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(54) **TOBACCO SMOKE FILTER**
FILTER FÜR TABAKRAUCH
FILTRE DE FUMÉE DE TABAC

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Description

[0001] The present invention relates to filters and filter elements for smoking articles such as cigarettes, in particular slim cigarettes.

[0002] An example of slim cigarette is disclosed in WO 2006/082161.

[0003] Conventional cigarettes have a circumference around 24.5 mm - 'slim' cigarettes (circumference around 21 - 23.2 mm) and 'superslim' cigarettes (circumference around 16 - 18 mm) are also known. It is also possible to manufacture cigarettes with even narrower circumferences, e.g. in the range 14 - 16 mm, although these are not generally commercially available. In the context of this document, the term 'slim' should be construed as including all cigarettes and/or cigarette filters with a circumference between around 14.0 and 23.2 mm.

[0004] Selective filtration occurs when the yield of selected chemicals in cigarette smoke is proportionally reduced to a greater extent than the majority of compounds in smoke (e.g. tar). Phenolic compounds - for example phenol, cresols, catechol and resorcinol - are known constituents of cigarette smoke. They are toxic compounds - in particular, phenol and catechol are included on the so-called "Hoffmann" list of the most hazardous compounds found in cigarette smoke. It is considered desirable to potentially selectively reduce the quantities of these compounds delivered to the smoker.

[0005] The usual filtering material used in cigarette filters is a continuous tow of filamentary cellulose acetate plasticised with triacetin, which is gathered together in rod form to form the filter or filter element. In such a continuous tow (and in filters and filter elements formed therefrom) the filaments of cellulose acetate tow are predominantly aligned in the longitudinal direction. It is well known that cellulose acetate exhibits a selective filtering action towards phenolic compounds. A filter for a "slim" cigarette will naturally include a reduced volume of cellulose acetate filtering material compared to a standard filter; any selective filtering effect may be reduced as there is less material available to act upon a similar quantity of smoke. It is desirable, therefore, to provide a slim filter which potentially selectively reduces the quantities of phenolic compounds delivered to the smoker of a slim cigarette.

[0006] The specification of a filter tow is described in terms of the denier per filament (dpf); total denier; and the fibre cross-sectional shape. The filament denier is defined as the weight in grams of 9000 metres of a single filament; the total denier is then simply the dpf multiplied by the number of filaments in the tow. Thus, for example, a 5Y30,000 tow describes a material with a filament with a dpf of 5 grams per 9000 metres in the shape of a Y, comprising 6,000 filaments giving a total denier of 30,000 grams per 9000 metre length. In order to manufacture a standard cellulose acetate ("monoacetate") cigarette filter having a low circumference (i.e. a slim monoacetate filter), it is necessary to use a cellulose acetate tow with a low total denier because there are limitations on the amount of material than can be packed into the slim product. It is well known in the industry that low total denier tows are more expensive (per unit weight) than higher total denier tows and there is also limited commercial availability of low total denier tows. It is desirable, therefore, to provide a slim filter, which can be made from a wider range of total denier of cellulose acetate tows than conventional slim or superslim monoacetate filters.

[0007] According to the present invention there is provided a tobacco smoke filter or filter element comprising a cylindrical plug of a substantially homogeneous filtering material of circumference between 14.0 and 23.2 mm (for example, between 16 and 23.2 mm), wherein the substantially homogeneous filtering material comprises a plurality of randomly oriented staple fibres.

[0008] Herein, the term "substantially homogeneous filtering material" means a filtering material which has substantially uniform physical characteristics throughout any cross-section therethrough.

[0009] Herein, the term "staple fibres" means individual, discrete, fibres of specific length. The staple fibres may be randomly oriented with reference to one another. The substantially homogeneous filtering material may comprise a plurality of randomly oriented staple fibres wherein a portion of the randomly oriented staple fibres generally extend transversely to the longitudinal axis of the cylindrical plug. The substantially homogeneous filtering material may comprise a plurality of randomly oriented staple fibres at least 10% (for example, 20%, 30%, 40%, 50%, 60%, 70%, 80% or 90%) of which by weight extend substantially transversely to the longitudinal axis of the cylindrical plug.

