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(54) Title of the Invention: **Smoking articles and smoking article filters**
Abstract Title: **Smoking article filters**

(57) A filter rod 1 for a smoking article 2 comprises a material that changes its visible appearance when exposed to non-visible light. The material is preferably only visible when exposed to non-visible light. The material may be a UV responsive material, such as a UV reflective material or a UV fluorescent material. The material is preferably provided in a thread 5 passing through the filter. The thread 5 may extend through the entire length of the filter rod 2 (as shown), or may extend only partially through the length (figure 2). More than one thread can be provided if desired. As an alternative to a UV responsive material, the material may instead be responsive to X-rays. The material is used as a mark of identification, to confirm that the smoking article is not counterfeit.

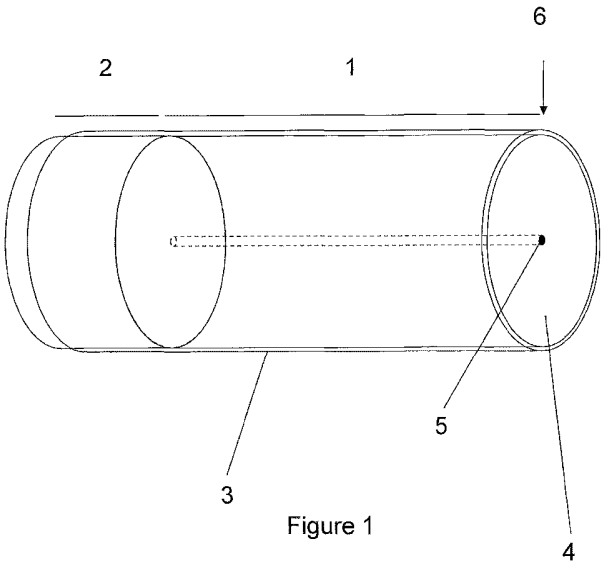

Figure 1

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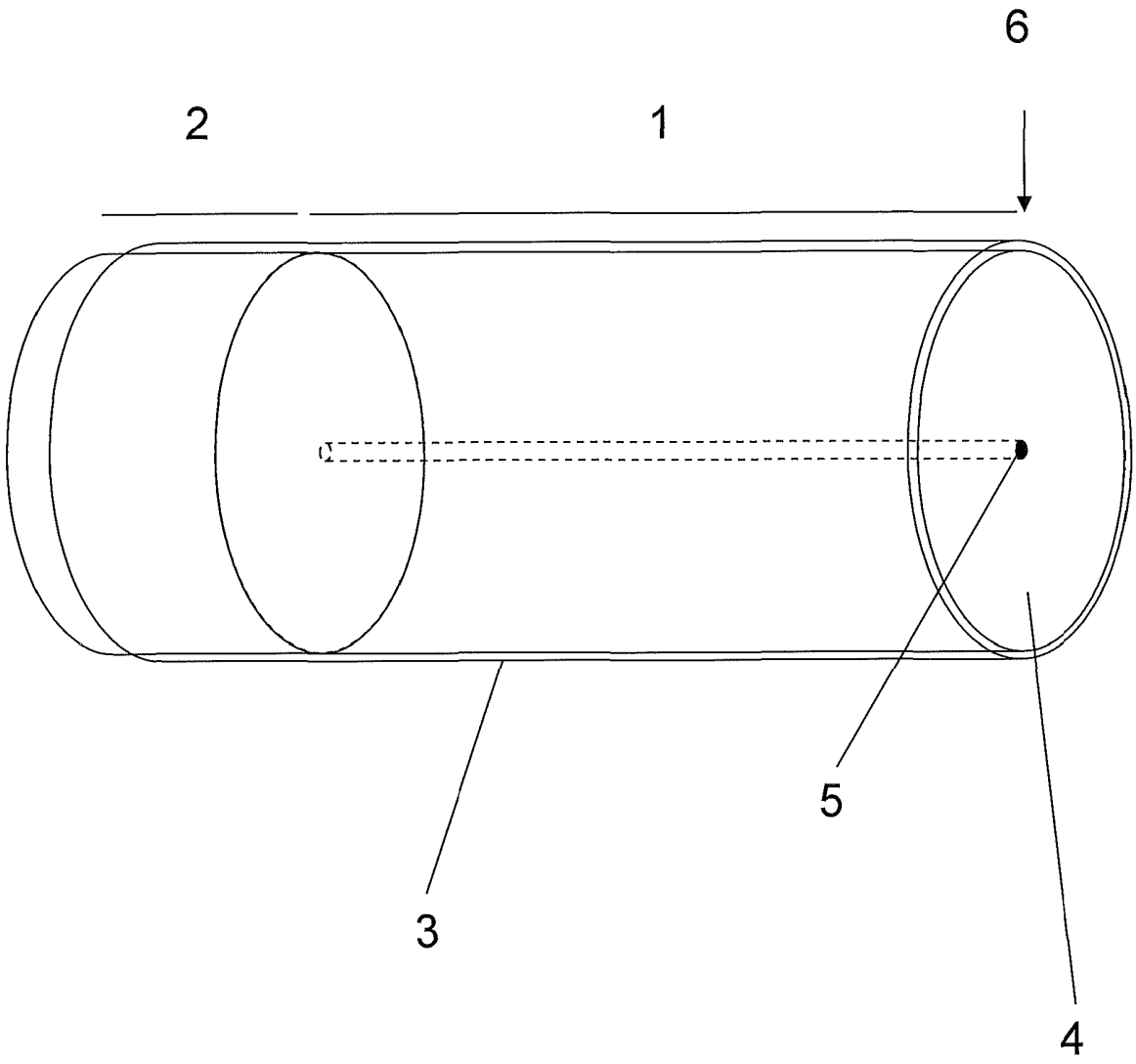

