

## [54] CIGARETTE FILTER

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[57]

## ABSTRACT

Filtering means for tobacco wherein the filter is composed of a permselective membrane supported in juxtaposition to the tobacco. Upon the application of the smoking process upon the tobacco, the smoke from the tobacco passes through the membrane and deposits the harmful tar particles and nicotine vapors on the membrane, allowing less harmful gas to pass into the mouth of the smoker.

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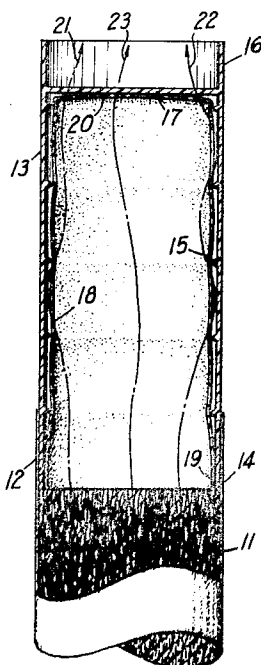
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10 Claims, 3 Drawing Figures



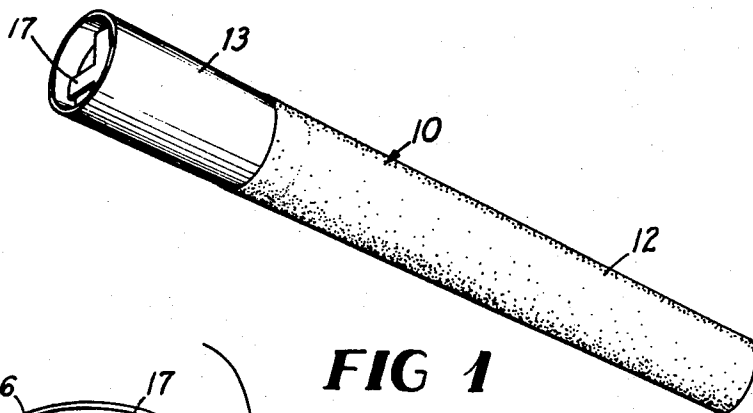


**FIG 1**

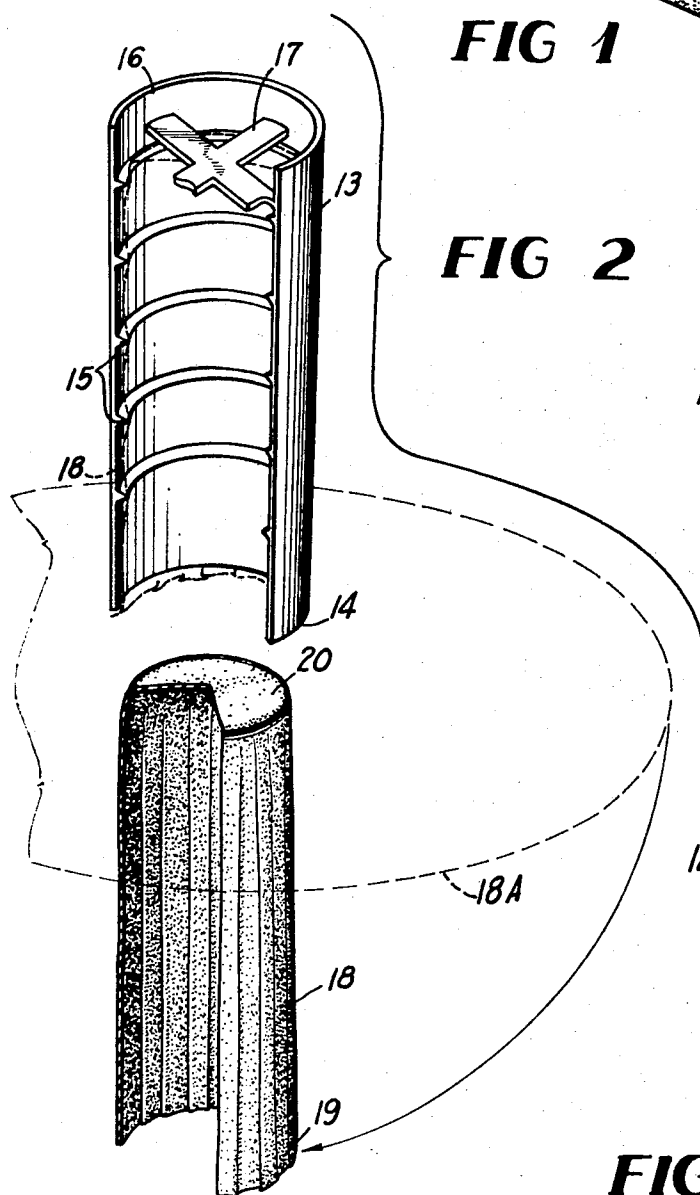


**FIG 2**

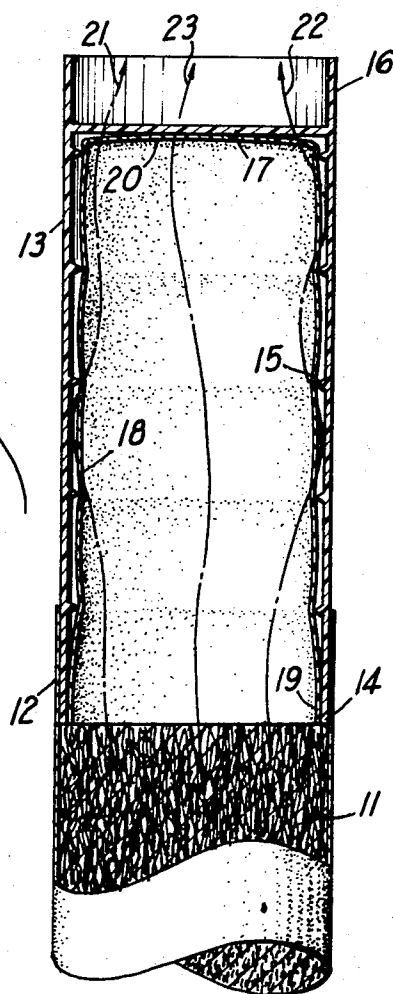


**FIG 3**

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## CIGARETTE FILTER

## BACKGROUND OF THE INVENTION

This invention relates to an improved cigarette construction and more particularly to an improved cigarette filter.

Smoking, in a myriad of forms, is historically one of man's oldest forms of pleasurable diversion. A majority of all persons have probably at one time or another, and perhaps during their entire lifetime, smoked some form of tobacco, either a cigarette, pipe, or a cigar. The use of smoking tobacco is wide spread in spite of the fact that it is recognized by some authorities that smoking is injurious to the delicate membranes of the nose, throat and lungs of the smoker and is credited with inducing various forms of cancer and with inducing heart ailments.

The principal harmful constituents of tobacco smoke include the tars and nicotine vapors. Even though only a small portion of these harmful products actually enter the smoker's system, that quantity is sufficient to be considered by some authorities as being harmful to the smoker.

