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PATENT SPECIFICATION

NO DRAWINGS

1091408

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Int. Cl.:—C 08 g 43/00

COMPLETE SPECIFICATION

Compositions containing Polyethylene Glycol for the Treatment of Cellulose Acetate Tow

We, EASTMAN KODAK COMPANY, a Company organized under the Laws of the State of New Jersey, United States of America of 343 State Street, Rochester, New York 14650, United States of America (Assignees of JOHN EDWARD KIEFER and GEORGE PATRICK TOUBEY), 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:—

The present invention relates to tow treating compositions and to tobacco smoke filter elements made from tow treated with such compositions.

In the manufacture of tobacco smoke filters from a tow of continuous filaments of cellulose acetate tow, it is known to spray the spread out tow filaments with an organic ester plasticizer such as glycerol diacetate, glycerol triacetate, glycerol dipropionate, glycerol tripropionate, propylene glycol mono- and diacetate, di(methoxyethyl) phthalate, methylphthalylethyl glycollate and triethyl citrate. The plasticizer functions as a curing or bonding agent for the filaments of the filter by partially solvating the filaments at random spots at which it contacts the filaments so that where adjacent filaments contact each other at such spots, the two filaments become bonded together thereby forming a firm rigid filter element. It is also known to treat the tow with polyethylene glycols for improving the tow for tobacco smoke filtering purposes. While both the organic ester plasticizers and the polyethylene glycols have proved highly successful for the individual purposes uniform application has sometimes been difficult to obtain due to lack of complete compatibility where attempts were made to combine these two additives or others. Two-phase systems were sometimes encountered making application to tow less effective. Accordingly, de-

velopment of an easily and uniformly applied composition which would utilize the desirable properties of both of these types of tow additives and also enhance the ability of filter rods prepared from tow containing said composition to remove certain undesirable components from tobacco smoke represents a highly desirable result.

In accordance with the present invention there is provided a cellulose acetate tow treating composition comprising 25 to 50% by weight of polyethylene glycol and 50 to 75% by weight of a plasticizer for the tow.

According to the present invention there is also provided a method of treating a tow of crimped, continuous filaments of cellulose acetate in the production of tobacco smoke filters, comprising spreading the filaments and applying thereto a composition containing 25 to 50% by weight of polyethylene glycol and 50 to 75% by weight of a plasticizer for the tow.

In accordance with the invention there is also provided a tobacco smoke filter element comprising compacted cellulose acetate tow in rod-like form carrying thereon a treating composition containing 25 to 50% by weight of said composition polyethylene glycol and 50 to 75% by weight of said composition a compatible organic ester plasticizer comprising glycerol monoacetate, glycerol diacetate, glycerol triacetate, glycerol monopropionate, glycerol dipropionate, glycerol tripropionate, mixed esters of glycerine containing acetyl and propionyl groups, dimethyl phthalate, triethyl citrate, propylene glycol monoacetate, propylene glycol diacetate, di(methoxyethyl)-phthalate or methylphthalylethyl glycollate.

We have found that by using a composition made up of 25 to 50% by weight polyethylene glycol, 50 to 75% organic ester plasticizer, up to 15% water and up to about 1% dispersing agent, a high degree of ease and uniformity of application to filter tow is

[Price 4s. 6d.]



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imparted thereto, and a high removal efficiency particularly as to phenol, is imparted to tobacco smoke filter rods which utilize tow to which said composition has been applied.

Our preferred composition contains from 38 to 46% by weight polyethylene glycol, and from 46 to 62% by weight triacetin (otherwise known as glycerol triacetate or glyceryl triacetate). When the amount of polyethylene glycol in the blend is higher than 50% by weight, the bonding effect of the mixture on the tow to produce a firm rod tends to be diminished. On the other hand, when the amount of polyethylene glycol is less than 25% by weight the phenol removability of the filter rods in which the treated tow is used may be somewhat diminished and some porosity lost due to increased bonding of filter filaments. Also, we have found that over 2.5%, preferably 3 to 8% by weight, of polyethylene glycol should be present in the finished filter element, based on the total weight of filter elements minus weight of wrapper. This is equivalent to at least about 10% of the plasticizer/polyethylene glycol blend.

