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R. A. TAMOL

3,511,247

SMOKING PRODUCT AND METHOD OF MAKING THE SAME

Filed May 10, 1968

FIG. 1

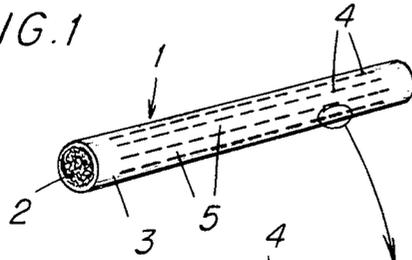


FIG. 2

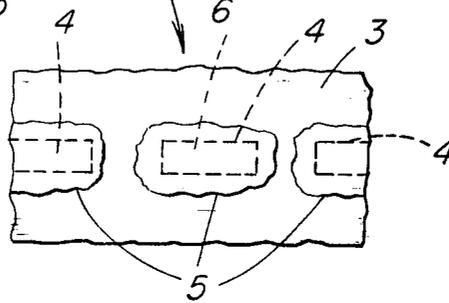


FIG. 3

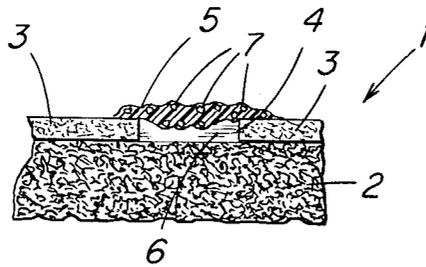
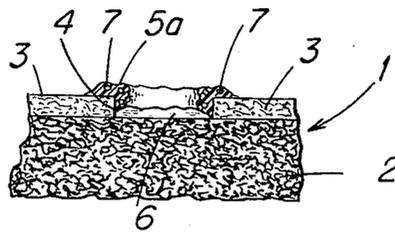


FIG. 4



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SMOKING PRODUCT AND METHOD OF MAKING THE SAME

Ronald A. Tamol, Richmond, Va., assignor to Philip Morris Incorporated, New York, N.Y., a corporation of Virginia

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3 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to a smoking product and method of making the same. More particularly the disclosure relates to a cigarette or similar smoking article which contains covered ventilation holes adapted to open during the smoking of the product to provide smoke diluted by air during the smoking of the product and which provides means for visibly indicating to the smoker the opening of the ventilation holes. The disclosure encompasses smoking products having ventilation holes which are covered or filled with a substance which is disintegrated by the action of the heat of the burning of the tobacco in said tobacco product. The ventilation holes may be in the wrapper of the smoking product, the holes being spaced some distance away from the end of the smoking product. The holes are closed with a heat-degradable material during the initial stages of smoking but are opened during subsequent stages of smoking due to the action of the heat of the coal and the tobacco smoke on the material which initially blocks said holes. The material which closes the holes, in accordance with the present invention, possesses a cellular structure and may, if desired, have substantially the same white color as the wrapper or filter in which the holes are located, so that it is virtually unnoticeable before the smoking product is smoked. By employing the present cellular heat degradable materials, it is possible to effect better opening of the holes, when exposed to heat, than with non-cellular heat degradable materials. Furthermore, when the holes are opened by degradation of the film during smoking, they assume a darker color which is readily noticeable to the smoker. Thus, the smoker can have visible evidence of the opening of the dilution holes, with the benefit of the full satisfaction from the smoke during the early stages of smoking and the psychological advantages of seeing the dilution holes open during the latter stages of smoking.

Other features of the disclosure appear in the following specification and accompanying drawing.

BACKGROUND OF THE INVENTION

It has been known that the amount of smoke delivered to the smoker of a cigarette can be lowered, without unduly 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 placing 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 charac-

terized by many smokers as being "thin," "tasteless" or "not satisfying."

