

SPECIFICATION

Improvements relating to smoke filtration

5 This invention relates to smoke filters, for tobacco smoke filtration for instance, and their production.

It is common practice to provide smoking articles, cigarettes for example, with a tobacco-smoke filter comprising a rod-form plug of fibrous material, for
10 instance cellulose acetate, paper or polypropylene, which plug is wrapped in a paper plugwrap. Such wrapped plugs are derived from filter rod manufactured in continuous fashion on a filter-rod making machine to which are fed the filtration material, for
15 example continuous cellulose acetate filament as a crimped tow from a bale thereof, and plugwrap in continuous strip form from a bobbin. The tow is spread and sprayed with a suitable plasticiser, such as triacetin in the case of cellulose acetate tow, and
20 is passed to a garniture of the making machine which operates to bring the tow to rod form and to wrap it in the plugwrap. This mode of manufacturing filter rod is the current orthodox method in the cigarette making industry.

25 Filter rod is also known which, instead of being provided with an enveloping plugwrap to provide stability, is made by a process which imparts a self-sustaining nature to the filtration material concerned.

30 Recently there has been increasing use of ventilated filters in filter-tip cigarette manufacture. Conventionally such a filter comprises a plug of fibrous filtration material wrapped in plugwrap, the filter being attached to the tobacco rod by a tipping paper.

35 Provision is made for ventilation air to pass through the tipping paper by perforating it. Usually one or more rows of ventilation holes extend around the tipping paper. The underlying plugwrap must also permit the flow of the ventilation air therethrough and may for this purpose have a requisite degree of
40 inherent porosity or be perforated, for example by an electrostatic or mechanical process. During cigarette manufacture, constant monitoring is required to ensure that the combined effects of

45 variations in the ventilation holes in the tipping paper and in the permeability of the plugwrap do not produce an overall degree of ventilation outside predetermined tolerances, since it is the overall degree of ventilation which determines smoke-constituent deliveries of the cigarette.
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The use of filter plugs cut from self-sustaining filter rod may simplify the problem of ensuring a consistent degree of ventilation because the use of such plugs having, as they do, porous peripheral
55 surfaces, obviates the need for plugwrap.

It has heretofore been proposed to produce self-sustaining filter rod by passing plasticiser-impregnated tow through a die to gather it into rod form, the tow, while within the die, being treated with a hot
60 gas or steam. Such a method of filter-rod production is disclosed in United Kingdom Patent Specification No. 970,817. In another proposed method of producing self-sustaining filter rod disclosed in United Kingdom Patent Specification No. 1,169,932, steam
65 is passed into a gathered bundle of plasticiser-im-

pregnated tow, but, instead of using a die to gather the tow into rod form, the tow is enveloped in a steam-pervious tape which serves to convey it through a heating enclosure in which the tow is
70 contacted by the steam.

These methods of producing self-sustaining rod entail significant, costly and inconvenient departures from the orthodox method of manufacture referred to above. Moreover, in carrying out the second of
75 these methods, an impression of the mesh structure of the steam-pervious tape is formed in the peripheral surface of the rod. This is disadvantageous because, for example, it is difficult to determine the rod diameter for quality control purposes.

80 It is an object of the present invention to provide filter rod which, although similar to non-wrapped, self-sustaining, rod, having a porous peripheral surface, can be manufactured by the orthodox rod-making method for wrapped rod. It is a further
85 object of the present invention to provide such filter rod having at its peripheral surface smoothness comparable with that of wrapped rod.

It has been proposed, in United Kingdom Patent Specification No. 1,110,785, to wrap a bundle of
90 unplasticised cellulose acetate fibres in a wrapper, preferably of cellulose acetate film, bonded to the outer layer of cellulose acetate fibres. Filter rod made in this manner would, because of the absence of plasticiser, not reliably possess the rigidity generally associated with commercially acceptable self-sustaining filter rod. Moreover, the physical structure and chemical nature of the cellulose acetate film is markedly different from that of conventional paper
95 plugwrap. Such film, which is physically similar to Cellophane (Trade Mark), lacks the fibrous structure of paper and is substantially air impermeable. The filter rod would thus be significantly different from a self-sustaining cellulose acetate filter rod.

