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(54) TOBACCO SUBSTITUTE

(71) We, CELANESE CORPORATION, of 522 Fifth Avenue, New York 36, State of New York, United States of America, a company incorporated in accordance with the laws of the State of Delaware, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a tobacco substitute for smoking, especially in the form of cigarettes.

It is widely believed that tobacco smoking, and particularly cigarette smoking, is harmful to health because of certain constituents of the tobacco smoke inhaled. The present invention is concerned with a material which burns in a manner similar to tobacco to produce a smoke which is pleasant and which has a lower content of such constituents.

Our prior Patent No. 1,055,473 is concerned with a tobacco substitute for smoking comprising a combustible material together with minor proportions of flavouring and other modifying agents, wherein the combustible material is cellulosic in nature and is intimately associated with one or more combustion-modifying inorganic compounds, including a hydrated metal compound to reduce the burning rate of the combustible material. It is stated that this substitute may incorporate a carbohydrate ether, e.g. ethyl cellulose or methyl cellulose, and it is indicated that the ether may be present in a large enough amount to stiffen the tobacco substitute.

The present invention is concerned with a tobacco substitute of the general class claimed in the patent referred to and comprises a substitute found especially acceptable to smokers and giving a smoke notable for its low content of constituents widely believed to be harmful.

According to the invention, a tobacco substitute suitable for smoking comprises a combustible matrix having one or more non-toxic

particulate fillers uniformly distributed therein and comprising, as film-former, one or more ethers of starch or of cellulose or salts thereof containing an average of 0.2 to 3.0 alkyl, hydroxyalkyl and/or carboxyalkyl ether groups per anhydroglucose unit, in which ether groups each alkyl radical contains up to 5 carbon atoms, the weight ratio of matrix to filler being from 15:85 to 85:15 and said film-former being present in an amount at least equal in weight to that of any anhydroglucose unit containing substance present besides said film-former.

The preferred film-formers are ethers containing one or more methyl, hydroxyethyl or carboxymethyl ether groups and alkali metal, alkaline earth metal, aluminium and iron salts of ethers containing one or more carboxymethyl ether groups; for instance the film-former may be carboxymethyl cellulose, hydroxyethyl cellulose, carboxymethyl hydroxyethyl cellulose, methyl cellulose or carboxymethylated starch. The degree of substitution by ether groups is preferably from 0.4 to 1.2 groups per anhydroglucose unit.

The film-former may be one which has been cross-linked, to improve its processability and reduce its solubility, by reaction of residual hydroxyl groups with a cross-linking agent, e.g. dimethylol ureaformaldehyde resins, melamine formaldehyde resins, "Kymene" 557, a polyamide epichlorohydrin manufactured by Hercules ("Kymene" is a Registered Trade Mark), glyoxal, or dialdehyde starch. Up to 5% and preferably from 0.001% to 0.5%, based on the weight of the material, is suitable for this purpose. Cross-linking may also be effected using organic salts or halides having a divalent or trivalent ion, e.g. iron or aluminium. The material may also be used as modified by interaction with metallic ions in tobacco pectins or even conventional tobacco additives such as humectants.

The particulate fillers employed preferably have an average minimum dimension of from 0.2 microns to 1.0 millimetre and especially

- from 0.2 microns to 0.05 millimeters. It is also preferred that the particulate fillers have maximum dimensions not greater than 0.25 mm, and especially 0.10 mm. Suitable materials can be selected from organic compounds, inorganic compounds and the elements, so long as the material selected is non-toxic, i.e., pharmacologically inactive in the sense of significant adverse effects in a causative relationship upon oral ingestion of the substance itself or its combustion products. However, a reduced delivery of undesirable components is more readily observed when the particulate material comprises an inorganic compound, an element or a mixture thereof.
- While not wishing to be held to any particular theory, it is believed that the rate of combustion of the present compositions is related to the thermal conductivity coefficient of the filler material employed. That is, a material having a relatively high thermal conductivity coefficient will tend to transfer heat to adjacent particles, thus maintaining smouldering of the combustible material. Of course, the density of particles will determine to a degree the preferred thermal conductivity coefficient of the final smoking product. An increased particle density will tend to promote combustion until there is no longer sufficient combustible material to support smouldering. Generally,