Figure 1

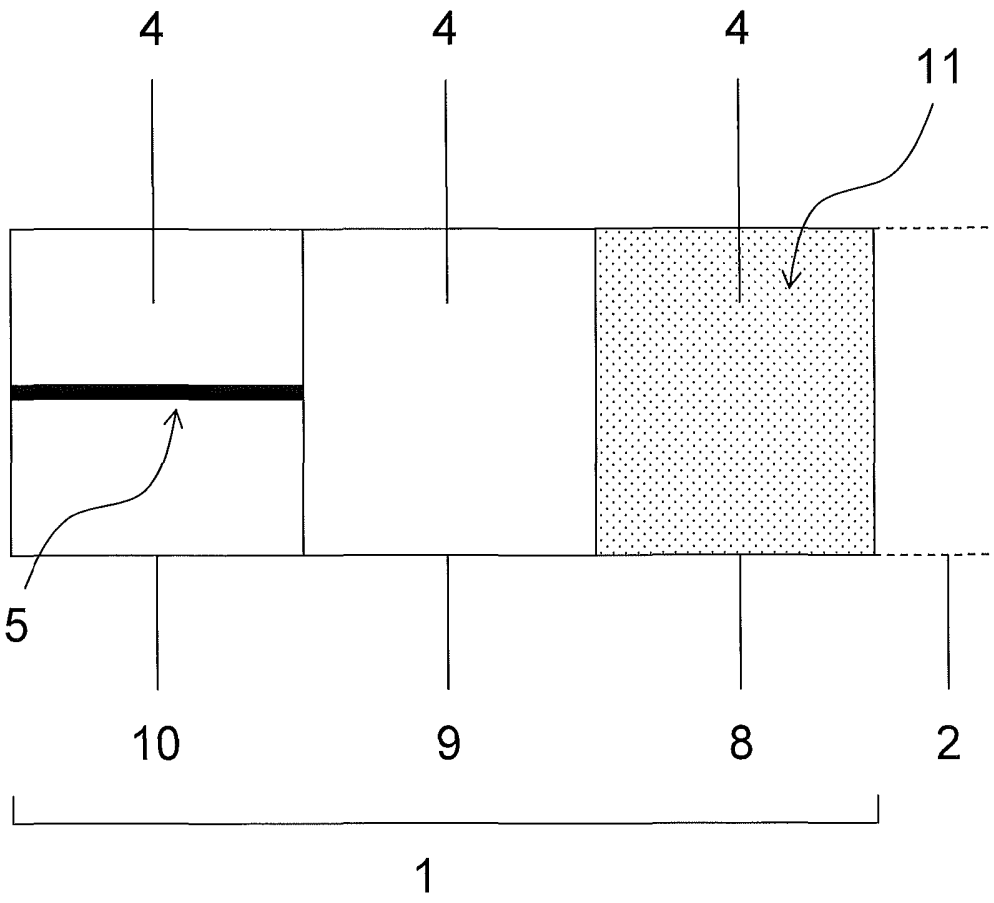

Figure 2

Smoking Articles and Smoking Article Filters

Field of the Invention

The present invention relates to smoking articles such as cigarettes and, in particular, to smoking article filters.

Background

Smoking articles often comprise a filter to remove some of the substances produced by combustion of the smokable material from the smoke flow as it is drawn by the smoker.

It is known to incorporate threads loaded with flavourant into smoking article filters, passing along the central axis of the filter. The usual material for the manufacture of such threads is cotton, although other materials, such as cellulose acetate and rayon, may be used. Cotton thread has drawbacks as a material for providing flavourant, however, as it may become discoloured and unsightly during consumption of the smoking article. To overcome this problem, the cotton may be dyed. Such dyes are subject to the usual regulatory approval for use in smoking article filters, which can result in difficulties in selecting an appropriate dye.

A further problem for the tobacco industry that is well documented in the prior art is that of illicit trade. It is estimated that some 330-660 billion cigarettes in circulation each year are illicit – smuggled, counterfeit or tax-evaded in other ways. Illicit smoking articles can be almost impossible to distinguish from the genuine goods and are unlikely to comply with the rigorous regulatory standards that legitimate tobacco companies adhere to.

Summary of the Invention

In a first aspect, the present invention provides a filter rod for a smoking article, wherein the filter rod comprises a material that changes its visible appearance when exposed to non-visible light.

The material may be essentially only visible in non-visible light. It may be essentially only visible in light having a wavelength that does not fall in the range of $700 \text{ nm} > \lambda \geq 400 \text{ nm}$.

The material may be an ultraviolet (UV) responsive material, such as a UV reflective material or a UV fluorescent material.

The filter rod may further comprise a thread extending through at least part of a filter plug in the filter rod, said thread comprising the material that changes its visible appearance when exposed to non-visible light. The material may be entrained within the thread.

The filter rod may be substantially cylindrical in shape, with the thread extending substantially longitudinally through the filter plug. The thread may extend substantially along the central cylindrical axis of the filter rod. The thread may extend through the entire length of the filter rod or extend only partially through the length of the filter rod.

The filter rod may comprise a plurality of substantially cylindrical filter plug sections, the first filter plug section being said filter plug having said thread extending substantially longitudinally therethrough. The filter rod may comprise a second filter plug section aligned substantially coaxially with the first filter plug section and comprising cellulose acetate impregnated with activated charcoal. The filter rod may comprise a third filter plug section aligned substantially coaxially with the first and second filter plug sections and comprising cellulose acetate.