An invention which involves reducing the amount of smoke delivered by a cigarette to the smoker is set forth in U.S. Pat. 2,992,647 to Frank H. J. Figge. The Figge patent involves a method of making a cigarette or the like having built-in means for regulating the combustion temperature, said means comprising perforations or pores in the cigarette paper which are filled with a material that melts or sublimates at such a temperature that the perforations or openings will open up a short distance in advance of the burning area to regulate the amount of air or the percentage of the puff coming through the burning area. While the Figge patent provides advantages over the previously known ventilation means, it does not provide a complete solution to the basic problem which involves a combination of: (1) reducing the amount of smoke delivered to the smoker of a cigarette and (2) satisfying the smoker of the cigarette. The Figge invention, while providing an automatic method for opening vent holes in cigarettes, involves an opening of the vent holes only upon the relatively close approach of the hot coal to the vent holes. The present invention involves an improvement over the prior art dilution methods, including that disclosed by Figge, and makes possible a smoking product which can provide the desired degree of smoking satisfaction while also providing lower delivery of tars and nicotine to the smoker on a per puff basis as well as on an overall cigarette basis. The present invention improves over all of the above-enumerated methods by providing holes which will open farther in advance of the burning tobacco and can also provide visible evidence of the opening of the dilution holes, with the benefit of the full satisfaction from the smoke during the early stages of smoking and the psychological advantages of seeing the dilution holes open during the latter stages of smoking.

SUMMARY OF THE INVENTION

This invention relates to a smoking product and method of making the same. More particularly the invention relates to a cigarette or similar smoking article which contains covered ventilation holes adapted to open during the smoking of the product to provide smoke diluted by air during the smoking of the product and which provides means for visibly indicating to the smoker the opening of the ventilation holes. The invention encompasses smoking products having ventilation holes which are covered or filled with a substance which is disintegrated by the action of the heat of the burning of the tobacco in said tobacco product. The ventilation holes may be in the wrapper of the smoking product, the holes being spaced some distance away from the end of the smoking product. The holes are closed with a cellular heat-degradable material during the initial stages of smoking but are opened during subsequent stages of smoking due to the action of the heat of the coal and the tobacco smoke on the material which initially blocks said holes. The material which closes the holes, in accordance with the present invention, possesses a cellular structure and may, if desired, have substantially the same white color as the wrapper or filter in which the holes are located, so that it is virtually unnoticeable before the smoking product is smoked. By employing the present cellular heat degradable materials, it is possible to effect better opening of the holes, when exposed to heat, than with non-cellular heat degradable materials. Furthermore, when the holes are opened by degradation of the film during smoking, they assume a darker color which is readily noticeable to the smoker. Thus, the smoker can have visible evidence of the opening of the dilution holes, with the benefit of the full satisfaction from the smoke during the early stages of smoking and the psychological advantages of seeing the dilu-

tion holes open during the latter stages of smoking.

It is an object of this invention to provide a cigarette which will give substantially undiluted smoke during the early puffs and diluted smoke during the later puffs. It is a further object to provide a cigarette which has a low total delivery of smoke components to the smoker. It is a further object to provide a cigarette which the smoker will find to have a reasonable resistance-to-draw and to give a satisfying smoke. It is a further object to provide a cigarette which delivers no more smoke components with each puff at the late stages of smoking, when there is less filtration by tobacco, than it does at the early stages. It is a still further object of the present invention to provide a cigarette which provides visible evidence of the opening of the dilution holes, with the benefit of the full satisfaction from the spoke during the early stages of smoking and the psychological advantages of seeing the dilution holes open during the latter stages of smoking. Other objects will appear hereinafter.

DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the invention will become apparent from the following description, read in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of one embodiment of the present invention, a plain cigarette having openings or vent holes in the wrapper which are covered or filled with a cellular plastic film.

FIG. 2 is an enlarged fragmentary view of a small area of the covered vent holes in the wrapper of the cigarette in FIG. 1.

FIG. 3 is a cross-section through one of the covered vent holes in the wrapper of the cigarette shown in FIGS. 1 and 2, showing the appearance of the coating before the cigarette is smoked.

FIG. 4 is a cross-sectional view of the same vent hole shown in FIG. 3, after the heat of the coal and of the cigarette smoke has caused the cellular plastic film to break down and the hole to be opened.

Referring now, in detail to FIG. 1, a cigarette 1 consisting of a cylinder of tobacco 2 is encased in a combustible paper cylinder 3. In paper cylinder 3 are vent holes 4, which have been covered by cellular plastic film 5.

Referring to FIGS. 2 and 3, an enlarged portion of cigarette 1 is shown, as indicated in the drawings, which is representative of all openings 4, wherein vent holes 4 are covered by cellular plastic film 5 having air bubbles 7. Film 5 blocks passage 6 in vent hole 4.

Referring to FIG. 4, opening 4 in paper cylinder 3 is shown with film 5a resulting from the degradation of cellular plastic film 4, to form free passage 6 through vent hole 4, which passage connects tobacco 2 with the exterior of the cigarette 1.