however, non-porous filler materials having an equivalent thermal conductivity coefficient of the dense, particulate filler at 800°C of greater than 6×10^{-3} calories cm/sec °C cm² are preferred in the present invention. It should be mentioned, however, that this factor may not be entirely applicable to decomposable salts, although those salts may have independently desirable characteristics, as noted herein below. Thermal conductivity coefficients are readily obtainable by passing heat through a thin bed of the material to be tested and measuring the rise in the temperature of the bed. This technique is more completely described by W. J. Kingery et al in the *Journal of the American Ceramic Society*, 37:107 (1954). Also, specific thermal conductivity coefficients are readily available from the literature. Exemplary coefficients are: 8.2×10^{-3} calories cm/sec °C cm² for titanium dioxide, 22.1×10^{-3} calories cm/sec °C cm² for magnesium oxide, 7.5×10^{-3} calories cm-sec °C cm² for fused silica, and 5.1×10^{-3} calories cm/sec °C cm² for zirconium dioxide.

Inorganic compounds suitable as fillers preferably consist of a cation selected from Column (A) and an anion selected from Column (B).

(A)			(B)
Lithium	Manganese	Silicon	Oxides
Sodium	Aluminum	Palladium	Hydrated Oxides
Potassium	Cerium	Tin	Hydroxides
Cesium	Cobalt	Zinc	Carbonates
Magnesium	Iron	Titanium	Phosphates
Calcium	Molybdenum	Zirconium	Aluminates
Strontium	Nickel	Copper	Stannates
Barium	Rubidium		Zincates
			Silicates
			Carbides

The most preferred inorganic compounds have been found to be the alkali metals and alkaline earth metal carbonates, oxides, silicates, aluminosilicates, aluminates, and aluminium hydroxide. Inorganic compounds in their naturally occurring state, such as dolomite, perlite, magnesite, diatomaceous earth or vermiculite, are also suitable in the present invention.

As previously noted, elements may also be used as filler materials. Preferred elements in-

clude carbon, zinc, magnesium, titanium, aluminum, and iron.

While the filler materials are generally granular in nature, they may also be in fibrous form. Materials readily useable in fibrous form are fiberglass, mica, asbestos, a metal, or metal oxide, and metal carbide whiskers. For the purposes of the present invention, thin metal strips such as aluminum shaving are considered to be fibrous. Preferably the fibrous materials will have an average length of from about

