

IMPROVED CIGARETTE FILTER

This invention relates to filters for cigarettes.

In one aspect, it relates to a filter with novel ventilating means therein. In another aspect, the invention relates to a filter cigarette having flow directing grooves therein for mixing ventilating air with a portion of the tobacco smoke while the remaining portion of the tobacco smoke passes through the filter without mixing with ventilating air.

It is well known in the art of filter cigarettes to provide filters with ventilating means to bring in ambient air to the filter to dilute the smoke stream. The dilution of the smoke stream reduces the quantity of smoke particulates as well as gas-phase components which are delivered to the mouth of the smoker. A number of means have been proposed and are utilised for introducing ventilating air into the cigarette. For example, the wrapper for the tobacco in a cigarette can be made from a porous material which allows for introduction of air along the entire length of the cigarette where it mixes with the smoke stream passing therethrough, thereby diluting the smoke in the stream prior to entering the smoker's mouth. Also, the cigarette wrapper may be perforated at selected locations along the length of the cigarette which provides ports for the cigarette through which ventilating air enters. Even further, it is known to perforate the

wrapper of the filter on the filter end of the cigarette to allow for ventilating air to enter the filter for dilution of the smoke stream. There have also been a number of suggestions for incorporating grooves within the filter plug for the cigarette in order to facilitate the addition of ventilating air into the smoke stream. These includes for example U.S. Patent No. 3,596,663; U.S. Patent No. 3,577,995; U.S. Patent No. 3,572,347; U.S. Patent No. 3,490,461; U.S. Patent No. 1,718,122, U.S. Patent No. 3,788,330; U.S. Patent No. 3,773,053; U.S. Patent No. 3,752,165; U.S. Patent No. 3,638,661; U.S. Patent No. 3,608,561; and U.S. Patent No. 3,910,288.

There have also been a number of suggestions for incorporating channels within the filter plug for the cigarette in order to facilitate addition of ventilating air into the smoke stream. These include for example U.S. Patent No. 3,416,541; U.S. Patent No. 3,910,288; U.S. Patent No. 3,773,883; U.S. Patent No. 3,581,748; U.S. Patent No. 3,045,680; and, U.S. Patent No. 1,996,990.

The present invention advantageously provides a straight forward arrangement of a filter for a cigarette which achieves lower or normal cigarette pressure drop with low to moderate efficiency filters. The present invention further provides a cigarette filter for lowering tar by combining ventilation with filtration. The present invention even further provide a filter ventilation system for cigarettes utilizing grooves and channels in the filter plugs for mixing ventilating

air with tobacco smoke. The present invention also provides a grooved filter with a non-porous wrap.

In the present invention, smoke leaving the tobacco column is split into two portions, one portion
5 passing through an opening in the filter rod which communicates with a groove or channel which is also in flow communication with ventilating channel which is also in flow communication with ventilating air. The remaining portion of smoke passes through the
10 filter.

Various other features of the present invention will become obvious to those skilled in the art upon reading the disclosure setforth hereinafter.

More particularly, the present invention provides
15 a filter for a cigarette comprising a porous filter rod of substantially cylindrical configuration circumscribed by a smoke-impervious plug wrap, the filter rod having at least one opening in at least one end thereof and at least one longitudinally extending
20 groove embedded into the outer periphery of the rod and the wrapper and longitudinally spaced from said at least one opening and in flow through communication with said at least one opening, wherein said at least one opening is in flow communication with a
25 longitudinally extending hollow channel disposed centrally of said filter rod and extending a distance less than the length of the filter rod, said longitudinal

channel interconnecting with groove-connecting channels, which are in flow communication with said groove, which is in flow communication with ventilating air.

It is to be understood that the description of the examples of the present invention given hereinafter is not by way of limitation and various modifications within the scope of the present invention will occur to those skilled in the art upon reading the disclosure setforth hereinafter.

Referring to the drawing:

Figure 1 is a perspective view illustrating a cigarette having one preferred filter structure of the present invention;

Figure 2 is a longitudinal sectional view taken along a plane passing along section line II-II of Figure 1;

Figure 3 is a transverse sectional view taken along a plane passing along section line III-III of Figure 2;

Figure 4 is a perspective view illustrating a cigarette having another preferred filter structure of the present invention;

Figure 5 is a longitudinal sectional view taken along a plane passing along section line V-V of Figure 4;

Figure 6 is a tranverse sectional view taken along a plane passing along section line VI-VI of Figure 5;

Figure 7 is a perspective view illustrating a cigarette having yet another preferred filter structure of the present invention;

Figure 8 is a longitudinal sectional view taken along a plane passing along section line VIII-VIII of Figure 7;

Figure 9 is a transverse sectional view taken along a plane passing along section line IX-IX of Figure 8;

Figure 10 is a transverse sectional view taken along a plane passing along section line X-X of Figure 8; and,

Figure 11 is a perspective view illustrating a cigarette having a filter structure of Figure 7 attached thereto wherein the ends of the filter attached to the cigarette are reversed.