The filter rod may comprise a plurality of said threads.

The thread may be made from cellulose acetate.

The thread may further comprise a flavourant.

In a second aspect, there is provided a smoking article comprising a filter rod of the first aspect.

A method for making a filter rod for a smoking article is provided in a third aspect, the method comprising introducing into the filter rod a material that changes its visible appearance when exposed to non-visible light.

The method may comprise introducing a thread comprising the material that changes its visible appearance when exposed to non-visible light into a plug of filter material.

The material may be essentially only visible in non-visible light. The material may be essentially only visible in light having a wavelength that does not fall in the range of 700 nm > $\lambda \geq$ 400 nm.

The material may be a UV responsive material, such as a UV reflective material or a UV fluorescent material.

The material may be entrained within the thread.

The filter rod may be substantially cylindrical, with the method comprising introducing the thread into substantially the central cylindrical axis of the filter rod.

The method may comprise introducing a plurality of said threads into the filter material. The method may comprise introducing the threads so that they are arranged substantially symmetrically about the central axis of the resulting filter rod.

The thread may be made from cellulose acetate.

The method may further comprise impregnating the thread with a flavourant.

In a fourth aspect, the invention provides the use of a material that changes its visible appearance when exposed to non-visible light in a filter rod for a smoking article as a mark of identification.

The material may be essentially only visible in non-visible light. It may be essentially only visible in light having a wavelength that does not fall in the range of $700 \text{ nm} > \lambda \geq 400 \text{ nm}$.

The material may be a UV responsive material, such as a UV reflective material or a UV fluorescent material.

The material may be entrained within a thread extending through at least part of a filter plug in the filter rod.

Brief Description of the Drawings

Figure 1 shows a perspective view of a smoking article, including a rod of smokable material, a filter in accordance with one embodiment of the invention, and tipping paper attaching the rod and filter together.

Figure 2 shows a cross-sectional view of a second embodiment of the filter rod according to the invention.

Detailed Description

The present invention relates to smoking articles and, in particular, to smoking article filters.

As used herein, the term "smoking article" includes smokable products such as cigarettes, cigars and cigarillos, whether based on tobacco, tobacco derivatives, expanded tobacco, reconstituted tobacco or tobacco substitutes, and also heat-not-burn products.

The smoking articles and smoking article filters of the present invention comprise a material that changes its visible appearance when exposed to non-visible light. The material may be essentially only visible in non-visible light.

The phrase "essentially only visible in non-visible light" can mean that the material cannot easily be seen by the naked eye in visible light. In an embodiment, the material cannot be seen by the naked eye in visible light, i.e. it will only become visible to the naked eye in non-visible light. The material may thus only be visually detectable in light having a wavelength falling outside the wavelength range of visible irradiances.

Visible (or "optical" or "VIS") irradiances are defined in the wavelength range of $700 \text{ nm} > \lambda \geq 400 \text{ nm}$. Thus, the material used in the present invention can be essentially only visible in light having a wavelength that does not fall in the range of $700 \text{ nm} > \lambda \geq 400 \text{ nm}$.

The material may be a UV responsive material. UV responsive materials are those that respond to UV light; they may absorb UV light, reflect it and/or fluoresce in it. The response to UV light may be detected by any means known in the art. As one example, the UV response may be a visible response, for example, the material may visibly fluoresce or 'glow' under a lamp or other device emitting UV light.

UV irradiances are defined in the wavelength range of $400 \text{ nm} > \lambda \geq 10 \text{ nm}$ as part of the Global Solar UV Index (UVI) designation. The electromagnetic spectrum of UV light may be subdivided in a number of ways, depending upon the user community, measurement techniques and instrumentation capabilities. The draft ISO standard on determining solar irradiances (ISO-DIS-21348) describes the following ranges:

(i) vacuum UV (VUV) irradiances are defined in the wavelength range of $200 \text{ nm} > \lambda \geq 10 \text{ nm}$. This wavelength range is commonly used by providers of the data of this spectral range as well as by the materials sciences community;

(ii) extreme UV (EUV) irradiances are defined in the wavelength range of 100 nm > $\lambda \geq$ 10 nm. This wavelength range is commonly used by providers of the data of this spectral range. Some members of the aeronomy community have used a definition with the lower wavelength cut-off at 30 nm and a higher cut-off at 120 nm;

(iii) Far UV (FUV) irradiances are defined in the wavelength range of 200 nm > $\lambda \geq$ 100 nm. This wavelength range is commonly used by providers of the data of this spectral range; some members of the aeronomy community consider the start of this wavelength range at 120 nm;

(iv) UVC irradiances (also known as "short wave" or "germicidal") are defined in the wavelength range of 280 nm > $\lambda \geq$ 100 nm as part of the Global Solar UVI designation;

(v) middle UV (MUV) irradiances are defined in the wavelength range of 300 nm > $\lambda \geq$ 200 nm. This wavelength range is commonly used by the aeronomy community;

(vi) UVB irradiances (also known as "medium wave") are defined in the wavelength range of 315 nm > $\lambda \geq$ 280 nm as part of the Global Solar UVI designation;

(vii) near UV (NUV) irradiances are defined in the wavelength range of 400 nm > $\lambda \geq$ 300 nm. This wavelength range is commonly used by the aeronomy community; and

(viii) UVA irradiances (also known as "long wave" or "black light") are defined in the wavelength range of 400 nm > $\lambda \geq$ 315 nm as part of the Global Solar UVI designation.

The material used in the present invention may respond to UV light in any, or indeed all, of these ranges. The UV responsive material may, for instance, comprise barium sulphate, aluminium or an aluminium-based composite or material,

polytetrafluoroethylene (PTFE) or polyester, although other suitable UV responsive materials would be known to those skilled in the art.