- 0.1 mm. to about 5 mm., and an average minimum dimension of the magnitude previously noted.
- In order to obtain a smouldering rate comparable to tobacco, the aforesaid ingredients are generally combined in a ratio of from 85:15 to 15:85. Preferably, the materials are combined in a ratio of from 25:75 to 75:25. Combination of these materials and these ratios will generally yield a material having a smouldering rate comparable to tobacco when smoked under analogous conditions; that is, 3—10 mm/minute in conventional cigarette form. A smouldering rate of this magnitude will correspond to a puff count of 12—5 in a cigarette smoked on a 60 second cycle, as described in later examples. It is to be expected, however, that specific compositions will have different combustion rates, particularly when filler materials having different thermal conductivity coefficients are used.
- It is also within the scope of the present invention to employ combinations of particulate fillers in order to obtain the ultimate smouldering rate desired. Fillers found to be particularly suitable in controlling smouldering rates include titanium dioxide, carbon, magnesium oxide, zeolite, silica gel, magnesium silicate, and diatomaceous earth.
- The compositions of the present invention are in the form of a self supporting film when the smokable product consists of solely the present smoking material. When the present compositions are blended with tobacco it is possible to use the composition as a film on the surfaces of the tobacco.
- Films are generally prepared by adding all of the desired ingredients to water, intimately mixing the materials and casting the mixture onto a suitable surface. The mixture at the time of casting will ordinarily contain 65 to 95% water. Percentages of water outside of this range are possible, but increased processing difficulties result. Generally, the film will be cast to a dried thickness of from 2 to 20 mils, preferably from 3 to 10 mils, and even more preferably to 5 mils. Such films are generally cut to a width of 16—60 cuts per inch prior to use.
- As earlier noted, the tobacco substitute of the invention, in addition to being used alone, may also be blended with tobacco. Suitable smoking products can be prepared from any combination of tobacco and substitute. However, tobacco to substitute ratios of from 95:5 to 25:75 will generally be employed. The primary criterion, of course, is that sufficient substitute is present in the mixture to obtain a significant decrease in the amount of objectionable substances in the smoke produced. Similarly, the tobacco substitute may be combined in all proportions with other synthetic smoking materials.
- Combination of the above materials within the specified ratios will generally produce a the most desirable smouldering have a thermal
- smoking material yielding an ash comparable to that of tobacco. If desired, however, the type of ash formation and appearance thereof can be readily modified by the addition of various substances as fiberglass, potassium salts, organic fibers, or phosphates, and non-toxic hydrated metal salts generally.
- The materials of the preceding nature produce a smoke which in itself is relatively odourless and tasteless. This property permits a wide range of modification of taste and odour by incorporating into the material a variety of flavourants. Examples of materials which have been found to be desirable in modifying the taste and odour properties of the present smoking material include tobacco extracts, fruit extracts, synthetic flavourants, natural gums, resins, and sugars, Nicotine and other alkaloids, while not essential ingredients in the present compositions, may also be added in controlled amounts.
- From an aesthetic standpoint, addition of various colouring agents to the smoking material may be desirable. For example, one may obtain a material having a colour similar to natural tobacco by the addition of materials such as carbon, iron oxide, food dyes, tobacco extracts, organic colourants, and inorganic pigments, or mixtures thereof to the basic smoking materials. Of course, contrary to natural tobacco, one may make the present material any colour desired. Generally, up to 5.0% of colouring agent based on the total composition can be employed. Preferably, 0.1 to 2.0% of colouring agent is utilized.
- When the present compositions are being prepared incorporation of a plasticizer in order to increase the flexibility of the film obtained is often desirable. Plasticizers which have been found to be suitable for this purpose include water, butylene glycol, glycerol, and propylene glycol. From 1 to 30% and preferably, from 2 to 25% of plasticizer based on the total weight of the composition is ordinarily used.
- Film formation may also be improved by adding a wetting agent such as "Tween" 20, a polyoxyethylene (20) sorbitan monolaurate manufactured by Atlas Chemical Industries, Inc.; "Tergitol," TMN, a polyglycol ether of trimethyl nomanol manufactured by Union Carbide; or Germ-i-tol, an alkyl dimethyl ($C_{12} - C_{18}$) benzyl ammonium chloride manufactured by Fine Organics, Inc.; to the composition prior to preparation of the film. ("Tween" and "Tergitol" are Registered Trade Marks). Preferably, 0.05 to 1.0% of wetting agent is employed, with up to 10% being suitable.
- The smouldering rate of the present films is not only felt to be attributable to the thermal conductivity coefficient of the filler material employed, as earlier described, but also to the thermal conductivity of the film itself. Generally, it has been found that the films having

