tipping paper is constructed to admit air to the filter plug, such as by the provision of tiny holes through it in a region overlying the filter plug. In accordance with the invention, a significant increase in the passage of air from the tipping paper holes into the filter plug is afforded by providing a corrugated inner wrapper between the filter plug and the tipping paper. The corrugations provide a multiplicity of passages adjacent to the filter plug and in communication with the air inlet holes in the tipping paper so that air entering through the perforations is spread over a relatively large area of the filter plug and is communicated over a considerably increased surface area of the filter plug. Thus, the invention makes it possible to lower the pressure drop at the exit end of the filter, as compared to essentially the same filter construction without a corrugated inner wrapper, or to provide the same pressure drop with a less restricted airflow to the filter, thus enabling a denser filter medium to be used.

DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention, reference may be made to the following description of exemplary embodiments, taken in conjunction with the figures of the accompanying drawings, in which:

FIG. 1 is a pictorial view of a cigarette having the improved ventilated filter, portions of the components of the cigarette being broken away more clearly to show the construction;

FIG. 2 is a pictorial view of a cigarette having the improved ventilated filter and also provided with a built-in mouthpiece, portions again being broken away;

FIG. 3 is an end cross-sectional view taken through the filter plug section of the cigarettes of either FIG. 1 or FIG. 2, the view being on an enlarged scale relative to FIGS. 1 and 2 and being taken generally along the plane represented by the lines 3-3 in FIGS. 1 and 2; and

FIG. 4 is a further enlarged end sectional view of a segment of the filter.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

The embodiment of FIG. 1 comprises, of course, a cylindrical rod 10 of tobacco encased within a paper wrapper 12 and constituting the body of the cigarette. In end-to-end relation to one end of the tobacco rod 10 is a filter plug 14, which may be any appropriate smoke filter medium. The drawings show a fibrous medium. Today's conventional fibrous filter plugs are manufactured with a paper wrapper (not shown), and for a ventilated filter, the filter plug wrapper is made of porous paper or a paper formed with perforations. For purposes of the following description any reference to the filter plug will mean the filter plug and its wrapper, if it has one.

The filter plug 14 is enclosed within an inner band or wrapper 16 of a material that is permeable to air either by virtue of a relatively porous structure or by the formation of perforations through a relatively nonporous closed structure. A preferred material for the inner wrapper 16 is a porous paper having the following specifications:

Thickness	0.05 mm.
Density	27-33 g/m ²
Greiner Porosity	1.9 sec/50 cc. air.

The filter plug 14 and the wrapper 16 are attached to the cigarette body 10 with a conventional tipping paper 18 which encompasses the entire filter plug and overlaps a portion of the cigarette body.

The embodiment of FIG. 2 is the same as the embodiment of FIG. 1 except for the lengths of the filter plug 14a and the inner wrapper 16a and the inclusion in end-to-end relation at the smoking end of the cigarette of a mouthpiece 20. The mouthpiece may be a cylindrical plastic extrusion formed with an internal structure providing support for the cylindrical body, and may, for example, be of the construction described as shown in U. S. Pat. No. 3,396,733. The inner wrapper 16a is wrapped around both the filter plug and the mouthpiece and serves to join them together for handling as a composite unit in tipping machinery.

The filter structures of the embodiments of both FIGS. 1 and 2 provide for the admission of air into the filter and thence to the smoker's mouth by, first of all, conduction of air through the tipping paper 18 by way of a multiplicity of small holes 22 spaced circumferentially around the tipping paper 18 in a region overlying the filter plug 14 (or 14a). The number and size of the holes is established so that a desired draw through the cigarette, with due consideration for the pressure loss of the smoke passing through the filter, is obtained. In other words, the filter plug may have a pressure loss in excess of that which would provide a desirable product, from the smoker's standpoint, and the perforations provide for the admission of air to the filter and the flow of air with the smoke to the smoker's mouth, the airflow compensating for the increased pressure drop across the filter.

In accordance with the invention, the air drawn in through the holes 22 when the cigarette is smoked is enabled to pass more readily into the filter plug material by forming corrugations in the inner wrapper 16 prior to assembling it onto the filter plug. The corrugations can be produced in various ways, such as by passing the strip for the wrapper paper between two grooved or screw-threaded rollers. The depth and pitch of the corrugations in the paper is controlled by the geometry of the forming rollers and the pressure applied to them. When threaded rollers are used, one has a right-hand thread and the

other a left-hand thread, and they are rotated in opposite directions so that the surfaces of both move with, and in fact, feed the paper through them. The number of corrugations is, of course, controlled by the number of grooves or threads on the forming rollers and may range from about 10 to about 60 per inch. The depth of the corrugations may range from about 0.01 to 0.06 inch and is related somewhat to the pitch of the corrugations.

The pitch of the corrugations is desirably such that the number of corrugations approximates the number of holes through the tipping paper so that most of the holes will be exposed to an open area between the points of contact between the tipping paper 18 and the wrapper 16. However, the corrugations should not have a pitch equal to the number of ventilated holes, since equality in that respect would present a risk of all ventilation holes being covered by the outer loops of the wrapper in some cigarettes produced.

As is apparent from FIG. 4., particularly, the corrugations provide a multiplicity of generally lengthwise airspaces running the length of the wrapper and in communication with the outside air through the ventilation holes 22. Thus, air drawn through the holes is distributed along the passages and flows through the porous or perforated wrapper 16 over a relatively large area of the surface of the filter plug. The opportunity for air to pass relatively freely into the filter plug is consequently greatly enhanced, as compared to the conventional construction in which a layer of paper overlying the filter plug closely engages the filter plug surface and is closely engaged by the tipping paper. The net effect of such closely engaged layers of wrapping material is a relatively nonporous laminate, whereas the interposition of the corrugated wrapper opens the structure and spreads the air over a much larger area of the filter plug.