In an embodiment, the material does not comprise and/or does not consist of zinc sulphide.

The material used in the present invention may be a material that responds to X-rays, for example barium sulphate, although other suitable materials would be known to those skilled in the art. Hard X-ray irradiances are defined in the wavelength range of 1 nm > λ. Soft X-ray irradiances are defined in the wavelength range of 10 nm > $\lambda \geq$ 1 nm. These wavelength ranges are commonly used by providers of the data of this spectral range. The aeronomy community sometimes considers soft X-rays (also called "XUV rays") to extend to 30 nm. The material used in the present invention may respond to X-rays in any, or indeed all, of these ranges.

Whichever material is selected for use with the invention, it should change its visible appearance when exposed to non-visible light. In one embodiment, it should be essentially 'invisible' when viewed in visible light, i.e. it should not be seen easily, or should not be seen at all, by the naked eye in visible light. Only when viewed under an appropriate light source (such as a UV lamp or X-ray machine) should the material, in this embodiment, become visible (for example, by fluorescing or 'glowing' in the UV light or providing contrast in an X-ray image).

The material used in the present invention may be included in any part of a smoking article. Assuming the selected material does not release harmful substances when combusted, it may be included in the tobacco rod of a smoking article, for example, it may be provided in the tobacco itself or in the cigarette paper. In an embodiment, if the material is included in the tobacco, the material does not comprise and/or does not consist of zinc sulphide. In another embodiment, the material is not comprised in the cigarette paper. Preferably, the material is included in the filtration zone of a smoking article, i.e. in the filter rod. For example, it may be provided in the plugwrap, tipping paper or, preferably, the filter of the filter rod.

If in the filter, it may be provided in the filter material or, preferably, in a thread passing through a plug of filter material. It may be provided as a coating on such a thread. However, most preferably, it is included as an ingredient used during the manufacture of the thread material, for instance as a component added during the manufacture of cellulose acetate or cotton thread. Suitable techniques for such manufacture would be apparent to those skilled in the art. The material can be entrained within the fibres of the thread.

The thread may be made of a material which is substantially filamentous. It is preferred that the thread is made of a non-toxic material, which is suitable for use in a smoking article filter. For example, the thread may comprise material selected from the group consisting of cotton, filter material (e.g. cellulose acetate), alginate, wool, cellulose fibre and viscose fibre. Preferably, the thread comprises cellulose acetate.

The use of cellulose acetate to make a thread for a smoking article filter is advantageous. For example, cellulose acetate filaments are white in colour and do not require bleaching for visual appeal. However, as acetate has little natural colour, it can be dyed if desired. Such dyes are subject to the usual regulatory approval for use in smoking article filters. The thread therefore meets market requirements when viewed *in situ* in a smoking article filter. Moreover, the use of cellulose acetate, dyed or otherwise, ensures that the appearance of the thread is maintained as the smoking article is consumed. The thread therefore remains visually appealing during consumption of the smoking article. The use of cellulose acetate in a filter thread may thus avoid the disadvantages that are associated with cotton filter threads. The UV responsive or other material of the present invention can also be included as an ingredient used during the manufacture of a cellulose acetate thread, preventing or significantly limiting its release from the thread material when the smoking article is consumed.

The thread may be between about 0.2 mm and about 5 mm in diameter, and is preferably between about 0.4 mm and about 3 mm in diameter.

If a material as herein described is provided as a coating on a filter thread, the particles may be adhered, or attached, to the thread by adhesive. For example, the thread (e.g. cotton or cellulose acetate) may be contacted with adhesive, which may be provided in a first container (e.g. a bath of adhesive). The thread may then be contacted with at least one particle of the material, which may be provided in a second container (e.g. a bath of material). Hence, by passing the thread first through the adhesive bath and then the material bath, a coating of the material is formed on the outer surface of the thread.

In some embodiments, instead of using adhesive, the thread (e.g. cotton or cellulose acetate) may be wetted, for example with water, prior to contacting with the material that changes its visible appearance when exposed to non-visible light.

In another embodiment, the particles of the material that changes its visible appearance when exposed to non-visible light may be adhered to the thread by (i) contacting said thread with a solution comprising at least one particle of the material, and (ii) allowing the thread to dry, such that the material particles adhere to the surface of the thread. A slurry comprising a plurality of the particles may be prepared, which slurry may further comprise a suitable binding agent. Preferably, the slurry is then contacted with the thread (e.g. cotton or cellulose acetate), under conditions suitable to allow a plurality of the particles to become adhered to the surface of the thread. The thread comprising particulate material thereon may then be allowed to dry, or heated, for example by an oven, such that the material adheres to the surface of the thread. The thread may then be used to form the filter rod of the first aspect.

The concentration of the material that is adhered to the thread may depend on the diameter or thickness of the thread.

If a material that changes its visible appearance when exposed to non-visible light, as herein described, is entrained within the fibres of the thread, this may be achieved by incorporating the material into the thread as the latter is prepared.

Natural or semi-synthetic fibres may be used. The preferred thread for use with this embodiment of the invention, however, is made of cellulose acetate.

Cellulose acetate thread may be produced using techniques known to the skilled person, such as dry spinning, wet spinning or melt spinning. A suitable dry spinning method is as follows.

Cellulose from wood or cotton is treated with acetic acid such that acetylisation is not complete. The cellulosic material formed in this process is known as secondary cellulose acetate, and it is both soluble and spinnable.