The polyethylene glycol used in the tow treating composition of this invention preferably has a melting point below 35°C. and is miscible with the triacetin or other plasticizer with which it is used. The preferred polyethylene glycol has an average molecular weight between 200 and 600 and is liquid at room temperature. Its structural formula may be represented as follows:



In this formula n is an integer from 2 to 12.

Other plasticizers which may be used according to our invention include glycerol mono- and diacetates, glyceryl mono-, di- and tripropionates, mixed esters of glycerine containing acetyl and propionyl groups, dimethyl phthalate, triethyl citrate, propylene glycol diacetate, di(methoxyethyl)phthalate and methylphthalylethyl glycolate.

By use of the plasticizer/polyethylene glycol composition of this invention not only are the removal characteristics of the tow to which it is added enhanced but the taste to the person who smokes a cigarette containing a filter made from the tow containing said composition is sweetened. Also, despite the liquid condition of the composition when applied, rigid filter rods are produced. Fur-

thermore, a further advantage of our composition is that the blend may contain up to 15% by weight water without encountering a two-phase system, and also may include up to about 1% by weight dispersing agent such as a water-soluble surfactant or wetting agent. Representative of dispersing agents which may be used are alkyl and aryl sulphates, alkyl and aryl sulphonates, alkylphenoxy poly(ethyleneoxy)ethanol, esters of sulphosuccinic acid, condensates of ethylene oxide with a hydrophobic base formed by condensing propylene oxide with propylene glycol and the like.

Filters which contain triacetin alone and which have been aged for three months or more are not effective for phenol removal as are filters of similar age which contain a blend of triacetin with polyethylene glycol. Filters which contain a proper blend of triacetin and polyethylene glycol are sufficiently rigid. Filters whether new or aged which contain a proper blend of triacetin and polyethylene glycol are as effective in the removal of both tar and phenol as filters which contain only triacetin.

Sections of a continuous 2.1 denier per filament, 12000 total denier filament cellulose acetate crimped filament tow (acetyl content 40%) were bloomed to a width of 12 inches. While in this spread-out condition, they were separately sprayed with the following plasticizers and plasticizer/polyethylene glycol combinations (indicated by sample number) until the liquid pickup was 9%.

1. Glycerol tripropionate (tripropionin)
2. 60% glycerol tripropionate—40% poly(ethylene glycol) (molecular weight 400)
3. Dimethyl phthalate
4. 60% dimethyl phthalate—40% poly(ethylene glycol) (molecular weight 400)
5. Triethyl citrate
6. 60% triethyl citrate—40% poly(ethylene glycol) (molecular weight 400)

Each section was processed into filter rods in known manner and after two hours all the rods were rigid. Half of the rods were then cut into 17 mm. lengths, attached to cigarettes having a length of 68 mm. and tested on a known automatic smoking machine for their ability to remove phenol and tar. After being stored for three months at room temperature the other rods were similarly tested. The following data was obtained.

Sample	Average Pressure Drop (In. of Water)	% Smoke Solids (Tar) Re- moved by Filter		% Phenol Removal by Filter	
		At Start	After 3 Months	At Start	After 3 Months
1	2.8	45	43	88	79
2	2.6	42	43	87	87
3	2.5	41	43	87	78
4	2.7	43	41	85	85
5	2.7	42	42	86	78
6	2.6	43	44	88	87

As may be seen from the Table, the filters containing only plasticizer (Samples 1, 3 and 5) were substantially the same in tar removal capacity after they had been aged 3 months as when first prepared, while they showed some drop in phenol-removing capacity after the 3 months.

On the other hand, filter rods made of tow containing the polyethylene glycol/plasticizer composition of this invention had substantially the same phenol-removing capacity after aging as before aging.

WHAT WE CLAIM IS:—

1. A cellulose acetate tow treating composition comprising 25 to 50% by weight of polyethylene glycol and 50 to 75% by weight of plasticizer for the tow.

2. A tow treating composition according to claim 1, wherein the plasticizer comprises an organic ester plasticizer selected from the group consisting of glycerol monoacetate, glycerol diacetate, glycerol triacetate, glycerol monopropionate, glycerol dipropionate, glycerol tripropionate, mixed esters of glycerine containing acetyl and propionyl groups, dimethyl phthalate, triethyl citrate, propylene glycol monoacetate, propylene glycol diacetate, di(methoxyethyl)phthalate or methylphthalylethyl glycolate.