DESCRIPTION OF THE INVENTION AND ITS PREFERRED EMBODIMENTS

The objects of the present invention are realized by perforating the wrapper of a cigarette or other smoking product with holes of sufficient size to provide significant dilution of the smoke by air, and covering or filling these holes with a material having a cellular structure, for example, a bubble coating, which is susceptible to the action of heat from the burning tobacco to such a degree that the smoke from the first portion of the cigarette causes the film gradually to disintegrate in such a way that the holes are opened after the first few puffs of the cigarette or similar smoking product have been taken. In accordance with this invention, the smoking product delivers undiluted smoke during the first few puffs, but during the latter stages of smoking the smoking product is ventilated, i.e. the smoke is diluted, to any desired degree, as determined by the number and size of the holes, and

the nature and thickness of the film filling or covering the holes. The portion of a cigarette rod which is without such holes and the size and spacing of the holes will be dependent on the amount of undiluted smoke desired in the first puffs and the amount of dilution thereafter desired and the specific rate of action of the smoke upon the cellular structure and in some instances upon the thickness of the structure. The film and its thickness can be varied to control the proportion of unventilated smoke delivered. Preferably, the holes will not be opened during the first four to six puffs.

Heat degradable cellular structures which may be employed include three-dimensional cellular structures having a multiplicity of microscopic or submicroscopic voids distributed throughout its volume beneath the outer surface thereof. The material, apart from these voids, is substantially continuous and homogeneous and the film as a whole is opaque because of its heterogeneous physical structure, due to such voids. Under the action of heat from the burning tobacco in a cigarette, the cellular material softens and coalesces with attendant collapse of the coating, whereby the vent holes covered by a coating or film of such a cellular structure are opened up.

Such a film may be prepared and applied to the paper base by applying thereto an emulsion of the water-in-oil type, wherein a film-forming plastic is the continuous phase and the dispersed phase is present in the form of multitudinous droplets, at least almost all of which are of microscopic or submicroscopic dimensions, and by drying the film in such manner that the dispersed phase is evaporated without essential disruption or substantial collapse of the cellular structure of the continuous phase. While the gelation of the plastic film and evaporation of the water therefrom may to a certain extent be simultaneous, in general they occur in substantial sequence in that order, in that the plastic layer first attains such a degree of semi-solidity as to be effective to drop the dispersed water droplets. The water is then evaporated by diffusion through the rigid, or substantially rigid, cellular walls of the plastic and is replaced by air forming the voids already referred to.

The continuous phase of the emulsion may be termed a lacquer in that it is a film-forming material dissolved in a solvent adapted, on normal evaporation of such solvent, to dry down as a continuous layer. In the present instance the solvent is characterized by insolubility in water. The dispersed phase is aqueous, either water, a water-soluble liquid or a water-dissolved solid, incompatible with the ingredients of the continuous phase, both film-former and solvent, or a combination of water with such liquid or solid. The formation of an emulsion is aided by the addition of an emulsifying assistant suitable for water-in-oil dispersions, for example stearyl dimethyl benzyl ammonium chloride, aromatic polyglycol ethers. These emulsifiers are soluble in the lacquer solvent, which may be benzene, toluene, chloroform or any other meeting the requirements outlined above. Ethyl cellulose may be used as the film-former, because of its compatibility with many substances capable of modifying the desired coating. Such modification may involve providing a lower softening temperature of the coating which may be achieved by adding a plasticizer to the film-former. In addition to compatibility with the resin, the plasticizer should be incompatible with the dispersed phase. Tricresyl phosphate, dioctyl phthalate and castor oil are examples of plasticizers which fill these requirements.

Satisfactory white coatings are obtained when the evaporation of the dispersed phase occurs essentially after the evaporation of the lacquer solvent, i.e. after gelation of the lacquer film. When a solvent of relatively low evaporation rate is used, such as toluene or even xylene, it may be advantageous to retard the evaporation rate of the water or other components of the dispersed phase. This can be effected by adding to water numerous water-soluble substances, for example salts such as sodium ace-

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tate or lead acetate, but especially polyvalent alcohols, such as ethylene glycol or glycerol. Such alcohols are insoluble in the lacquer solvent and incompatible with the film-formers.

The dispersed phase determines the degree of aeration of the final coating in two ways, (1) the water to lacquer ratio as indicated in the previous paragraph and (2) the particle size of the dispersion which may be reduced by homogenization, which results in a more stable emulsion and thus improves the degree of aeration of the solidified coating resultant from evaporation of the dispersed phase. The degree of aeration determines the whiteness of the final coating.