In the production of acetate fibres, the spinning solution consists of secondary acetate blended from a large number of batches to assure a high degree of uniformity. The blended acetate is dissolved in a solution of the solvent acetone and a small proportion of water (up to 5% of the weight of the acetone), and pigments may be added at this stage.

In a preferred embodiment of the invention, a material that changes its visible appearance when exposed to non-visible light and, for instance, that is essentially only visible in non-visible light, as described herein, is added at this stage. The material may be added in solution form, or it may be in solid form and simply dissolved or otherwise carried within the spinning solution.

Other pigments may also be added at this stage. For example, in one embodiment, titanium dioxide is added to produce a dull fibre when a high degree of lustre is not desired. In another embodiment, as acetate has little natural colour, it can be dyed if desired. Acetate fibres can be produced in a range of shades varying from delicate tints to deep, heavy colours. Suitable dyes may be added to the spinning solution. Such pigments and dyes are subject to the usual regulatory approval for use in smoking article filters.

The treated spinning solution, containing 20-30% cellulose acetate, is then filtered and deaerated. After a final filtering, the material is pumped through very fine holes

in the spinneret, then emerges into a spinning tube (an enclosed vessel through which hot air flows at a temperature of about 100 °C). As the jets of spinning solution meet the hot air stream, the acetone is evaporated, leaving solid filaments of cellulose acetate.

Any pigments or materials that were added to the spinning solution, such as a material that changes its visible appearance when exposed to non-visible light (and, for instance, that is essentially only visible in non-visible light), titanium dioxide and/or any dyes, become entrained within the fibres of the thread during this process. They may thus be evenly distributed throughout the finished thread, where they can have permanent effect.

Being thermoplastic, acetate fibre becomes sticky at 190 °C and, at 205 °C, is soft enough to deform under pressure. The newly formed filament of cellulose acetate is thus stretched slightly while still plastic, aligning the long molecules and developing the strength of the filament. The fibres can be manufactured with different diameters and cross-sectional shapes.

Acetate filament yarns produced in this way are ready for immediate use without any of the washing or purification treatment necessary for wet-spun fibres.

Acetate can alternatively be melt-spun, as it is a thermoplastic material, melting at 230 °C.

The cellulose acetate thread so produced can then be incorporated into a smoking article filter using techniques that will be known to the skilled person.

For example, the thread may be encased by filter material to form a filter rod of the first aspect. A plug of filter material may comprise any suitable filter media, which will be known to the skilled technician. A preferred filter material comprises, or consists of, cellulose acetate. The diameter of the plug of filter material may be between about 5 mm and about 15 mm, preferably between about 6 mm and about 12 mm, more preferably between about 7 mm and about 11 mm, and most

preferably between about 8 mm and about 10 mm. The diameter of the plug may be between about 5 mm and about 10 mm.

Preferably, the ratio of the diameter of the plug of filter material to the diameter of the thread is between about 2:1 and about 25:1, and is more preferably between about 4:1 and about 10:1.

The thread preferably extends substantially longitudinally between mutually opposing end faces of the plug of filter material. Preferably, the thread extends in a direction which is substantially parallel to a side face of the plug of filter material, which side face is preferably substantially perpendicular to one or both end faces. Preferably, the thread extends through an inner portion of, and is surrounded by, the filter material. Preferably, the thread extends through substantially the centre of the plug of filter material. In one embodiment, the filter rod is substantially cylindrical in shape, with the thread extending substantially longitudinally through the plug. The thread may extend substantially along the central cylindrical axis of the filter rod.

Preferably, the thread extends to the mouth end of the filter rod; that is to say, the end of the thread is flush with the mouth end of the filter rod. When comprising or coated with a material that changes its visible appearance when exposed to non-visible light and, for instance, that is essentially only visible in non-visible light, as herein described, the thread can thus be quickly and easily detected *in situ* in a smoking article filter by viewing the mouth end of the filter under the appropriate light conditions. For example, where the material is a UV responsive material such as a UV fluorescent material, the mouth end of the filter may be viewed in UV light and the material will fluoresce or 'glow' in that light. This practice can be employed to identify any counterfeit articles not containing the UV responsive material.

The filter rod may comprise a flavourant. In embodiments where a flavourant is used, the flavourant may be incorporated in the plug of filter material. However, preferably, the flavourant is incorporated in a thread passing through the filter

material. Such flavourants are subject to the usual regulatory approval for use in smoking article filters.

Advantageously, the thread is disposed in close proximity with the path of the gaseous flow as it moves through the filter element, and is therefore able to affect various characteristics of the gaseous flow before the flow reaches the smoker's mouth. When the thread is impregnated with a flavourant, the flavourant will diffuse from the thread into the flow of smoke, and is thus sucked into the mouth of the user. The amount of any flavourant provided to the smoke by the thread is dependent on a number of factors including the thickness of the thread, the fine structure and the moisture content, and the concentration of flavourant in the chosen raw material. Furthermore, when the thread is disposed substantially longitudinally within the plug of filter material, it does not adversely affect the direction or rate of gaseous flow, and so the smoker does not detect a significant difference in the resistance to draw therethrough.

In one embodiment, the flavourant is incorporated in the same thread that comprises the material that changes its visible appearance when exposed to non-visible light, such as a material that is essentially only visible in non-visible light.

Two or more threads can be incorporated within the filter, for example between 2 and 20 threads, preferably between 3 and 15 threads, more preferably between 4 and 10 threads. One or more, or indeed all, of the threads may comprise a material that changes its visible appearance when exposed to non-visible light, such as a material that is essentially only visible in non-visible light, as described herein.

