United States Patent

Tamol et al.

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[54] **FILM COVERING FOR APERTURED SMOKING PRODUCT WRAPPER**

[72] Inventors: **Ronald A. Tamol; Leo F. Meyer,** both of Richmond, Va.

[73] Assignee: **Philip Morris Incorporated,** New York, N.Y.

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[52] **U.S. Cl.** .....**131/15 B,** 131/9

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[58] **Field of Search**.....131/17, 2, 9, 15, 8, 140–144

[56] **References Cited**

UNITED STATES PATENTS

3,473,535 10/1969 Stahly .....131/15 B

3,526,904 9/1970 Tamol.....131/15 B

Primary Examiner—Melvin D. Rein

Attorney—Elmer R. Helferich et al.

[57] **ABSTRACT**

The disclosure relates to a film covering for a smoking product wrapper, such as a cigarette wrapper. The wrapper is either porous, or is deliberately perforated with vents or apertures. These openings or vents are covered with a polymeric film that has been submitted to a degradation operation. The degradation is electrically produced, for example, by irradiation. The degradation expedites the removal of film over the apertures by smoke components so that air is permitted to dilute the smoke during the later stages of smoking.

6 Claims, No Drawings

FILM COVERING FOR APERTURED SMOKING PRODUCT WRAPPER

BACKGROUND OF THE INVENTION

It has been known that the amount of smoke delivered to the smoker of a cigarette can be lowered, without increasing the resistance-to-draw of the cigarette, by increasing the proportion of air which is drawn in with the smoke behind the burning coal. It is also known that additional air can be provided with the smoke by using a very porous paper as the wrapper for the tobacco or by making perforations in the paper. In this way a greater proportion of the combustion products are dissipated to the atmosphere in the intervals between puffing. Cigarettes have also been made wherein ventilation holes have been included in the paper or in the overtipping surrounding the filter plug of a filter cigarette. In addition, various methods have been described for the smoker to select the degree of ventilation before smoking.

None of the above-described methods have been completely satisfactory, however. Cigarettes which have been ventilated to any significant degree have been characterized by many smokers as being "thin," "tasteless"b or "not satisfying."

Among the various proposals made to provide a degree of ventilation may be mentioned a patent to Swain, U.S. Pat. No. 2,754,828 disclosing the use of covered apertures in a non-combustible cigarette sheet, the covering over the apertures being combustible and thus providing for heat-opening of the apertures during the burning of the tobacco. The essential purpose of this patent is to supply sufficient air through the apertures to support combustion when they are opened by the heat of burning tobacco.

A patent to Figge, U.S. Pat. No. 2,992,647, also teaches the use of a perforated or vented cigarette wrapper, with the apertures being closed with a sealing material selected to melt or sublime at low temperatures but actually a short distance in advance of the burning area, the patentee's purpose and objective being to lower the combustion temperature of the burning cigarette with air intake through the apertures upon the approach of the hot coal to the vent holes. Figge, therefore, selected sealants that would melt or sublime close to the burning area, mentioning polyethylene or cellulose sealant compounds, that is said to dissipate at 50° to 100° C. but also mentions monosodium phosphate mono-hydrate that probably decomposes at about 200° C.

More recently, patents dealing with film covered apertured cigarette wrappers issued as Tamol U.S. Pat. Nos. 3,511,247 and 3,526,904. The earlier patent teaches the use of a white cellular thermoplastic resin having microscopic voids throughout covering the apertures. The patent indicates that such a film permits improved opening of the holes by heat and at a much greater distance from the coal in the cigarette, and in addition, the white opacity changes to permit the smoker to see the vent holes being opened. The later patent stresses the use of a water-soluble polymeric material covering the apertures and designed to be opened by smoke components, mainly the moisture in the smoke, when the cigarette is burned. Here also the psychological effect is mentioned in seeing the vent holes opened during the smoking of the cigarette. However, with respect to both of these disclosures, the holes would not always open or opened ineffectively under conditions of use. To approach the desired objectives in Tamol, a critical feature was to select the proper film thickness for the particular wrapper thickness and the tobacco used and to avoid any variations of the polymer film to insure the holes would open in the prescribed manner.

The present invention is an improvement over these prior disclosures in that while a polymeric film is used to cover the apertures of cigarette wrappers which eventually is opened to admit air after a period of smoking, the film is specifically treated and modified in its structure after it is applied to the wrapper, giving it characteristics that substantially expedite and insure the removal of the film by the smoke action, regardless of the film thickness or the type of wrapper or the tobacco used.

SUMMARY OF THE INVENTION

The present invention relates to a smoking product, and more particularly to a cigarette or other smoking article utilizing a combustible wrapper. The wrapper is normally porous or specifically provided with apertures, these being covered by a degradable polymeric film. Degradation of the film produces partial chain scission thereby hastening and facilitating the removal of the film over the apertures by smoke components when the tobacco is smoked. The degradation of the film is carried out by electrical irradiation or equivalent energy treatment, for example, using ultrasonic energy, which effects a degradation of the polymeric film.