3. A tow treating composition according to claim 1 or 2, containing a water-soluble surfactant.

4. A tow treating composition according to claim 1, comprising a blend of 38 to 46% by weight polyethylene glycol having a molecular weight of 200—600 and liquid at room temperature and 46 to 62% by weight triacetin, the blend having dispersed therein up to 15% by weight water and up to 1% of a water-soluble surfactant.

5. A tow treating composition according to claim 3 or 4, wherein the water-soluble surfactant comprises an alkyl or aryl sulphate, alkyl or aryl sulphonate, alkylphenoxy-poly(ethyleneoxy)ethanol, an ester of sulphosuccinic

acid or a condensate of ethylene oxide with a hydrophobic base formed by condensing propylene oxide with propylene glycol.

6. A method of treating a tow of crimped, continuous filaments of cellulose acetate in the production of tobacco smoke filters, comprising spreading the filaments and applying thereto a composition containing 25 to 50% by weight of polyethylene glycol and 50 to 75% by weight of a plasticizer for the tow.

7. Method according to claim 6, wherein the composition also includes a water-soluble surfactant.

8. Method according to claim 6 or 7, wherein the plasticizer comprises an organic ester plasticizer selected from the group consisting of glycerol monoacetate, glycerol diacetate, glycerol triacetate, glycerol monopropionate, glycerol dipropionate, glycerol tripropionate, mixed esters of glycerine containing acetyl and propionyl groups, dimethyl phthalate, triethyl citrate, propylene glycol monoacetate, propylene glycol diacetate, di(methoxyethyl)phthalate or methylphthalylethyl glycolate.

9. Method according to claim 7 of treating a cellulose acetate tow of crimped, continuous filaments, wherein the composition comprises a blend of 38 to 46% by weight polyethylene glycol having a molecular weight of 200—600 and liquid at room temperature and 46 to 62% by weight triacetin, the blend of polyethylene glycol and triacetin containing dispersed therein up to 15% by weight water and up to 1% of a water-soluble surfactant.

10. Method according to claim 7, 8 or 9, wherein the water-soluble surfactant comprises an alkyl or aryl sulphate, an alkyl or aryl sulphonate, alkylphenoxy-poly(ethyleneoxy)-ethanol, an ester of sulphosuccinic acid, or a condensate of ethylene oxide with a hydrophobic base formed by condensing propylene oxide with propylene glycol.

11. A tobacco smoke filter element comprising compacted cellulose acetate tow in rod-



Sample	Average Pressure Drop (In. of Water)	% Smoke Solids (Tar) Re- moved by Filter		% Phenol Removal by Filter	
		At Start	After 3 Months	At Start	After 3 Months
1	2.8	45	43	88	79
2	2.6	42	43	87	87
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As may be seen from the Table, the filters containing only plasticizer (Samples 1, 3 and 5) were substantially the same in tar removal capacity after they had been aged 3 months as when first prepared, while they showed some drop in phenol-removing capacity after the 3 months.

On the other hand, filter rods made of tow containing the polyethylene glycol/plasticizer composition of this invention had substantially the same phenol-removing capacity after aging as before aging.

WHAT WE CLAIM IS:—

1. A cellulose acetate tow treating composition comprising 25 to 50% by weight of polyethylene glycol and 50 to 75% by weight of plasticizer for the tow.

2. A tow treating composition according to claim 1, wherein the plasticizer comprises an organic ester plasticizer selected from the group consisting of glycerol monoacetate, glycerol diacetate, glycerol triacetate, glycerol monopropionate, glycerol dipropionate, glycerol tripropionate, mixed esters of glycerine containing acetyl and propionyl groups, dimethyl phthalate, triethyl citrate, propylene glycol monoacetate, propylene glycol diacetate, di(methoxyethyl)phthalate or methylphthalylethyl glycollate.

3. A tow treating composition according to claim 1 or 2, containing a water-soluble surfactant.

4. A tow treating composition according to claim 1, comprising a blend of 38 to 46% by weight polyethylene glycol having a molecular weight of 200—600 and liquid at room temperature and 46 to 62% by weight triacetin, the blend having dispersed therein up to 15% by weight water and up to 1% of a water-soluble surfactant.