In addition to providing an increased surface for the air to enter the filter, the corrugations of the wrapper increase the

16 do not afford any opportunity for channeling or bypassing of smoke along the corrugations. The end of the filter wrapper 16 is an end-to-end engagement with the end of the cigarette body wrapper 12, and therefore the ends of the air passages constituted by the corrugations of the wrapper 16 are closed off.

Tests have been conducted to determine the contribution of the corrugated wrapper to a ventilated-type filter structure. The tests were made on control cigarettes and sample cigarettes, the controls and the samples being of identical construction except that the samples incorporated a plain (uncorrugated) wrapper of the same material around the filter plug. The cigarettes were tested on conventional mechanical smoking machines, and the pertinent physical properties and the results of the smoking tests are set forth in table I below.

One series of tests involved smoking the cigarettes with the holes taped closed so as to provide a measure of the degree of similarity between the controls and samples apart from the ventilation feature. It is apparent from the results that the controls and samples were quite similar. With the holes open, however, the draw was improved, and the amounts of tar and nicotine were substantially lower, as compared to the results obtained when the holes were taped. Moreover, the tests showed clearly that the draw was improved and tar and nicotine were significantly reduced in the samples, as compared to the controls, thus demonstrating that the invention provides material improvements in draw, tar and nicotine.

Samples A and B1 included corrugated filter plug wrappers made of paper having the specifications given above corrugated by passing through rolls having 24 threads per inch and a thread depth of 0.027 inch urged together with a nip pressure on the paper of 12 lbs./inch. Sample B2 had a wrapper of the same paper corrugated on the same equipment but with a nip pressure of 13 lbs./inch and thus sample B2 had a slightly greater depth of corrugation than samples A and B1.

TABLE I

	Cigarette weight (g.)	Cigarette pressure drop (mm. H ₂ O)	Tar (mg.)	Nicotine (mg.)	Smoking time (min.)
Holes taped:					
Control A.....	1.074	120	14.8	.72	6.8
Sample A.....	1.075	110	14.8	.77	7.2
Holes open:					
Control A.....	1.071	110	11.0	.58	7.2
Sample A.....	1.074	84	8.2	.48	8.0
Control A, percent reduction.....			25.7	19.4	
Sample A, percent reduction.....			44.6	37.7	
Control A, 33 mm. butt.....				10.4	
Sample A, 33 mm. butt.....				7.7	
Holes taped:					
Control B.....	1.096	132	16.4	.90	7.0
Sample B1.....	1.085	132	15.4	.85	6.9
Sample B2.....	1.088	140	15.4	.83	7.3
Holes open:					
Control B.....	1.096	132	15.4	.85	7.9
Sample B1.....	1.085	126	12.3	.68	7.8
Sample B2.....	1.088	126	11.2	.66	8.0
Control B, percent reduction.....			6.1	5.6	
Sample B1, percent reduction.....			20.1	20.0	
Sample B2, percent reduction.....			27.3	20.5	
Control B, 33 mm. butt.....				14.6	
Sample B1, 33 mm. butt.....				11.6	
Sample B2, 33 mm. butt.....				10.5	

¹ Corrected TPM.

porosity of the paper material itself by an opening up of the fiber structure in the process of forming the corrugations. The corrugating process involves a significant stretching of the paper in a direction transverse to the corrugations. Therefore, this additional factor of increased porosity of a corrugated wrapper further enhances the freedom of entry of air into the filter.

It should be mentioned that the corrugations in the wrapper

We claim:

1. A smoking article comprising an elongated body of tobacco, a filter mass in end-to-end relation to the tobacco body, a separate wrapper of air-permeable material surrounding and directly engaging the filter mass, and a tipping paper surrounding the air-permeable wrapper and a portion of the tobacco body and secured to them to join them together, the tipping paper having means overlying the air-permeable

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wrapper for admitting air to the filter air-permeable wrapper, and the air-permeable wrapper being corrugated to increase the permeable surface area thereof to facilitate conducting air admitted through the tipping paper to the filter mass.

2. A smoking article according to claim 1 wherein the means for admitting air through the tipping paper comprises at least one generally circumferential row of spaced-apart perforations overlying the filter mass, and wherein the number of corrugations in the air-permeable wrapper corresponds generally to the number of such perforations in the row.

3. A smoking article according to claim 1 wherein the corrugations in the air-permeable wrapper range from about 10 to about 60 per inch in number and have an overall depth in the range of from about 0.01 inch to about 0.06 inch.

4. A smoking article according to claim 1 further comprising a mouthpiece in end-to-end relation to the filter mass.

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5. A smoking article comprising an elongated body of tobacco, a filter mass in end-to-end relation to the tobacco body, a wrapper of porous paper surrounding the filter mass and a tipping paper surrounding the paper wrapper and a portion of the tobacco body and secured to them to join them together, the tipping paper having at least one generally circumferential row of perforations overlying the filter mass and the paper wrapper, and the paper wrapper being corrugated generally lengthwise of the filter mass with corrugations in the range of from about 10 to about 60 per inch in number and having an overall depth of from about 0.01 inch to 0.06 inch thereby to define a multiplicity of passages for conducting air admitted through the tipping paper to the filter mass, the number of corrugations in the wrapper corresponding generally to the number of such perforations in the row.

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