In the case of a filter containing multiple threads, one or more of the threads within the filter may comprise a flavourant; the different threads may comprise the same or different flavourants. In some embodiments, one or more threads may be treated with a colourant prior to their incorporation into the filter, for example, for the purpose of providing an interesting and attractive appearance to the mouth end of the filter, to provide flavour identification (such as different colours for different flavours), or to mask any discolouration of the thread or filter material.

The flavourant, colourant and/or material that changes its visible appearance when exposed to non-visible light and, for instance, that is essentially only visible in non-visible light, may be provided on the same thread or on separate threads. Any combination of threads comprising a flavourant, colourant and/or material that changes its visible appearance when exposed to non-visible light is envisaged and indeed encompassed by the present invention. For example, the thread comprising the material that changes its visible appearance when exposed to non-visible light may further comprise a flavourant and/or a colourant. Alternatively, a flavourant and/or a colourant may be provided on a separate thread or threads. Flavourants, colourants and such like are subject to the usual regulatory approval for use in smoking article filters.

The filter may be a composite filter comprising a plurality of abutted filter sections, for example at least two, preferably at least three filter sections, provided that at least one of the sections comprises a material that changes its visible appearance when exposed to non-visible light, such as a material that is essentially only visible in non-visible light as herein described. Preferably the composite filter comprises a single section incorporating a thread as herein described, this section being preferably located at the mouth end of the filter. The filter sections of the composite filter not containing a thread may comprise one or a combination of cellulose acetate, polypropylene, paper or any other suitable material, and may alternatively or additionally comprise adsorbent material, for example, activated charcoal, a resin material such as amberlite or duolite, and/or catalytic material. The adsorbent filter section is provided to adsorb, and hence reduce, certain components of the smoke during smoking. The adsorbent filter section may comprise a plug of filter material in which the adsorbent material is dispersed. The filter material may be cellulose acetate. A preferred adsorbent material is activated carbon. The activated carbon may be in the form of granular activated carbon, which is preferably distributed substantially throughout the volume of the plug of filter material.

Preferably, the filter comprises a filter section comprising a thread that comprises a material that changes its visible appearance when exposed to non-visible light, such as a material that is essentially only visible in non-visible light as herein described, a filter section comprising an adsorbent and a filter section which does not include a thread or adsorbent. Preferably, multiple filter sections are arranged longitudinally of one another with the end face of one filter section abutting the end face of an adjacent filter section. It is preferred that the filter sections have substantially similar diameters. It should be appreciated that the various filter sections may be in any order in the filter. However, preferably, the filter section comprising a material that changes its visible appearance when exposed to non-visible light as herein described should be in the mouth end of the filter. This enables the material to be easily detected when viewed *in situ* in a smoking article filter under the appropriate light conditions.

The filter rod may be included in a smoking article in a manner well known in the art. The present invention thus includes a smoking article comprising a filter rod of the first aspect.

The present invention also includes a method for making a filter rod for a smoking article, the method comprising introducing into the filter rod a material that changes its visible appearance when exposed to non-visible light, such as a material that is essentially only visible in non-visible light as herein described.

The material may be applied to the filter material, plugwrap or tipping paper, using techniques that will be known to the skilled person.

However, preferably, the method comprises introducing a thread comprising the material that changes its visible appearance when exposed to non-visible light into a plug of filter material.

The thread and material may be as already described.

The method preferably comprises a step of introducing the thread into substantially the centre of the filter material. The method may comprise using guide means to guide the tobacco thread as a plug of filter material is formed therearound. The guide means may comprise a guide tube through which the thread is entrained. As the thread exits the guide means, it is preferably surrounded by filter material.

The thread need not be located at the diametric centre of the filter, and so may be off-centre, and may even be situated substantially towards the circumferential edge of the filter. Two or more threads can be incorporated within the filter, for example between 2 and 20 threads, preferably between 3 and 15 threads, more preferably between 4 and 10 threads.

A plurality of guide means may be used where a plurality of threads are to be introduced into the filter material, each guide means being arranged to introduce a respective one of the plurality of threads into the filter material. The threads may be introduced such that they are arranged substantially symmetrically about the central axis of the resulting filter rod.

The filter may contain one or more threads that do not comprise a material that changes its visible appearance when exposed to non-visible light as herein described. In some embodiments, one or more threads may be treated with a colourant prior to their incorporation into the filter.

The method may further comprise the step of introducing a flavourant to the filter, preferably by impregnating at least one thread with the flavourant. Different threads may comprise the same or different flavourants. The colourants may be used to indicate the different flavourants in the threads. Flavourants, colourants and such like are subject to the usual regulatory approval for use in smoking article filters.

When colourants and/or flavourants are added to a thread, these agents are preferably applied to the or each thread immediately before the thread is incorporated in the filter material, for example, by directing the thread through a

solution or fine mist of the agent and then into the filter material as it is condensed. The solvent for the agent is chosen to be compatible with the filtering material and any other component of the filter product.

The filter rod resulting from the method of the third aspect may be as herein described for the first aspect.

According to a fourth aspect of the invention, there is provided the use of a material that changes its visible appearance when exposed to non-visible light and, in particular, that is essentially only visible in non-visible light, in a filter rod for a smoking article as a mark of identification. The material may be as herein described. Thus, where the material is a UV responsive material, the mark of identification may be viewed by holding the filter rod, or a smoking article comprising the filter rod, under a source of UV light, for example, a UV lamp; the material may fluoresce or 'glow' in the UV light. Where the material is an X-ray responsive material, the mark of identification may be viewed by subjecting the filter rod, or a smoking article comprising the filter rod, to X-rays, for example, in an X-ray machine, and viewing the contrast provided by the material in the resultant X-ray image.