The present invention provides filter rod comprising a body of rod form having as at least major
100 constituent a thermoplastics cellulose acetate or polypropylene smoke-filtration material and wrapped in a plugwrap comprising at least 50% by weight of fibres or filaments of, respectively, cellulose
105 acetate or polypropylene material of substantially the same chemical identity as the said major constituent of the filtration material, said plugwrap having been bonded to said body and said plugwrap having a permeability for air of not less than 10,000 Coresta units.
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The air permeability of sheet material in Coresta units is based on measurement of the rate of flow, expressed in cubic centimetres per minute, of air, which is caused to flow through a one square
120 centimetre zone of the sheet material under a pressure difference, across the zone, of 10 centimetres of water.

Preferably the plugwrap is bonded to the rod-form body by a bonding agent which is a plasticiser or
125 adhesive for the plugwrap and the smoke-filtration material. If required, the bonding may be enhanced by a light application of the bonding agent to the plugwrap prior to the wrapping of the filtration material in the plugwrap.

130 The present invention further provides a method

of making smoke filter rod, wherein a continuous tow or web having as at least major constituent a thermoplastics cellulose acetate or polypropylene smoke-filtration material is impregnated with a bonding agent for said material and is gathered into a rod-form body and wrapped in a continuous fibrous or filamentary plugwrap having a permeability for air of not less than 10,000 Coresta units, whereby said plugwrap is bonded to said rod-form body, said plugwrap comprising at least 50% by weight of fibres or filaments of, respectively, cellulose acetate or polypropylene material of substantially the same chemical identity as the said major constituent of the filtration material. Suitably, said filtration material is brought to said rod form and wrapped in said plugwrap by feeding them together to a filter-rod garniture. The longitudinal plugwrap seam is preferably lap sealed.

Advantageously the smoke filtration material is of a fibrous or filamentary nature. In addition to the above-mentioned thermoplastics filtration material constituting the major constituent of the rod-form body, that body may further include contents of one or more thermoplastics or non-thermoplastics materials. If the material constituting the said major constituent is a cellulose acetate material, the rod-form body may also include a content of polypropylene material and conversely.

Preferably the plugwrap comprises not less than 80% by weight, advantageously not less than 90%, of the said thermoplastics material which is of substantially the same chemical identity as said major constituent of the rod-form body. However, the plugwrap may additionally include one or more further thermoplastics or non-thermoplastics materials. Cellulosic fibres, for instance wood pulp, may be included and the plugwrap may also contain strength-imparting additives and binders. The plugwrap may be made by a non-woven or conventional paper-making process.

It is essential that the plugwrap should possess sufficient tensile strength and be suitable in other respects for efficient running on a filter-rod making machine. Preferably the tensile breaking strength of the plugwrap should not be less than 50 g per mm of the plugwrap width.

By use of the present invention, there can be provided filter rod suitable for use in the hot-shaping process disclosed in the Specification of our United Kingdom Patent No. 1,507,765.

The following are examples of ways in which the invention may be carried into effect, reference being made to the accompanying drawing which represents to a large scale a longitudinal section through a short length of filter rod from which cigarette filters are to be produced.

EXAMPLE I

Using a Hauni KDF 1 filter-rod making machine, filter rod 1 was made from crimped cellulose acetate tow 2 of denier specification 8/36,000 and plugwrap 3 consisting of cellulose acetate fibres with 4.5% wood pulp and having a permeability of about 25,000 Coresta units, a tensile breaking strength of 60 g per mm width, a weight of 31.4 g/m², a width of 27 mm and a thickness of 142 microns. The tow was

plasticised and the plugwrap 3 bonded at boundary 4 to the tow 2, using triacetin. The tow was brought to rod form and wrapped in the plugwrap by feeding them together to the garniture of the machine. A

PVA plugwrap adhesive supplied by Swifts Chemical Company Limited was used for the longitudinal plugwrap seam. The resultant filter rod 1 had a circumference of 24.85 mm and gave a pressure drop of 150 mm WG over a fully encapsulated length of 120 mm. It was found to be closely similar to self-sustaining cellulose acetate filter rod made by the process of United Kingdom Specification No. 1,169,932. An equally advantageous product resulted when the cellulose acetate plugwrap had a permeability of about 32,000 Coresta units.

As alternative adhesive agents for the plugwrap seam, use may be made of triacetin (alone or with an addition of 3% of cellulose acetate), diethyl succinate or 1-3 butane diol diacetate.