Materials which are suited for use in accordance with the present invention include cellular structures made employing a thermoplastic resinous material. Illustrative of such materials are ethyl cellulose, polystyrene, polyvinyl chloride, copolymers of vinyl chloride, such as vinyl chloride, vinyl acetate, copolymers, polymethylmethacrylate, nitrocellulose, cellulose acetate, cellulose acetate butyrate, cellulose acetate propionate, and ethylene vinyl acetate.

The following examples are illustrative of coating materials which may be employed in accordance with the present invention:

EXAMPLE 1

41.24 grams of ethyl cellulose, grades N-100 are dissolved in 650 cc. of toluene under stirring. Grade N-100 identifies a resin, a 5% solution of which in a solvent consisting of 80 parts toluene and 20 parts ethanol has a viscosity of 93.5 centipoises. As emulsifier, 1.9 grams of stearyl dimethyl benzene ammonium chloride ("Triton K-60") are added. Under constant high-speed stirring, 92 cc. of distilled water are added dropwise or in the form of a fine spray at a rate slow enough to permit uniform emulsification. This emulsion produces a photometer reading of 73% when applied and dried as a coating of 6.0 pounds per ream. The apparent density of the coating is measured to 0.39.

EXAMPLE 2

This differs from Example 1 in the amount of water used to form the dispersed phase, 184 cc. of water, or twice as much as in Example 1. This emulsion produces a photometer reading of 80% when applied and dried as a coating of 4.0 pounds per ream. That is, the coating is lighter in Example 1, but the whiteness is superior. The apparent density of the coating is measured to be 0.16.

EXAMPLE 3

This is like Example 1 except a still larger amount of water is used, 504 cc. This emulsion produces a photometer reading of 71% when applied and dried as a coating of 2.2 pounds per ream. The apparent density of the coating is measured to be 0.08.

EXAMPLE 4

This example illustrates the use of a less volatile solvent for the resin and an evaporation retarder for the aqueous constituent. If the resin solvent is less readily driven off the continuous resin phase does not pass over into the solid form so rapidly and it might be possible for much of the water to evaporate before it was trapped, with resultant collapse to a considerable degree of the cellular structure and the production of a coating of poor hiding power. This may be avoided by the addition to the water phase of an ingredient retarding its evaporation, that is, providing a decreased vapor pressure of the dispersed phase. This is the specific example.

41.25 grams of ethyl cellulose, grade N-100, are dissolved in 650 cc. of xylene under stirring. As emulsifier,

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1.9 grams of "Triton K-60" are added. Under constant high-speed stirring, a mixture of 378 grams of ethylene glycol and 126 cc. of distilled water are added dropwise or in the form of a fine spray at a rate slow enough to permit uniform emulsification. This emulsion produces a photometer reading of 71% when applied and dried as a coating of 2.2 pounds per ream.

EXAMPLE 5

This example as contrasted with Example 2 illustrates the use of a smaller amount of resin of greater molecular weight and hence greater viscosity, whereby a lower proportion of solids may be utilized to provide a coating of acceptable whiteness and opacity. Ethyl cellulose of grade N-300, having a viscosity of 319.7 centipoises as contrasted with 93.5 for grade N-100 previously referred to, is used.

24.5 grams of ethyl cellulose, grade N-300, are dissolved in 650 cc. of toluene under stirring. As emulsifier, 1.9 grams of "Antarox A-200" are added. Under constant high-speed stirring, 229 cc. of distilled water are added dropwise or in the form of a fine spray at a rate slow enough to permit uniform emulsification. This emulsion produces a photometer reading of 69% when applied and dried as a coating of 2.8 pounds per ream.

EXAMPLE 6

This example, as contrasted with Example 2, illustrates the addition of a plasticizer in order to reduce the softening temperature of the coating and increase its heat sensitivity.

41.25 grams of ethyl cellulose, grade N-100, are dissolved in 650 cc. of toluene under stirring. As plasticizer, 20.62 grams of tricresyl phosphate, available under the commercial name "Lindol," and as emulsifier, 1.9 grams of polyglycol ethers ("Antarox A-200") are added. Under constant stirring, 229 cc. of distilled water are added dropwise or in the form of a fine spray at a rate slow enough to permit uniform emulsification. The emulsion produces a photometer reading of 70% when applied and dried as a coating of 4.9 pounds per ream.