In Figure 1, a filter plug 2 of the present invention is shown attached to a cigarette tobacco column 1. Filter plug 2 comprises a cellulose acetate filter element 4 or any other filter, made from fibrous or foam materials, for tobacco smoke which may be known in the art, circumscribed by a non-porous or smoke-impervious wrapper 6. It is realized that, in the use of the term "smoke impervious" or "non-porous wrapper", this includes non-porous outer surfaces of foam material which are integral with the filter element as well as non-porous wrapping materials which are not integral with the filter element.

In Figure 2, the filter plug 2 is provided with an opening 8 in the end thereof in communication with the tobacco column 1. The opening 8 defines the inlet into a centrally disposed longitudinally extending duct 9 which extends a preselected distance into the filter rod, and, as best shown in Figures 2 and 3, is in flow communication with radially or transversely extending groove-connecting channels 10. Embedded into the outer periphery of the filter rod is a plurality of longitudinally extending grooves 12 which are in flow communication with the transversely extending channels 10. Each groove 12 extends a preselected distance along the outer periphery of the filter and intermediate thereof connects with radially or transversely extending groove-connecting channels 14. The transversely extending channels 14 interconnect with a centrally disposed axial longitudinally extending duct 16 which extends longitudinally to the opposite or the mouth end of the filter.

Circumscribing the wrapper 6 is an air pervious tipping paper 20, tipping paper 20 being shown with two rows of perforations 21 therein, it being realised that only one row of perforations or other flow through means may be provided. The perforations 21 are in flow communication with the grooves 12.

In the use of the filter of the present invention as shown in Figures 1, 2 and 3, when tobacco smoke enters

filter, a portion of the smoke travels through the filter rod 4 and the remaining portion of the smoke travels through the area of least resistance, that being the center longitudinally extending duct 9. This smoke then splits to one of the intersecting transversely extending channels 10 and then moves outwardly to be swept along one of the intersecting longitudinally extending grooves 12 where it becomes mixed or diluted with ventilating air entering the grooves 12 through the perforations 21 of the porous tipping paper 20. The diluted smoke swept down the grooves 12 between the porous tipping paper 20 and the non-porous plug wrap 6 flows into the intersecting transversely extending channels 14. The ventilated smoke then exits through the connecting center longitudinally extending duct 16. The portion of the smoke that does not get swept into the channel portions of the filter plug is filtered as it passes through the filter material under normal smoke draw.

In Figure 4, a filter plug 22 of the present invention is shown attached to a cigarette tobacco column 1. This filter plug 22 comprises a cellulose acetate filter element 24 or any other filter made from fibrous or foam materials for tobacco smoke which may be known in the art circumscribed by a non-porous wrapper 26. The filter plug 22 is provided with a plurality of longitudinally extending grooves 32 embedded in the outer periphery thereof. Grooves 32 terminate at one end at

the tobacco column 1 and at the other end, as best shown in Figures 5 and 6, connect with radially or transversely extending groove-connecting channels

34. The transversely extending channels 34 interconnect with a centrally disposed axially aligned duct 36 which extends longitudinally to the opposite or mouth end of the filter.

In the use of the filter of the present invention as shown in Figures 4, 5 and 6, tobacco smoke entering

the filter is spilt into two portions. One portion of the smoke travels through the filter rod 24 and the remaining portion of the smoke travels through the area of least resistance, that being the longitudinally extending grooves 32. This smoke is then swept along

the longitudinally extending grooves 32 where it becomes mixed or diluted with ventilating air entering the grooves 32 through the perforations 41 in the air pervious tipping paper 40. The diluted smoke swept down the grooves 32 between the tipping paper 40 and

the plug wrap 26 flows into the intersecting transversely extending channels 34. The ventilated air-smoke stream then exits through the connecting center longitudinally extending duct 36. The portion of the smoke that vitually does not get mixed with ventilating air in the grooves 32 is filtered as it passes through the filter material under normal smoke draw.

In Figures 7, 8, 9, and 10, a filter plug 42 of the present invention is shown attached to a cigarette

tobacco column 1. This filter plug 42 comprises a cellulose acetate filter element 44 or any other filter made from fibrous or foam materials for tobacco smoke which may be known in the art circumscribed by a non-porous wrapper 46. The filter plug 42 is provided with a plurality of longitudinally extending grooves 52 embedded in the outer periphery thereof. Each groove 52 extends a preselected distance along the outer periphery of the filter and intermediate thereof connecting radially or transversely extending groove-connecting channels 54 at one end and 56 at the other. Connecting channel 54 is in flow communication with a centrally disposed axially extending duct 58 which extends from opening 60 in one end of the filter a preselected distance into the filter rod. Connecting channels 56 extend radially into the filter connecting with each other at the central axis of the filter rod.