- conductivity of from about 3.7×10^{-3} °C cm/sec to about 5.0×10^{-3} °C cm/sec. In testing the films of the present invention, data was obtained by placing a film of 12 mils in thickness between two aluminium blocks, maintaining one block at 117°C, and measuring the increase in temperature of the second block. Standardization was obtained by using in all instances a heat source which would increase the temperature of the second block at the rate of 0.19°C/sec when the blocks were placed in contact without the presence of an interposed film.
- The following examples illustrate the invention.
- EXAMPLE I
- One hundred-forty (140) ml. deionized water at 80°C was transferred to a high shear blender along with 12.6 g rutile, heavy grade titanium dioxide. The titanium dioxide was completely dispersed before 8.4 g medium molecular weight, 0.7 degree of substitution, sodium carboxymethyl cellulose (CMC) was slowly added to the vortex of the vigorously agitated water. After the CMC was completely dispersed (5 —
- 10 minutes; ca. 65°C), a film was cast on a "Teflon" (Registered Trade Mark) coated fabric at 35 mils and dried in a circulating air oven at 125°C. After drying and conditioning (74°F/60%RH), the film was shredded to an average width of 0.9 mm and an average length of 1.0 cm. Shredded films of the composition given below were formed into cigarettes of 8 mm diameter and 85 mm length by wrapping in cigarette paper on a hand roller. Cigarettes thus prepared were smoked on an apparatus which took 35 ml. puffs over a 2 second interval on a 60 second cycle. Pressure drop, i.e., the flow resistance occurring when air was drawn through the column at the rate of 1050 ml/min. was determined. Tar weight was obtained by drawing the smoke from the cigarette through a "Cambridge" (Registered Trade Mark) filter pad which removed at least 98% of the solid particulate matter and weighing the pad before and after smoking. Puff count is defined as the number of puffs required to smoke the cigarette to a 30 mm butt. Table I sets forth the data obtained in comparison with analogous data obtained by smoking tobacco under the same conditions.

TABLE I

% TiO ₂	% CMC	Shred Weight (grams)	Pressure Drop	Puff Count	Wet Tar (mg/cigt)	Dry Tar (mg/cigt)
30	70	—	—	DNB*	—	—
35	65	1.10	10	11.1	3.2	2.9
60	40	1.10	7	5.4	2.3	2.0
80	20	2.50	7	9.9	1.4	1.1
85	15	—	—	DNB	—	—
(Tobacco)		1.10	70	10.0	28.7	24.7

* Did Not Burn.

- From the above data, it is apparent that a substantially reduced amount of tars is obtained when the present materials are substituted for tobacco.

EXAMPLE II

Films were prepared and tested in the

manner of Example I with the exception that carboxymethyl hydroxyethyl cellulose (CMHEC) and diatomaceous earth were used as the ingredients. The data obtained is set forth in Table 2.

TABLE 2

% Diatomaceous Earth	% CMHEC	Shred Wgt. g	Pressure Drop	Puff Count	Wet Tar (mg/cigt)	Dry Tar (mg/cigt)
20	80	1.10	15	*N.B.	—	—
25	75	1.10	15	9	15.6	13.4
75	25	1.10	15	5	2.25	1.4
89	11	1.25	90	8	0.9	0.0
90	10	1.40	500	N.B.	—	—
All Tobacco		1.10	70	10.0	28.7	24.7

* Non-Burnable

EXAMPLE III

As noted earlier, in some systems it is desirable to utilize two or more fillers to bring the smouldering rate of the system to an optimum value. In the present example, the smouldering rate of a carboxymethyl cellulose-dolomitic limestone system was modified by

the inclusion of a second particulate filler, titanium dioxide. The three components were formed into a film and converted into cigarettes as described in Example I. The results set forth in Table 3 were obtained upon smoking the cigarettes in the manner previously described.

TABLE 3

% CMC	% Dolomite	% TiO ₂	Puff Count
40	60	—	Did Not Burn
40	40	20	9

EXAMPLE IV

Data on the amount of organic components in the gas phase was determined by gas chromatography for a synthetic material consisting of a film comprised of 37% carboxymethyl cellulose, 37% dolomitic limestone,

10% carbon, and 16% wetting agent, plasticizer and colourants; for a 50—50 blend of tobacco and the film; for a 50—50 blend of tobacco and the synthetic material in dry admixture. Table 4 contains the results obtained in μ g/puff.