5. A tow treating composition according to claim 3 or 4, wherein the water-soluble surfactant comprises an alkyl or aryl sulphate, alkyl or aryl sulphonate, alkylphenoxy-poly(ethyleneoxy)ethanol, an ester of sulphosuccinic

acid or a condensate of ethylene oxide with a hydrophobic base formed by condensing propylene oxide with propylene glycol.

6. A method of treating a tow of crimped, continuous filaments of cellulose acetate in the production of tobacco smoke filters, comprising spreading the filaments and applying thereto a composition containing 25 to 50% by weight of polyethylene glycol and 50 to 75% by weight of a plasticizer for the tow.

7. Method according to claim 6, wherein the composition also includes a water-soluble surfactant.

8. Method according to claim 6 or 7, wherein the plasticizer comprises an organic ester plasticizer selected from the group consisting of glycerol monoacetate, glycerol diacetate, glycerol triacetate, glycerol monopropionate, glycerol dipropionate, glycerol tripropionate, mixed esters of glycerine containing acetyl and propionyl groups, dimethyl phthalate, triethyl citrate, propylene glycol monoacetate, propylene glycol diacetate, di(methoxyethyl)phthalate or methylphthalylethyl glycollate.

9. Method according to claim 7 of treating a cellulose acetate tow of crimped, continuous filaments, wherein the composition comprises a blend of 38 to 46% by weight polyethylene glycol having a molecular weight of 200—600 and liquid at room temperature and 46 to 62% by weight triacetin, the blend of polyethylene glycol and triacetin containing dispersed therein up to 15% by weight water and up to 1% of a water-soluble surfactant.

10. Method according to claim 7, 8 or 9, wherein the water-soluble surfactant comprises an alkyl or aryl sulphate, an alkyl or aryl sulphonate, alkylphenoxy-poly(ethyleneoxy)-ethanol, an ester of sulphosuccinic acid, or a condensate of ethylene oxide with a hydrophobic base formed by condensing propylene oxide with propylene glycol.

11. A tobacco smoke filter element comprising compacted cellulose acetate tow in rod-

- like form carrying thereon a treating composition containing 25 to 50% by weight of said composition polyethylene glycol and 50 to 75% by weight of said composition a compatible organic ester plasticizer comprising
- 5 glycerol monoacetate, glycerol diacetate, glycerol triacetate, glycerol monopropionate, glycerol dipropionate, glycerol tripropionate, mixed esters of glycerine containing acetyl and
- 10 propionyl groups, dimethyl phthalate, triethyl citrate, propylene glycol monoacetate, propylene glycol diacetate, di(methoxyethyl)phthalate or methylphthalylethyl glycollate.
12. A tobacco smoke filter element according to claim 11, wherein the tow carries at
- 15 least 10% by weight of the treating composition which comprises 38 to 46% by weight of the composition polyethylene glycol having a molecular weight of 200—600 and
- 20 46 to 62% by weight of the composition triacetin.

13. A tobacco smoke filter element according to claim 11 or 12, wherein the treating

composition also includes up to 1% by weight of a water-soluble surfactant.

14. A tobacco smoke filter element according to claim 13, wherein the water-soluble surfactant comprises an alkyl or aryl sulphate, an alkyl or aryl sulphonate, alkylphenoxypoly-(ethyleneoxy)ethanol, an ester of sulpho-

30 succinic acid, or a condensate or ethylene oxide with a hydrophobic base formed by condensing propylene oxide with propylene glycol.

15. Tow treating compositions according to claim 1, substantially as hereinbefore described.

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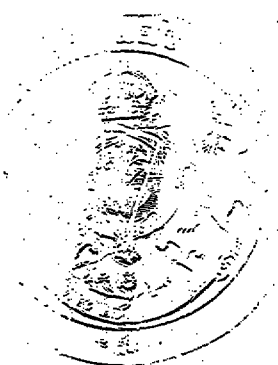
16. Methods of treating tow according to claim 6, substantially as hereinbefore described.

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17. Cigarette filter elements according to claim 11, substantially as hereinbefore described.

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Rodate