Circumscribing the wrapper 46 is an air pervious tipping paper 62, tipping paper 62 being shown with two rows of perforations 61 therein, perforations 61 being in flow communication with the grooves 52.

In the use of the filter of the present invention as shown in Figure 7, 8, 9, and 10, tobacco smoke entering the filter is split into two portions. One portion of the smoke travels through the filter rod 44 and the remaining portion of the smoke travels through the area of least resistance, that being the

center longitudinally extending duct 58. This smoke then splits to one of the intersecting channels 54 and then moves outwardly to be swept along one of the intersecting longitudinally extending grooves 52 where it becomes mixed or diluted with ventilating air entering the grooves 52 through the perforations 61 in the air pervious tipping paper 62. The diluted smoke swept down the grooves 52 between the tipping paper 62 and the plug wrap 46 flows into the intersecting transversely extending channels 56. The ventilated air-smoke stream then enters the body of the filter substantially at the center thereof to mix with the filter rod smoke just prior to leaving the filter material under normal smoke draw.

In Figure 11, the same filter element as shown in Figure 7, 8, 9, and 10, and described hereinbefore is connected to the cigarette tobacco column 1. In Figure 11 the filter attached to the tobacco column 1 is reversed. That is, the duct 58 is disposed as a passageway for the mixture of ventilating air and smoke leaving the filter whereas, in the arrangement of in Figure 7, duct 58 is in the end of the filter attached to and in flow communication with the tobacco column 1.

In the use of the filter as shown in Figure 11, tobacco smoke enters the filter and intermediate thereof a portion of the partially filtered smoke enters one of the intersecting channels 56 and then moves outwardly

to be swept along one of the intersecting longitudinally extending grooves 52 where it becomes mixed or diluted with ventilating air entering the grooves 52 through the perforations 61 in the air pervious tipping paper 62.

5 The diluted smoke swept down the grooves 52 between the tipping paper 62 and the plug wrap 46 flows into the intersecting transversely extending channels 54. The ventilated air-smoke stream then enters the body of the filter, one portion of the stream mixing with the
10 smoke being filtered therein and the remaining portion exits through the connecting center longitudinally extending duct 58.

Various changes may be made to the specific embodiment shown and described without departing from the scope
15 of the appended claims.



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CLAIMS:

1. A cigarette filter comprising a porous filter rod of substantially cylindrical configuration circumscribed by a smoke-impervious plug wrap, the filter rod having at least one opening in at least one end thereof, at least one longitudinally extending duct in the form of a groove embedded into the outer periphery of the rod and the wrapper and longitudinally spaced from said at least one opening and in flow-through communication with said at least one said opening, wherein said at least one opening is in flow communication with a longitudinally extending hollow duct disposed centrally of said filter rod and extending a distance less than the length of the filter, said centrally disposed longitudinal duct interconnecting with duct connecting channels which are in flow communication with said least one groove, which is in flow communication with ventilating air.
2. The cigarette filter of claim 1, wherein a flow-through channel connects said at least one groove in flow-through communication into said filter rod.
3. The cigarette filter of claim 1 or 2 in combination with a cigarette tobacco column, wherein a said at least one opening is in flow communication with said tobacco column.



4. The cigarette filter of claim 1, 2 or 3, in combination with a cigarette tobacco column, wherein a said at least one opening is opposite the end attached to said cigarette tobacco column.

5. The cigarette filter of claim 1 or 2, wherein said filter rod includes an opening in the end opposite said at least one end and said filter includes a second longitudinally extending duct at the end opposite said at least one end in flow communication with said opening at said opposite end and at least one connecting channel interconnecting with each said longitudinally extending duct, said connecting channel being connected with said at least one groove.

6. The cigarette filter of any preceding claims, wherein at least one opening of one end defines an inlet into said at least one groove.

7. The cigarette filter of claim 6, wherein said least one groove has an outlet spaced from said inlet connected with a groove-connecting channel, which is connected with a centrally disposed longitudinally extending duct in flow communication with the opening of said other end.



8. The cigarette filter of any preceding claim and comprising air-pervious tipping material circumscribing said plug wrap and spaced therefrom when enclosing said groove.

5 9. The cigarette filter of claim 8, wherein said tipping material is attached to the outer surface of said plug wrap.

10. The cigarette filter of claim 8 or 9, wherein said tipping material has selective perforations therein
10 in flow-communication with said groove.

11. The cigarette filter of any preceding claim, wherein the plug wrap is integral with said porous filter rod.

12. A cigarette filter substantially as hereinbefore
15 described with reference to Figs. 1 to 3, Figs. 4 to 6, Figs 7 to 10 or Fig. 11 of the accompanying drawings.