Portions of filter rod thus manufactured with a plugwrap permeability of 25,000 Coresta units were employed in the hot-shaping process disclosed in United Kingdom Specification No. 1,507,765 whereby grooved filter elements were formed. As the cellulose acetate plugwrap melted under the action of the hot-shaping process, the resultant filter elements were of a quality equal to that obtained when similar elements were made by subjecting portions of unwrapped self-sustaining cellulose acetate filter rod to the same process.

EXAMPLE II

Again using a Hauni KDF1 filter-rod making machine, filter rod was produced from crimped polypropylene tow and a plugwrap formed from a non-woven polypropylene sheet material having a permeability of about 25,000 Coresta units. An ethylene-vinyl acetate copolymer emulsion was used as plasticiser for the tow and bonding agent for the plugwrap. A hot melt adhesive was used for the plugwrap seam.

Portions of the filter rod were subjected to the above-mentioned hot-shaping process and used to produce filter elements.

Portions of filter rod produced in accordance with the invention can also be employed to produce filter elements for which hot-shaping by the aforesaid process is not required.

CLAIMS

1. Smoke-filter rod which comprises a body of rod form having as at least major constituent a thermoplastics cellulose acetate or polypropylene smoke-filtration material and wrapped in a plugwrap comprising at least 50% by weight of fibres or filaments of, respectively, cellulose acetate or polypropylene material of substantially the same chemical identity as said major constituent of the filtration material, said plugwrap having been bonded to said body and said plugwrap having a permeability for air of not less than 10,000 Coresta units.
2. Filter rod according to Claim 1, wherein said plugwrap is bonded to said body by an agent which is a bonding agent for the material of said fibres or filaments and for said filtration material.
3. Filter rod according to Claim 1 or 2, wherein the smoke filtration material is of a fibrous or



of making smoke filter rod, wherein a continuous tow or web having as at least major constituent a thermoplastics cellulose acetate or polypropylene smoke-filtration material is impregnated with a bonding agent for said material and is gathered into a rod-form body and wrapped in a continuous fibrous or filamentary plugwrap having a permeability for air of not less than 10,000 Coresta units, whereby said plugwrap is bonded to said rod-form body, said plugwrap comprising at least 50% by weight of fibres or filaments of, respectively, cellulose acetate or polypropylene material of substantially the same chemical identity as the said major constituent of the filtration material. Suitably, said filtration material is brought to said rod form and wrapped in said plugwrap by feeding them together to a filter-rod garniture. The longitudinal plugwrap seam is preferably lap sealed.

Advantageously the smoke filtration material is of a fibrous or filamentary nature. In addition to the above-mentioned thermoplastics filtration material constituting the major constituent of the rod-form body, that body may further include contents of one or more thermoplastics or non-thermoplastics materials. If the material constituting the said major constituent is a cellulose acetate material, the rod-form body may also include a content of polypropylene material and conversely.

Preferably the plugwrap comprises not less than 80% by weight, advantageously not less than 90%, of the said thermoplastics material which is of substantially the same chemical identity as said major constituent of the rod-form body. However, the plugwrap may additionally include one or more further thermoplastics or non-thermoplastics materials. Cellulosic fibres, for instance wood pulp, may be included and the plugwrap may also contain strength-imparting additives and binders. The plugwrap may be made by a non-woven or conventional paper-making process.

It is essential that the plugwrap should possess sufficient tensile strength and be suitable in other respects for efficient running on a filter-rod making machine. Preferably the tensile breaking strength of the plugwrap should not be less than 50 g per mm of the plugwrap width.

By use of the present invention, there can be provided filter rod suitable for use in the hot-shaping process disclosed in the Specification of our United Kingdom Patent No. 1,507,765.

The following are examples of ways in which the invention may be carried into effect, reference being made to the accompanying drawing which represents to a large scale a longitudinal section through a short length of filter rod from which cigarette filters are to be produced.