EXAMPLES 7 AND 8

Examples 7 and 8 are examples in which a mixture of resinous plastics is utilized as the lacquer base, or otherwise expressed, ethyl cellulose as used in the previous examples is modified by added resins. In these instances coatings of improved gloss and hardness and a superior degree of whiteness are provided for.

EXAMPLE 7

41.25 grams of ethyl cellulose, grade N-100, are dissolved in 650 cc. of toluene under stirring. As resin modifier 10.25 grams of chlorinated diphenyl resin ("Aroclor 5460") and as emulsifier, 1.9 grams of polyglycol ethers ("Antarox A-200") are added. Under constant stirring, 299 cc. of distilled water are added dropwise or in the form of a fine spray at a rate slow enough to permit uniform emulsification. This emulsion produces a photometer reading of 83% when applied and dried as a coating of 5.4 pounds per ream.

EXAMPLE 8

41.25 grams of ethyl cellulose, grade N-100, are dissolved in 650 cc. of toluene under stirring. As resin modifier, 41.24 grams of a coumarine-indene resin and as emulsifier, 1.9 grams of polygonal ethers ("Antarox A-200") are added. Under constant stirring, 620 cc. of water are added dropwise or in the form of a fine spray at a rate slow enough to permit uniform emulsification. This emulsion produces a photometer reading of 82% when applied and dried as a coating of 5.8 pounds per ream.

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EXAMPLE 9

40 grams of polystyrene are dissolved in 200 cc. of benzene under stirring. As emulsifier, 2 grams of sorbitan sesquioleate, available under the commercial name "Arlacel C" are added. Under constant stirring, 100 cc. of water are added dropwise or in the form of a fine spray at a rate slow enough to permit uniform emulsification. This emulsion produces a photometer reading of 74% when applied and dried as a coating of 5.8 pounds per ream.

EXAMPLE 10

8 grams of polyvinyl chloride-acetate (commercial grade VYHH of Carbide and Carbon Chemicals Corporation) are dissolved in 60 cc. of propylene dichloride under stirring. As emulsifier, 0.5 gram of "Arlacel C" are added. Under constant stirring, 30 cc. of water are added at a rate slow enough to permit uniform emulsification. This emulsion produces a photometer reading of 69% when applied and dried as a coating of 5.9 pounds per ream.

EXAMPLE 11

25 grams of polymethyl methacrylate, having a molecular weight of 31.60 or more and a flow temperature (Max.) of 138° C. are dissolved in a mixture of 100 cc. of toluene and 50 cc. of methylene dichloride. As emulsifier, 2 grams of "Arlacel C" are added. Under constant stirring, 75 cc. of water are added at a rate slow enough to permit uniform emulsification. This emulsion produces a photometer reading of 82% when applied and dried as a coating of 10.5 pounds per ream.

EXAMPLE 12

25 grams of nitrocellulose, of a grade having a viscosity of 5-6.5 seconds in a solution of 12.2% concentration, are dissolved in 200 cc., of n-butyl acetate. As emulsifier, 2 grams of an anhydrous aliphatic polyethylene glycol amide, available under the commercial name "Antarox G-100" are added. Under constant stirring, 200 cc. of water are added at a rate slow enough to permit uniform emulsification. This emulsion produces a photometer reading of 77% when applied and dried as a coating of 4.3 pounds per ream.

EXAMPLE 13

10 grams of cellulose acetate of a grade having a low acetyl value and an Eastman viscosity of 2-5 seconds are dissolved in a mixture of 100 cc. of methylene dichloride and 10 cc. of iso-octyl alcohol under stirring. As emulsifier, 1.5 grams of "Antarox G-100" are added. Under constant stirring, 55 cc. of water are added at a rate slow enough to permit uniform emulsification. This emulsion produces a photometer reading of 77% when applied and dried as a coating of 5.5 pounds per ream.

Particularly suitable cellular plastics for use in accordance with the present invention are those which will melt or degrade at temperatures from about 35° to about 250° C.

As mentioned in this specification earlier, the dimensions and arrangements of the holes or perforations will vary in accordance with the desired results. They may be arranged and may be of the sizes and shapes shown in the above-mentioned Figge patent or they may have other sizes, shapes and configurations.