Preferably, the material is provided in a thread that extends to the mouth end of a filter rod for a smoking article; that is to say, the end of the thread is flush with the mouth end of the filter rod. The thread can thus be quickly and easily detected *in situ* in the filter by viewing the mouth end of the filter under the appropriate light conditions (e.g. in UV light, where the material is a UV responsive material). This practice can be employed to identify any counterfeit articles not containing the UV (or other non-visible light) responsive material.

The use of a material that changes its visible appearance when exposed to non-visible light, such as a material that is essentially only visible in non-visible light, as a mark of identification in a smoking article is advantageous because it enables illicit goods, which do not contain the material, to be easily, quickly and conveniently identified. The invention therefore provides a new and improved authentication

device for a smoking article, that enables counterfeit goods to be identified and confiscated by the enforcement agencies. This will be invaluable in the fight against counterfeit trade.

All of the features described herein (including any accompanying claims, abstract and drawings), and/or all of the steps of any method so disclosed, may be combined with any of the above aspects in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying Figures 1 and 2. Even though the Figures show a cigarette, it should be appreciated that the invention extends to other forms of smoking article, such as cigars and cigarillos etc.

Figure 1 shows a smoking article, in the form of a cigarette, comprising a filter **1** and a tobacco rod **2**. Both the filter **1** and tobacco rod **2** are substantially cylindrical, being generally circular in cross-section, and have diameters which are of a similar size. A layer of tipping paper **3** is wrapped around the cigarette and holds the tobacco rod **2** and the filter **1** together in a longitudinally abutting relationship.

The filter is primarily composed from fibrous cellulose acetate filter material **4** encompassed by a layer of plugwrap (not shown) in a manner well known per se. Located within the filter material is a thin thread **5** which is manufactured from cellulose acetate and comprises a UV responsive material. The thread **5** is situated substantially in the diametric centre of the filter and extends from the mouth end **6** of the filter to the tobacco rod **2** in a generally linear configuration.

In use, negative pressure created by the user sucking on the mouth end **6** of the filter has the effect of drawing smoke along the tobacco rod **2** and through the filter **1**. As smoke passes through the filter **1**, particulate components of the smoke are retained by the cellulose acetate fibres in the filter material **4**, at least to some extent. When a flavourant is also included in the thread **5**, the flavourant will

diffuse from the thread **5** into the flow of smoke, concurrently with the removal of particulate components, and are thus sucked into the mouth of the user.

One method of introducing the thread **5** into the filter **1** is as follows. The filter **1** is manufactured using a process in which a supply of filter material is continuously advanced, the advancing material being continuously condensed to rod form, and the resulting rod being continuously cleaved into individual lengths. Incorporation of the thread **5** occurs as the continuous thread is directed into the centre of the filter material as or before its condensation to rod form. As a result the thread becomes incorporated in the body of the filter rod and extends continuously longitudinally thereof.

The filter **1** may comprise a ventilated filter, for example having a porous or perforated wrapper through which, in use, external air is drawn to dilute the smoke drawn through the filter. Diluting air tends to travel along the peripheral region of the filter, so that the thread extending along the filter core, where the smoke concentration is highest, increases the possibility of diffusion of any flavourant from the thread most effectively and economically.

Referring to Figure 2, there is shown a second embodiment of the filter rod of the present invention. The filter **1** comprises a plurality of different discrete filter sections **8**, **9**, **10**, each of which may have a different material composition. Each filter section is generally cylindrical in shape having substantially equivalent diameters. Each filter section is wrapped in a layer of plugwrap (not shown), which may be formed of conventional paper materials. The filter section **10** that is furthest from the tobacco rod **2** (and which will be closest to the smoker's mouth when in use) contains a continuous plug of filter material **4** having the thread **5**, with a UV responsive material comprised therein, extending substantially longitudinally therethrough. This filter section is similar to that shown in Figure 1, except that it does not extend along the entire length of the filter **1**. The filter section **9** that is disposed adjacent section **10** comprises a generally cylindrical rod of filter material **4**, such as cellulose acetate. The filter material **4** provides a filter through which smoke may pass as a smoker inhales on the cigarette. The third filter

section 8 that is disposed between the filter section **9** and the tobacco rod **2** comprises a plug of filter material **4**, in which an adsorbent, such as activated carbon **11**, has been dispersed. The activated carbon **11** may be in the form of granular activated carbon, which is distributed evenly throughout the volume of the plug of cellulose acetate **4** in a "Dalmatian" style, as is known in the art. Alternatively, the activated carbon **11** may be sprinkled onto a sticky exterior surface of the plug of cellulose acetate **4**, adhered to the inner surface of the plugwrap surrounding the cellulose acetate (not shown) or adhered to a cotton thread surrounded by the plug of cellulose acetate 4 (not shown). The activated carbon **11** could also be held in a cavity surrounded by the plug of cellulose acetate **4**. The activated carbon **11** is provided to improve the characteristics of the smoke that is inhaled, by removing toxic chemicals.

It should be appreciated that the different filter sections **8**, **9**, **10**, as shown in Figure 2, could be arranged in an alternative order in the filter rod. Preferably, however, filter section **10,** containing the thread **5** comprising a UV responsive material, remains furthest from the tobacco rod **2,** such that the thread is visible when the mouth end of the filter is viewed in UV light.

It should also be appreciated that, although the three filter sections **8**, **9**, **10**, are shown in Figure 2 as being substantially equal in length, they could have different lengths.

In addition, the filter **1** may comprise only two filter sections. For example, the filter **1** may comprise the filter section **10** (containing the thread) at its mouth end and the filter section **9** (containing only filter material) closest to the tobacco rod **2**. Alternatively, the filter **1** may comprise the filter section **10** (containing the thread) at its mouth end and the filter section 8 (containing activated carbon **11**) closest to the tobacco rod **2**.