Many varied constructions of cigarettes have been devised in the past in an attempt to reduce the harmful effects of cigarette smoking. These constructions employ devices such as air baffles in the filter portion, aerating holes in the filter portion or in the cigarette wrapper, cellulose and/or charcoal filter elements, chambers between two or more filter elements, and chemicals within the tobacco. Usually, these devices and methods of reducing the harmful effects of cigarette smoking more often reduce the taste and satisfaction derived from smoking the cigarettes than do they accomplish their intended purpose. Also, some of the devices require manual manipulation by the smoker so that they inhibit the smoker's enjoyment of the cigarette.

## SUMMARY OF THE INVENTION

Briefly described, the selected embodiment of the present invention consists of a column of tobacco to which at one end is secured a tubular, hollow rigid mouthpiece or filter portion which defines a smoking chamber. The mouthpiece is provided with a plurality of ridges circumferentially extending along its interior wall and a perforate partition supported within the smoking chamber adjacent the end of the mouthpiece adapted to enter the mouth of the smoker. Disposed within the smoking chamber and secured across the ridges and the partition is a permselective membrane, preferably a dimethyl silicone membrane, through which the smoke from the column of tobacco passes upon inhalation by the smoker. The tars and nicotine in the smoke collect on and in the membrane, thereby allowing the relatively harmless gases to pass into the mouth of the smoker.

It is, therefore, the primary object of this invention to provide a filter for tobacco which substantially minimizes the harmful products within the tobacco smoke prior to the smoke being drawn into the mouth of the smoker.

It is another object of this invention to provide a tobacco filter which is adaptable to the various forms of tobacco, such as cigarettes, pipes, and cigars.

It is another object of this invention to provide a tobacco filter which allows the tobacco product to be enjoyable to smoke while, at the same time, reducing to a minimum the possibility of introducing injurious substances into the system of the smoker.

A further object of this invention is to provide a tobacco filter which may be fabricated by existing manufacturing method and equipment.