DESCRIPTION OF THE INVENTION

The present invention relates to an apertured wrapper for a tobacco product such as a cigarette, and more particularly to a specifically treated film used to cover the wrapper and the pores or apertures therein.

It is an object of the present invention to obtain a controlled dilution of the smoke of a cigarette or the like with air admitted through apertures opened by the smoke of the burning tobacco.

It is a further object of the present invention to provide a film coating over wrapper apertures so designed as to permit its easy removal by smoke components as well as by heat of the coal.

It is a still further object of the invention to make possible a reduction in the delivery per puff after early puffs and also in total delivery.

These and other objectives will become evident in the following description of the invention.

The objects of the present invention may be realized by treating a cigarette wrapper or other combustible tobacco wrapper having spaced openings or apertures with a synthetic polymeric material capable of forming a thin but continuous film over the wrapper when dry. After the film has solidified, the apertured wrapper with the film overlay is then submitted to a degradation operation to cause at least partial chain scission of the polymeric film. The resulting degraded film is then capable of quick breakdown by smoke components during the smoking operation, thereby providing the necessary openings for ventilation and smoke dilution at the time it is most desired.

Any polymeric or resinous material capable of forming a continuous, thin, degradable film on a tobacco wrapper and that does not produce toxic components when the wrapper is burned in smoking may be used. A preferred material is one having the necessary characteristic of being able to form a continuous film without breaks when spread thin, that is, when spread on the wrapper to a thickness from 5 to 15 microns.

Polymeric substances that may be used for this purpose are polyalkylene oxides, i.e., polyethylene or polypropylene oxides, polyvinyl alcohol or copolymers containing butadiene or isoprene units. Natural gums or resins such as dextrins, pectins, guar gum, tragacanth or gum arabic may also be used, although the easily controlled characteristics of synthetic polymers are preferred. Of these, polyethylene oxide of high molecular weight, in excess of 100,000 molecular weight is a preferred film-forming agent. More specifically, a polymeric material having a molecular weight of about 150,000 to about 600,000 is preferred although polymers of up to 5,000,000 molecular weight may be used.

The preferred polymers would have the general formula:

$$HO(-C_2H_4-O-)_xH$$

where x is an integer of about 1,600 to about 120,000, preferably representing an integer of about 3,400 to about 13,600. The polymer may be prepared by known methods, for example, as described in U. S. Pat. No. 3,526,904. A particularly suitable polymeric material is sold by Carbide and Carbon Chemicals Corp. under the trade name "Polyox." Resin grades are usually assigned with grades N–80, and N–750 and N–3000 representing the particular molecular weights of the resin, namely, materials of 150,000 mol. wt., and 300,000 mol. wt., and 600,000 mol. wt., respectively, being preferred.

The above mentioned polymers may be used by themselves or may be modified with plasticizers, emulsifiers, or non-ionic surfactants or other additives to improve the coating action or the type of coating, or merely for ease in applying the polymer coating to the wrapper. One type of modified polymeric resin that is preferred is the above-described "Polyox" polyethylene oxide having a molecular weight in the general range mentioned above to which has been added from 2 to 10 percent by weight of a nonylphenoxy polyethylene oxide of 800 to 2,000 molecular weight as a non-ionic surfactant or plasticizer. Compositions of this nature are sold under the trade name "Tergitol" by Carbide and Carbon Chemicals Co.

The process of the invention is carried out by dispersing or solubilizing the polymeric material in an inert organic liquid or solvent for the polymer with or without additives and the solution or dispersion is then applied to the perforated wrapper material by any known coating procedure capable of producing an even continuous coating or thin layer on a relatively thin wrapper base. One coating method is by knife-coating the coating solution on to the perforated wrapper. Another method utilizes roller coating. The wrapper itself is preferably the usual thin cigarette paper having pores similar in size and number as described in Tamol, U.S. Pat. No. 3,526,904 or Figge, U.S. Pat. No. 2,993,647 to which reference had previously been made. However, cigarette wrappers having about 150–200 pores per inch with pore sizes of about 0.005 to about 0.01 inch produce effective results.

After the coating is applied over the perforated wrapper, it is dried either under atmospheric conditions or under higher temperature conditions, for example, by heating using hot air in a single or series of stages, or by infrared or other heat inducing means.

Following the drying operation to form the desired continuous film over the perforated wrapper, the polymeric coating is then at least partially degraded to make it more susceptible to attack by the smoke.

The degradation of the polymeric film is carried out by irradiation utilizing a radiant energy source, such as by electrical discharge, for example, an electrostatic or gamma ray generator, or an ultraviolet energy source, i.e., a mercury vapor or quartz ultraviolet lamp. Degradation may also be carried out utilizing mechanical energy by means of an ultrasonic generator. Actually, any device may be used that is capable of generating radiant or mechanical energy of an intensity sufficient to degrade the polymeric film. The most preferred method of degradation by irradiation, however, is the use of an electrical discharge produced by a Van de Graaff generator. With this apparatus, the amount of exposure can be controlled to give a desired degree of degradation which will leave the film intact but removable by smoke at a rate determined by the exposure.