EXAMPLE I

Using a Hauni KDF 1 filter-rod making machine, filter rod 1 was made from crimped cellulose acetate tow 2 of denier specification 8/36,000 and plugwrap 3 consisting of cellulose acetate fibres with 4.5% wood pulp and having a permeability of about 25,000 Coresta units, a tensile breaking strength of 60 g per mm width, a weight of 31.4 g/m², a width of 27 mm and a thickness of 142 microns. The tow was

plasticised and the plugwrap 3 bonded at boundary 4 to the tow 2, using triacetin. The tow was brought to rod form and wrapped in the plugwrap by feeding them together to the garniture of the machine. A PVA plugwrap adhesive supplied by Swifts Chemical Company Limited was used for the longitudinal plugwrap seam. The resultant filter rod 1 had a circumference of 24.85 mm and gave a pressure drop of 150 mm WG over a fully encapsulated length of 120 mm. It was found to be closely similar to self-sustaining cellulose acetate filter rod made by the process of United Kingdom Specification No. 1,169,932. An equally advantageous product resulted when the cellulose acetate plugwrap had a permeability of about 32,000 Coresta units.

As alternative adhesive agents for the plugwrap seam, use may be made of triacetin (alone or with an addition of 3% of cellulose acetate), diethyl succinate or 1-3 butane diol diacetate.

Portions of filter rod thus manufactured with a plugwrap permeability of 25,000 Coresta units were employed in the hot-shaping process disclosed in United Kingdom Specification No. 1,507,765 whereby grooved filter elements were formed. As the cellulose acetate plugwrap melted under the action of the hot-shaping process, the resultant filter elements were of a quality equal to that obtained when similar elements were made by subjecting portions of unwrapped self-sustaining cellulose acetate filter rod to the same process.

EXAMPLE II

Again using a Hauni KDF1 filter-rod making machine, filter rod was produced from crimped polypropylene tow and a plugwrap formed from a non-woven polypropylene sheet material having a permeability of about 25,000 Coresta units. An ethylene-vinyl acetate copolymer emulsion was used as plasticiser for the tow and bonding agent for the plugwrap. A hot melt adhesive was used for the plugwrap seam.

Portions of the filter rod were subjected to the above-mentioned hot-shaping process and used to produce filter elements.

Portions of filter rod produced in accordance with the invention can also be employed to produce filter elements for which hot-shaping by the aforesaid process is not required.

CLAIMS

1. Smoke-filter rod which comprises a body of rod form having as at least major constituent a thermoplastics cellulose acetate or polypropylene smoke-filtration material and wrapped in a plugwrap comprising at least 50% by weight of fibres or filaments of, respectively, cellulose acetate or polypropylene material of substantially the same chemical identity as said major constituent of the filtration material, said plugwrap having been bonded to said body and said plugwrap having a permeability for air of not less than 10,000 Coresta units.

2. Filter rod according to Claim 1, wherein said plugwrap is bonded to said body by an agent which is a bonding agent for the material of said fibres or filaments and for said filtration material.

3. Filter rod according to Claim 1 or 2, wherein the smoke filtration material is of a fibrous or



filamentary nature.

4. Filter rod according to Claim 1, 2 or 3, wherein the rod-form body is made of cellulose acetate tow, or has cellulose acetate tow as said major constituent, and said fibres or filaments of the plugwrap are of cellulose acetate.

5. Filter rod according to Claim 4 as appended to Claim 2, wherein the bonding agent is triacetin.

6. Filter rod according to Claim 1, 2 or 3, wherein the rod-form body is made of polypropylene tow, or has polypropylene tow as said major constituent and said fibres or filaments of the plugwrap are of polypropylene.

7. Filter rod according to any one of the preceding claims, wherein the plugwrap comprises at least 90% of said fibres or filaments.

8. A portion of filter rod according to any one of Claims 1 to 7, wherein said portion has been subjected to a hot-shaping process.

9. Smoke-filter rod according to claim 1 and substantially as hereinbefore described in Example I or Example II.

10. A method of making smoke-filter rod, wherein a continuous tow or web having as at least major constituent a thermoplastics cellulose acetate or polypropylene smoke-filtration material is impregnated with a bonding agent for said material and is gathered into a rod-form body and wrapped in a continuous fibrous or filamentary plugwrap having a permeability for air of not less than 10,000 Coresta units, whereby said plugwrap is bonded to said rod-form body, said plugwrap comprising at least 50% by weight of fibres or filaments of, respectively, cellulose acetate or polypropylene material of substantially the same chemical identity as the said major constituent of the filtration material.

11. A method according to Claim 10, wherein said filtration material is brought to said rod form and wrapped in said plugwrap by feeding them together to a filter-rod garniture.

12. A method of making smoke-filter rod according to claim 10 and substantially as hereinbefore described.

13. A filter for a smoking article made from filter rod according to any one of Claims 1 to 9 or by the method according to Claim 10, 11 or 12.