Still other objects and advantages of the present invention will become apparent after reading the accompanying description of the selected illustrative embodiment of the invention with reference to the attached drawings in which like reference characters have been used to refer to the like parts throughout the figures of drawing, and wherein:

## BRIEF DESCRIPTION OF THE FIGS. OF DRAWING

FIG. 1 is a perspective view of a cigarette employing the tobacco filter of the present invention;

FIG. 2 is an exploded perspective cutaway view of the tobacco filter as used in a cigarette; and

FIG. 3 is a fragmentary cross-sectional view of the cigarette filter showing the flow of tobacco smoke through the filter element while smoking.

## DESCRIPTION OF THE INVENTION

Referring now in detail to the embodiment chosen for the purpose of illustrating the present invention, numeral 10 denotes generally the cigarette depicted in FIG. 1.

The cigarette 10 includes a conventional column of tobacco 11, a cigarette wrapper 12, and a mouthpiece 13. The cigarette wrapper 12 is constructed of the usual imperforate paper material found on conventional cigarettes. The wrapper 12 completely encircles the column of tobacco 11 and encircles a portion of the mouthpiece 13 adjacent the end 14 of the mouthpiece 13 which abuts the tobacco 11, as shown in FIG. 3. In this manner, the mouthpiece 13 is secured to the column of tobacco 11. The diameter of the mouthpiece 13 is the same as the diameter of the column of tobacco so that the tobacco 11 and the mouthpiece 13 present a relatively smooth outward appearance when secured together by the wrapper 12.

The mouthpiece 13 is a tubular, hollow element with its interior describing a smoke chamber through which the smoke passes upon inhalation by the smoker. The mouthpiece 13 may be constructed of a rigid, plastic material to provide a means for supporting the membrane 18, which will hereinafter be described in detail, in juxtaposition to the column of tobacco 11. The interior surface of the mouthpiece 13 is detailed to include a plurality of membrane supports which are the circumferentially extending, upwardly tapering ridges 15, as shown in FIGS. 2 and 3. These ridges 15 are preferably spaced equally distanced apart. The membrane supports can also be longitudinally disposed within the mouthpiece 13 or can assume a spiral configuration.

Supported within the mouthpiece 13 is a perforate partition 17, preferably cross-shaped in design as shown in FIGS. 1 and 2. The partition 17 is located adjacent and recessed from the end 16 of the mouthpiece 13 which is adapted to enter the mouth of the smoker.

The element of the filter which actually filters the smoke is the permeable membrane 18. The membrane 18 is a silicone rubber membrane, preferably a dimethyl silicone rubber membrane as produced by the General Electric Company.

The membrane 18 is free of any holes. While, in an ordinary porous membrane, a mixture of gases will pass unchanged through the holes in the membrane, a mixture of gases attempting to pass through a silicone membrane will have to go into solution with the membrane molecules and emerge on the other side.

Different gases pass through the membrane at different rates. Because of this fact, the membranes are usually called "selective" membranes. In the adaption of the membrane to a tobacco filter, it allows the harmless gases in the tobacco smoke to pass through while retarding the passage of tars, nicotine, and other particles in the smoke. This filtering ability is due to its high permeability.

As long as the permeating gases do not react chemically with the membrane, permeability is equal to the product of the solubility coefficient and diffusion rate of the permeating gas in the membrane.

The mechanism involved in this filtering technique is that a gas dissolves in the membrane on the side having a high partial pressure, diffuses through the membrane under the influence of the pressure difference, and then comes out of solution on the lower pressure side of the membrane. In the use of the membrane as a tobacco filter, this permeation mechanism is accomplished by the smoker creating a vacuum on the side of the membrane closest to his mouth by his inhalation of the tobacco smoke. When a vacuum or low partial pressure is thus created, the gas molecules of the tobacco smoke pass through the membrane while the particles of tars and the nicotine permeate the membrane very slowly, if at all. The resulting gases which pass through the membrane are thus less harmful to the smoker than the original tobacco smoke. The harmful products of the tobacco smoke are deposited on and within the membrane.

The membrane 18 is shown in its unfolded position 18A in FIG. 2. The diameter of the membrane used in a cigarette construction as shown in the accompanying figures is approximately 3 inches with a suggested thickness ranging from about 0.0001 inches to about 0.0002 inches. A thinner membrane 18 is preferred as it does not create so much of a "drag" when the smoker is puffing on the cigarette 10 as does a thicker membrane 18.

For insertion into the mouthpiece 13, the membrane 18A is folded into the shape of a tubular plug, membrane 18. As seen in FIG. 3, the membrane 18 is disposed within the smoke chamber of the mouthpiece 13 by having the open end 19 of the membrane 18 secured by suitable means, such as an adhesive, around the inner wall of the mouthpiece 13 adjacent the end 14. The membrane 18 is bonded along the wall up to the first ridge 15. The membrane 18 then has its outer surface secured to the top of the ridges 15 by suitable means, such as an adhesive. Finally, the top 20 of the membrane 18 is secured by suitable means to the underside of the partition 17. The recessed partition 17 provides support for the membrane within the mouthpiece 13 and protects the tongue of the smoker

from coming into contact with the top 20 of the membrane 18.