Also, the filter **1** may comprise more than three filter sections **8**, **9**, **10**. For example, the filter **1** may comprise first and second filter sections **9** composed of cellulose acetate, a third filter section 8 comprising cellulose acetate and activated carbon **11**,

and a fourth filter section **10** comprising the longitudinal thread, as described above. It will be appreciated that the various filter sections **8**, **9**, **10** may be arranged in the filter **1** in a variety of alternative orders. However, in each embodiment, at least one filter section **10** containing the thread **5**, with a UV responsive material comprised therein, is included in the filter **1**, preferably located at the filter's mouth end.

The invention also includes further modifications and variations falling within the scope of the claims.

Claims

1. A filter rod for a smoking article, wherein the filter rod comprises a material that changes its visible appearance when exposed to non-visible light.

2. A filter rod according to claim 1, wherein the material is essentially only visible in non-visible light.

3. A filter rod as claimed in claim 2, wherein the material is essentially only visible in light having a wavelength that does not fall in the range of 700 nm > $\lambda \geq$ 400 nm.

4. A filter rod as claimed in any one of claims 1-3, wherein the material is a UV responsive material.

5. A filter rod as claimed in claim 4, wherein the material is a UV reflective material or a UV fluorescent material.

6. A filter rod as claimed in any one of claims 1-5, wherein the filter rod further comprises a thread extending through at least part of a filter plug in the filter rod, said thread comprising the material that changes its visible appearance when exposed to non-visible light.

7. A filter rod as claimed in claim 6, wherein the material that changes its visible appearance when exposed to non-visible light is entrained within the thread.

8. A filter rod as claimed in claim 6 or claim 7, wherein the filter rod is substantially cylindrical in shape and the thread extends substantially longitudinally through the filter plug.

9. A filter rod as claimed in claim 8, wherein the thread extends substantially along the central cylindrical axis of the filter rod.

10. A filter rod as claimed in claim 8 or claim 9, wherein the thread extends through the entire length of the filter rod.

11. A filter rod as claimed in claim 8 or claim 9, wherein the thread extends partially through the length of the filter rod.

12. A filter rod as claimed in claim 11, wherein the filter rod comprises a plurality of substantially cylindrical filter plug sections, the first filter plug section being said filter plug having said thread extending substantially longitudinally therethrough.

13. A filter rod as claimed in claim 12, wherein the filter rod comprises a second filter plug section aligned substantially coaxially with the first filter plug section and comprising cellulose acetate impregnated with activated charcoal.

14. A filter rod as claimed in claim 13, wherein the filter rod comprises a third filter plug section aligned substantially coaxially with the first and second filter plug sections and comprising cellulose acetate.

15. A filter rod as claimed in any one of claims 6-14, comprising a plurality of said threads.

16. A filter rod as claimed in any one of claims 6-15, wherein the thread is made from cellulose acetate.

17. A filter rod as claimed in any one of claims 6-16, wherein the thread further comprises a flavourant.

18. A smoking article comprising a filter rod as claimed in any one of claims 1-17.

19. A method for making a filter rod for a smoking article, the method comprising introducing into the filter rod a material that changes its visible appearance when exposed to non-visible light.

20. A method as claimed in claim 19, wherein the method comprises introducing a thread comprising the material that changes its visible appearance when exposed to non-visible light into a plug of filter material.

21. A method as claimed in claim 19 or claim 20, wherein the material that changes its visible appearance when exposed to non-visible light is as defined in any one of claims 2-5 or 7.

22. A method as claimed in claim 20 or claim 21, wherein the filter rod is substantially cylindrical and the method comprises introducing the thread into substantially the central cylindrical axis of the filter rod.

23. A method as claimed in any one of claims 20-22, wherein the method comprises introducing a plurality of said threads into the filter material.

24. A method as claimed in claim 23, wherein the method comprises introducing the threads so that they are arranged substantially symmetrically about the central axis of the resulting filter rod.

25. A method as claimed in any one of claims 20-24, wherein the thread is made from cellulose acetate.

26. A method as claimed in any one of claims 20-25, further comprising impregnating the thread with a flavourant.

27. Use of a material that changes its visible appearance when exposed to non-visible light in a filter rod for a smoking article as a mark of identification.

28. A use as claimed in claim 27, wherein the material that changes its visible appearance when exposed to non-visible light is as defined in any one of claims 2-5 or 7.

Application No:	GB1105141.4	**Examiner:**	Dr Steven Chadwell
Claims searched:	1-28	**Date of search:**	10 July 2012

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-5, 18, 19, 21, 27 & 28	GB 677156 A (SCHEICHNER) see page 2 lines 10-13 and 92-99, and claim 4 in particular
A	-	CN 201750709 U (CHINA TOBACCO) also see EPODOC abstract and WPI Abstract Accession No. 2011-E32350 [30]
A	-	CN 200944825 Y (QI) also see EPODOC abstract and WPI Abstract Accession No. 2008-C51136 [19]
A	-	CN 201076003 Y (ZHANG) also see EPODOC abstract and WPI Abstract Accession No. 2008-H83380 [50]
A	-	CN 1132051 A (ZHAO) also see EPODOC abstract and WPI Abstract Accession No. 1998-009325 [02]
A	-	WO 2010/052100 A1 (BRITISH AMERICAN TOBACCO)

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A24D

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC, TXTE, TXTT, TXTCNT, TXTKRT; Internet

International Classification:

Subclass	Subgroup	Valid From
A24D	0003/06	01/01/2006
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