TABLE 4

	All Tobacco Control	50/50 Film Formed	50/50 Dry Mixed	100% Film Formed
Methanol	12.8	5.7	5.9	0.0
Acetaldehyde	47.8	46.7	34.9	39.5
Acetonitrile	16.6	8.6	6.1	0.2
Acrolein	5.8	4.3	3.8	1.8
Furan	3.1	1.9	1.45	0.7
Propionaldehyde	4.1	5.6	2.0	4.2
Acetone	28.2	22.4	15.8	7.1
Propionitrile	2.7	1.1	0.8	0.01
Isobutylaldehyde	2.2	1.3	1.0	0.3
Benzene	7.1	4.8	2.7	1.3

The hydrogen cyanide, phenol, carbon monoxide, and benzpyrene values for the above synthetic films were also determined utilizing conventional techniques. The data obtained is contained in Table 4(a). 5

TABLE 4 (a)

Sample	Cyanide ug/cig.	Phenol ug/cig.	Carbon Monoxide (vol. %)	Benzpyrene (ug/100 cig.)
100% Synthetic Film	5	3	1.7	1.1
50% Film + 50% Tobacco Shred	83	39	3.1	2.4
All Tobacco	225	63	3.8	2.4

- As noted above, the carbon monoxide level was only 1.7 volume percent for the 100% synthetic film. Generally, the present compositions, and particularly those compositions containing dolomite or similar fillers, will deliver less than 2 volume percent or carbon monoxide. While not wishing to be held to any particular theory, it is believed that this reduction is at least partially attributable to the fact that that these compositions have a lower peak temperature upon combustion that does tobacco. Notably, the carbonates undergo an endothermic decomposition in the region of smoking temperatures and thus may be preferred for this purpose. 20
- EXAMPLE V
- In order to demonstrate the effect upon organic gas phase and tar values when using the components of the present material alone in combination, the following compositions were prepared in conventional cigarette form. 25

Sample	% Tobacco	% Carboxymethyl cellulose	% Dolomitic limestone	Form of Synthetic Material
A	50	25	25	Dry Mixture
B	67	33	—	Dry Mixture
C	67	—	33	Dry Mixture
D	100	—	—	
E	50	25	25	CMC and Dolomite in film mixed with tobacco shred
F	50	25	25	All ingredients in film (reconstituted type materials)

Wet and dry tar values were determined by the procedure described in earlier examples. The results obtained are set forth in Table 5.

TABLE 5

Sample	Shred Wgt. g	Pressure Drop mm H ₂ O	Puff Count	Wet Tar mg/cig.	Dry Tar mg/cig.
A	1.10	40	11.8	15.4	13.7
B	1.10	50	14.4	19.2	17.6
C	1.10	66	8.0	21.5	16.8
D	1.10	70	10.0	28.7	24.8
E	1.10	36	10.9	16.5	12.0
F	1.10	25	7.6	22.5	19.7

The data on the organic gas phase components in $\mu\text{g}/\text{puff}$ is set forth in Table 5 (a).

TABLE 5 (a)

	(A)	(B)	(C)	(D)	(E)	(F)
Acetaldehyde	27.2	34.2	53.4	47.8	35.1	40.5
Acetonitrile	5.0	6.9	18.5	16.6	7.5	6.5
Acrolein	2.5	2.7	7.5	5.8	4.0	3.5
Furan	1.1	1.5	3.4	3.1	1.7	1.6
Propionaldehyde	1.8	3.1	4.8	4.1	2.7	3.3
Acetone	15.6	21.4	28.9	28.2	20.3	19.3
Propionitrile	0.9	1.3	2.9	2.7	1.2	1.4
Isobutyaldehyde	0.8	1.2	3.6	2.2	1.3	1.3
Benzene	3.4	4.1	7.5	7.1	3.5	3.5