In utilizing the Van de Graaff generator, the perforated wrapper having a film of about 5 to 15 microns thick is exposed to electronic discharge, the generator being operated to produce an irradiation dosage range of about 0.02 to 1.0 megarad per gram weight, and preferably from 0.1 to 1.0 megarads per gram weight of film.

The effect produced by the described irradiation procedure is believed to result in chain scission of at least a portion of the polymeric film thereby facilitating the breakdown of the film and the opening of the apertures when the tobacco is smoked as to provide a nearly level total particulate matter (TPM) delivery throughout the smoking period.

The following example is illustrative.

EXAMPLE 1

A 10 g. portion of "Polyox" N–750 polyethylene oxide (molecular weight 300,000) was dispersed in 30 ml. of petroleum naptha and 100 ml. of ethylene chloride was added together with 0.5 g. of "Tergital" NP–40 non-ionic surfactant (Carbide and Carbon Chemicals Co.) and the mixture was rolled overnight to complete the solution. This solution was knife-coated on cigarette paper perforated with 0.010 × 0.014 inch holes, 154 per inch of length, and dried, forming a film of about 10 to 12 microns thick.

The coated paper was exposed to varying dosages (see Table I) of high energy electrons from a Van de Graaff generator. Cigarettes with 20 mm. cellulose acetate filters, 65mm. rods were made from these wrappers and a commercial filler, and cigarettes for controls were made correspondingly with unperforated wrapper which had been irradiated at the same levels.

The results of smoking these cigarettes by machine with measurement of TPM delivery puff-by-puff are shown in Table I. The method used was that described by Wartman, Coghill, and Harlow, Analytical Chem. 31, pp. 1705–1709 (1958) and the machine used for measuring TPM puff-by-puff is that disclosed by W. F. Mutter in the U.S. Pat. No. 3,433,054, granted Mar. 18, 1969.

It is judged that 0.1 megarad dosage of the coated perforated wrapper is sufficient to facilitate opening of holes to provide a nearly level TPM delivery throughout the smoking, as compared to an unirradiated wrapper shown in the last column. It will also be noted from the Table that there was increasing degradation with increasing irradiation dose. Irradiation at 1.0 megarad resulted in delivery at a very low level throughout. This level of irradiation would be indicated for thicker films or films of higher molecular weight.

TABLE I

	Cigarette								
	Number 1	Control	Number 2	Control	Number 3	Control	Number 4	Control	
Coating*	Perf., 750, 5% Terg.	Nonperf., none	Perf., 750, 5% Terg.	Nonperf., none	Perf., 750, 5% Terg.	Nonperf., none	Perf., 750, 5% Terg.	Nonperf., none	Number 5, Perf., 750, 5% Terg.
Irradiation dosage, megarad	0.1	0.1	0.3	0.3	0.6	0.6	1.0	1.0	None
TPM Puff:									
Number 1	1.3	1.2	1.0	1.0	0.6	1.4	0.05	1.0	1.1
Number 2	1.7	1.6	1.3	1.6	0.9	1.8	0.2	1.5	1.2
Number 3	1.9	1.7	1.5	1.7	0.9	1.9	0.2	1.5	1.8
Number 4	1.8	1.9	1.4	1.9	1.0	2.0	0.3	1.7	2.0
Number 5	1.6	2.1	1.1	2.2	0.9	2.3	0.3	2.0	2.0
Number 6	1.5	2.3	0.9	2.3	0.5	2.4	0.2	2.1	1.9
Number 7	1.8	2.5	1.1	2.3	0.6	2.7	0.1	2.3	2.0
Number 8	1.8	2.7	1.2	2.6	0.7	3.2	0.3	2.7	2.1
Number 9	2.0	3.3	1.2	3.1	0.9	3.3	0.5	2.9	2.4
Number 10	2.1	4.3	1.4	3.0	1.2		0.6	3.2	2.5

*Coating—750 denotes Polyox N-750 grade material with molecular weight~300,000.
Tergitol—Tergitol NP-40.

The invention that is claimed is:

1. A cigarette wrapper or the like comprising a combustile material having spaced apertures therein and a thin continuous polyethylene oxide film degraded by electrical discharge from a Van de Graaff generator covering said apertures and said wrapper.

2. The product of claim 1, in which the polyethylene oxide polymer has a molecular weight of about 150,000 to about 600,000.

3. The product of claim 1, in which the polymeric film has a thickness of about 5 to 15 microns.

4. The process comprising coating a cigarette wrapper or the like having spaced apertures therein with a polyethylene oxide film of 5 to 15 microns thick, drying said film to form a thin, continuous coating over the wrapper and apertures, drying said coating and then submitting said coated wrapper to the electrical discharge of a Van de Graaff generator to cause degradation of the polymeric film.

5. The process of claim 4, in which the film is exposed to an irradiation dosage range of 0.02 to 1.0 megarads per gram weight of film.

6. The process of claim 4, in which the film is degraded by irradiation in a dosage range from about 0.1 to 1.0 megarad per gram weight of film.

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