Care should be taken in the construction of the filtering element that the membrane 18 be supported across the ridges 15 tightly enough so that, in response to the suction by the smoker, the membrane 18 does not collapse against the interior wall of the mouthpiece 13. Also, there should be enough space between the membrane 18 and the interior wall of the mouthpiece 13 so that the smoke can freely pass in, through, and out of the membrane 18.

#### OPERATION

Referring to FIG. 3, the arrows 21, 22 and 23 depict the flow of the tobacco smoke being drawn by the smoker through the column of tobacco 11 and into the smoke chamber of mouthpiece 13. Arrow 21 depicts the smoke flowing through the membrane 18, back through again, and out the top 20 of the membrane 18 and through the partition 17 to the mouth of the smoker. In this manner, the smoke is filtered as it enters the membrane 18, is filtered again as it goes back through the membrane 18, and then is filtered once more as it exists through top 20 of the membrane 18. Each time the smoke passes through membrane 18, the tar and nicotine particles are deposited on and in the membrane 18. Thus, these harmful products are filtered out of the smoke and only the relatively harmless gases pass on to the smoker.

Arrow 22 depicts the smoke twice entering the membrane 18 before it exits through the top 20. Arrow 23 shows the tobacco smoke being filtered only once through the top 20 of the membrane.

It is understood that while the membrane 18 is depicted in the chosen embodiment as a filtering element incorporated within a cigarette construction, the membrane 18 can also be used in a cigarette holder which has one end adapted to communicate with a cigarette and the other end adapted to be inserted into the mouth of the smoker. The membrane 18 could be periodically removed and a fresh membrane 18 could be inserted in its place.

The membrane 18 can also be employed as a filtering means for pipes. For example, a filter support similar in design to mouthpiece 13 can be constructed so as to fit into the stem of a pipe. Here, also, the membrane 18 could be periodically removed and a new one inserted in its place. The membrane 18 could also be used in connection with filtering the smoke from cigars.

While the membrane 18 is depicted in the figures of drawing as the sole filtering element of the cigarette 10, it is also understood that the membrane 18 can be used in conjunction with other filtering elements, such as cellulose and/or charcoal filters.

It is obvious that one skilled in the art may make modifications in the details of construction without departing from the spirit of the invention which is set out in varying scope in the appended claims.

What is claimed is:

1. A filtering means for use in a smoking process comprising a mouthpiece forming a cylindrical smoke chamber, one end of which is adapted to enter the mouth of a smoker and the other end of which is connectable to the downstream end of a body of tobacco, said mouthpiece being cylindrical in form, a plurality of

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spaced ridges extending from the inner wall of said mouthpiece inwardly into said smoke chamber, a filter element comprising a cylindrical porous smoke pervious membrane in the form of a cup member located in said smoke chamber with the closed end of said filter member adjacent the end of the smoke chamber which is adapted to enter the mouth of the smoker and with the cylindrical wall of said membrane being spaced from and parallel with the wall of the smoke chamber and in contact with said ridges, said spacing being such as to provide a smoke passageway between the outer cylindrical wall of said membrane and the inner wall of said mouthpiece and thus smoke emanating from the body of tobacco will pass both through said smoke passageway and also directly through the closed end of said filter member, and means for sealingly securing the open end of said filter member throughout its circumference to the inner wall of said smoke chamber.

2. A filtering means as described in claim 1 wherein said membrane is a silicone membrane.

3. A cigarette as described in claim 2 wherein the thickness of said membrane ranges from about 0.0001

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inches to about 0.0002 inches.

4. A cigarette as described in claim 1 wherein said mouthpiece further includes a perforate partition supported within said mouthpiece adjacent said end adapted to enter said mouth of said smoker for maintaining said membrane away from the tongue of said smoker.

5. A cigarette as described in claim 1 wherein said partition is recessed from said end adapted to enter said mouth of said smoker.

6. A cigarette as described in claim 5 wherein said partition is cross-shaped in design.

7. A filtering means as in claim 5 wherein said membrane is secured to said partition.

8. A filtering means as in claim 1 wherein said ridges are in the form of annular rings.

9. A filtering means as in claim 8 wherein said ridges are inwardly tapered.

10. A filtering means as in claim 9 wherein said filter element is adhesively secured to the inner edges of said ridges.

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