- Three facts are readily apparent from the above data. First, the values obtained with the blends comprising a combination of the two components of the present invention with tobacco are noticeably lower than the values from tobacco alone. Second, use of the combustible material and the filler material in combination yields lower values than those obtained when using these materials separately in tobacco blends. In fact, it will be noted from the above data that the use of the filler material alone produces generally higher organic gas phase values. Third, the data in Table 5 indicates that lower tar values are obtained by using the film and tobacco shred in physical admixture (E) than are obtained when the tobacco is incorporated into the film (F).
- EXAMPLE VI**
- A synthetic composition similar to that described in Example V was prepared by combining 14 parts of carboxymethyl cellulose (0.7 D. S.) with 14 parts of dolomitic limestone and 10 parts of magnesium oxide. The composition exhibited very desirable smouldering properties and yielded amounts of components comparable to those shown for the synthetic composition of Example V.
- EXAMPLE VII**
- Other suitable formulations were prepared by incorporating tobacco extract in a film made by combining the following ingredients:
- 0.2 guar gum
2.5g CMC
3.0g Magnesium Oxide
1.0g RA Grade High Alpha cellulose pulp
5 drops Germitol (wetting agent)
- The tobacco extract used was an alcoholic extract of burley leaves. Utilizing 3.0g of extract, the material in 100% cigarette form had a puff count of 8 on a 60 second cycle and yielded a smoke of very satisfactory taste and aroma. When only 1.5g of extract were used, the puff count was increased to 9.5 on a 60 second cycle. Satisfactory products were also obtained when these formulations were blended with an equal amount of tobacco.
- EXAMPLE VIII**
- Another suitable formulation was also prepared by incorporating 1.75 parts of the extract of Example VII into a film prepared from the following ingredients:
- 5.0 parts Sodium Carboxymethyl
0.4 parts guar gum
5.0 parts RA high alpha cellulose
1.2 parts silica gel (100/325 mesh)
- The composition thus prepared was shredded and then blended in 50/50 admixture with tobacco to obtain the final product.

EXAMPLE IX
A suitable substitute was prepared by form-

ing a film of the following ingredients in the
manner previously described:

Material	Parts	% Added
Carboxymethyl Cellulose	12	33
Dolomitic Limestone	12	33
Diatomaceous Earth	10	28
Carbon	0.4	1.1
Wetting Agent	0.6	1.7
Glycerine	0.6	1.7
Wet Strength Resin	1.2	0.33
Food Colors	0.18	0.50

Data were compiled in the manner also previously described and the following results were obtained:

	100% Synthetic Material	100% Tobacco
Selected cigarette weight grams	1.20 $\pm$ 0.3	1.20 $\pm$ 0.3
Average cigarette pressure drop mm water (range)	41 (38—45)	63 (54—72)
Puff Count	7.3	9.6
Wet Particulate Matter mg/cig.	2.8	28.0
Dry Particulate Matter mg/cig.	1.7	24.7
Nicotine Delivery mg/cig.	<0.01	1.52
Cyanide Delivery, as μ g HCN/cig.	1.4	216
Benzo (a) pyrene delivery μ g/100 cig.	1.2	2.8
Phenol Delivery, μ g/cig.	<4	98
Carbon Monoxide in smoke, Vol. %	1.5	3.6
Methyl Alcohol, μ g/puff	1.4	22
Acetaldehyde, μ g/puff	41.5	52.8
Acetonitrile, μ g/puff	0.7	15.0
Acrolein, μ g/puff	3.2	4.9
Furan, μ g/puff	0.7	1.9
Propionaldehyde, μ g/puff	2.9	4.2
Acetone, μ g/puff	14.3	28.0
Propionitrile, μ g/puff	0.0	2.8
Isobutyraldehyde, μ g/puff	0.4	2.6
Benzene, μ g/puff	1.5	5.6

5 Interestingly, it is observed in testing of the materials in the present invention that the peak particle size in the smoke aerosol obtained by combustion of these materials ranges from about 0.1 to 0.2 microns. In comparison, the peak particle size in tobacco smoke is from about 0.2 to 0.3 microns. In view of the difference in particle size of the present material, optimum filtration may be attained utilizing a filter adapted to remove smoke stream particles having the above specified peak particle size. It has also been noted that the smoke obtained upon combustion of the presently claimed material contains only about 100 million particles/cc as compared to about 1 billion particles/cc in tobacco smoke.