A particular combination which provides outstanding results in accordance with the present invention involves the use, in a cigarette or the like, of spaced perforations no closer to the smoking end of the cigarette or smoking article than 20 mm., said perforations having a total surface corresponding to from about 0.2 to about 1.5% of the total surface area of the cigarette wrap, said perforations being filled with or coated with a film having an average thickness across the holes or perforations of from about 3 to 60 microns and preferably of about

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5 to 15 microns of a cellular structure of the type described earlier in this specification.

The advantage of employing a film of the type set forth above over a film or coating which is not cellular, resides in the more accurate control over the opening of the filled perforations or holes and in the fact that holes can be caused to open a much greater distance from the coal in the cigarette, whereby ventilation can be started and maintained at a desired level with greater accuracy and greater control. Furthermore, I have discovered that the use of the bubble coating to form the dissipatable film which seals the vent holes is characterized by a white opacity which disappears as the film melts or in the moments before when collapse of the bubble structure brings transparency. The smoker can see the vent holes being opened. The bubble structure also results in a thicker film from a given weight of material, and this added thickness permits easier control during application. The greater bulk of thickness means that a difference of a fraction of a mil is of less consequence than it would be otherwise. The bubble-coating technique and the resulting film have been described earlier. The film which results contains many small air bubbles which may occupy much more space than the solid portion but, in general, the bubbles are not connected. They have roughly the size of the wave length of visible light and the light-scattering effect of the bubbles gives the film opacity and brightness. The bubbles are introduced by evaporation of a liquid which is first dispersed as minute droplets in the continuous phase with which the liquid is immiscible. The continuous phase or binder, which is a solution of the film-former in a different liquid, gels after coating is applied, usually due to partial evaporation of the latter liquid. The gel then fixes the liquid-filled bubbles. There is some shrinkage of the structure during the drying, while the liquid is passing out of the bubbles and diffusing to the surroundings and air is replacing it in the bubbles.

Bubble coatings may be applied as either water-in-oil or oil-in-water emulsions to form cellular coatings which are heat degradable filling material. For the water-susceptible, and thus water-soluble, films, oil-in-water systems would seem to be called for; that is, the continuous phase is a water solution. A variation of the oil-in-water system is possible, however, and has showed an advantage. In this variation, two non-aqueous liquids, less polar than water, are employed; the two may be miscible, but one is not a solvent for the film-forming resin. When the resin is dissolved in the solvent liquid and the second liquid added, a clear solution may result. The dispersed droplets do not appear until the film has been cast and enough of the solvent liquid has evaporated to force the separation and coalescence of the non-solvent within the film. The trapped droplets then produce bubbles by the same exchange with air that has been described. The advantage of this system lies in the fact that it does not wet the paper and better control of the application is possible. Bubble coatings may contain pigment, but this is usually unnecessary for the purposes of the present invention and would merely obscure the desired change in appearance. The coating may be applied by conventional methods to the perforated wrapper or mouthpiece material; for example, it may be printed, roll-coated, knife or brush coated, or sprayed. I have found that a form of coating that coats only the perforations is probably most desirable. Coating preferably is done on the perforated wrapper or the like before the rod is formed, but it could instead take place on the wrapped tobacco rod or filler rod of the finished cigarette.

I claim:

1. In a cigarette wrapper or the like a combustible material having spaced apertures therein, and non-toxic filling material normally closing said apertures, which filling material is dissipated in advance of the combustion zone at temperatures in the range of 35°-250° C.,

the improvement which comprises employing as the non-toxic filling material a cellular thermoplastic material said material having an average thickness across said apertures of from about 3 to 60 microns.

2. In a cigarette or the like, including a combustible wrapper having perforations filled with a non-toxic filling material which is dissipated at relatively low temperatures within the range of 35-250° C., in advance of the combustion zone, the improvement which comprises utilizing as said non-toxic material a cellular thermoplastic material said material having an average thickness across said perforations of from about 3 to 60 microns.

3. In a cigarette wrapper or the like a combustible material having spaced apertures therein, and non-toxic filling material normally closing said apertures, which filling material is dissipated in advance of the combustion zone at temperatures in the range of 35°-250° C., the improvement which comprises employing as the non-toxic filling material a three-dimensional cellular thermo-

plastic structure, including a multiplicity of discrete microscopic or sub-microscopic enclosed voids beneath the outer surface thereof and distributed throughout the volume of the structure said structure having an average thickness across said apertures of from about 3 to 60 microns.

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ALDRICH F. MEDBERY, Primary Examiner

DENNIS J. DONOHUE, Assistant Examiner

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