The materials and composite structure des-

cribed hereinabove in smoking composition form have been shown to exhibit particular advantages residing in the reduction of the delivery of selected known or suspected deleterious matter in cigarette smoke, when tested in cigarette form as detailed hereinabove. While some studies, notably the Surgeon General's Report, Public Health Service Publication No. 1103, would indicate the desirability of these results as a possible means to reduce the incidence of certain forms of cancer which may be related to cigarette smoking, it should be emphasized that there is no similar degree of evidence linking such performance to the incidence of other diseases possibly related to cigarette smoking such as emphysema and heart disease.

in cigarette form, it will be obvious that they are also readily usable in cigars and pipe tobacco. Also the compositions may be processed by paper making procedures and used for cigarette papers.

We are aware of the Customs and Excise Act, 1952, and of the Tobacco Substitutes Regulations, 1970, and the following claims are not at any time to be interpreted as covering any use of the invention which would be contrary to the law at that time.

WHAT WE CLAIM IS:—

- 15 1. A tobacco substitute suitable for smoking, which comprises a combustible matrix having one or more non-toxic particulate fillers uniformly distributed therein and comprising, as film-former, one or more ethers of starch or of cellulose or salts thereof containing an average of 0.2 to 3.0 alkyl hydroxyalkyl and/or carboxyalkyl ether groups per anhydroglucose unit, in which ether groups each alkyl radical contains up to 5 carbon atoms, the weight ratio of matrix to filler being from 15:85 to 85:15 and said film-former being present in an amount at least equal in weight to that of any anhydroglucose unit containing substance present besides said film-former.
- 30 2. A tobacco substitute according to Claim 1, wherein the particulate filler is a non-porous substance having a thermal conductivity greater than 6×10^{-3} calories cm./sec. °C cm² at 800°C.
- 35 3. A tobacco substitute according to Claim 1 or 2 and containing, as the filler material or as one of a plurality of filler materials present, diatomaceous earth, titania, a zeolite or dolomitic limestone.
- 40 4. A tobacco substitute according to Claim

sent, magnesium oxide, hydroxide, carbonate or silicate.

5. A tobacco substitute according to Claim 1 or 2 and containing, as the filler material or as one of a plurality of filler materials present, a carbonate of calcium, aluminium or iron.

6. A tobacco substitute according to any of the preceding claims, wherein the particles of filler material present have an average minimum dimension of from 0.2 microns to 0.05 millimetres and maximum dimensions not greater than 0.1 millimetres.

7. A tobacco substitute according to any of the preceding claims, wherein said film-former consists of one or more of the substances carboxymethyl cellulose, hydroxyethyl cellulose, carboxymethyl hydroxyethyl cellulose, methyl cellulose and salts thereof.

8. A tobacco substitute according to Claim 1 and substantially as hereinbefore described.

9. A smoking mixture comprising a shredded blend of tobacco and the substitute claimed in any of the preceding claims containing 5% to 75% by weight of said substitute.

10. Cigarettes and cigars containing a tobacco substitute as claimed in any of Claims 1 to 8 or a mixture as claimed in Claim 9.

11. Cigarettes and cigars according to Claim 10 and fitted with a filter adapted to remove particles having a diameter of from 0.1 to 0.2 microns.

A. J. BUTTERWORTH,
Chartered Patent Agent,
Brettenham House,
Lancaster Place,
London, WC2E 7ES.