[0010] The term randomly oriented staple fibres means that the staple fibres are randomly oriented in three dimensions (in the filter or filter element). The term randomly oriented staple fibres, herein, is not intended to (and does not) mean a continuous cellulose acetate tow, the individual strands of which are predominantly aligned in the longitudinal direction (although it will be appreciated that staple fibres may be formed from such tows, as discussed below). The term randomly oriented staple fibres, herein, is not intended to (and does not) mean a web or sheet of filtering material which is formed (from e.g. pulp and/or fibres) and then shaped as a whole or substantially whole web or sheet into rod form (by e.g. wrapping). The term randomly oriented staple fibres does not mean a two dimensional paper-like artefact which is taken up in a roll form. The term randomly oriented staple fibres, herein, is not intended to (and does not) mean a web or sheet of filtering material which is formed (from e.g. pulp and/or fibres) and then shredded and then shaped into rod form. Sheets or webs may have random orientation in two dimensions but (even when shredded) undergo processes (such as embossing) so they retain some integrity when drawn through a filter making machine. Thus, the fibres in a filter or filter element made from a sheet or web (even a shredded sheet or web) will be predominantly aligned along the

longitudinal axis of the filter or filter element, and are therefore not randomly oriented (in three dimensions) staple fibres.

[0011] The plurality of randomly oriented staple fibres may form a porous matrix providing a labyrinth of passages - these may act as passages for smoke when utilised as a cigarette filter. The applicants have found that the performance of the filter or filter element of the invention may be comparable to existing products (e.g. a "monoacetate" product formed of a continuous tow of longitudinally oriented filaments of cellulose acetate tow plasticised with triacetin gathered together in rod form), but the applicants have found that 20-30% less filtering material (e.g. cellulose acetate) is required when it is used in the form of randomly oriented staple fibres. In addition to the requirement for less filtering material per filter, there is the further advantage that it is possible to use much higher total denier cellulose acetate tows than for a conventional superslim product. Thus, in addition to the cost benefits of the weight saving arising due to the applicant's invention (because less filtering material is required), the unit cost of the tow used itself may also be cheaper, because there is no longer the need to use (expensive and less readily available) low total denier tows.

[0012] The applicants have unexpectedly found that tobacco smoke filters or filter elements of the invention may provide enhanced removal of phenols from tobacco smoke (in a slim cigarette), compared to e.g. a standard monoacetate filter or filter element (which does not comprise randomly oriented staple fibres). The unexpected reduction in phenolic compounds by filters and filter elements of the invention is even more significant when the lower weight of filtering material (cellulose acetate) is taken into account. The applicants have also unexpectedly found that tobacco smoke filter or filter elements of the invention may be more readily and swiftly degraded under e.g. environmental conditions, compared to e.g. a standard monoacetate filter or filter element.

[0013] The staple fibres may be made of filamentary material. The staple fibres may be crimped, as is well known in the art. The staple fibres may be, for example, cellulose acetate or polypropylene fibres. The staple fibres may be made of (or formed from) a fibre tow, for example cellulose acetate tow, polypropylene tow. The staple fibres may be, for example, natural and/or synthetic fibres; fibres formed from natural plant material(s) etc. The staple fibres may be cellulose pulp fibres (e.g. which have been fiberized via a hammermill). The staple fibres may be cut herbs (e.g. cut tobacco leaf), or obtained from reconstituted tobacco sheet. The staple fibres may impart flavouring and/or filtration properties to the final product. The staple fibres may be of substantially the same length (of substantially uniform length). The staple fibres may be of a variety of different lengths. The staple fibres may be for example of length between 4 mm and 20 mm, e.g. between 5 mm and 19 mm, e.g. between 6 mm and 18 mm, e.g. between 7 mm and 16 mm. The staple fibres may be made of, or formed from, a fibre tow, for example cellulose acetate tow, of total denier of from 14,000g to 55,000g per 9,000m length, e.g. from 20,000g to 50,000g per 9,000m length, e.g. from 23,000g to 45,000g per 9,000m length, e.g. from 25,000g to 40,000g per 9,000m length.

[0014] The substantially homogeneous filtering material may optionally include other material, for example a liquid additive (such as a flavourant, e.g. menthol solution). The substantially homogeneous filtering material comprising a plurality of randomly oriented staple fibres may be formed from a plurality of staple fibres, and may optionally include other material, for example a plasticiser, a binder material or other additive. The staple fibres may be bonded to each other (e.g. due to action of a plasticiser) at a multiplicity of contact points.

[0015] The substantially homogeneous filtering material may optionally include a binder material. The substantially homogeneous filtering material may optionally include a water soluble binder material. Examples of water soluble materials include water soluble polymer materials such as polyvinyl alcohol, polyvinyl pyrrolidone, polyvinyl ether, starches, polyethylene glycols and polypropylene glycols; blends of water soluble binders with plasticisers such as triacetin; and hot melt water soluble binders in particulate form. The inclusion of a water soluble binder material may further enhance the ability of the filter or filter element to be readily and swiftly degraded e.g. under environmental conditions.

[0016] The filter or filter element may include one or more particulate additives - e.g. within the body of the filter or filter element. The (or each) particulate additive may be a powder (e.g. particles of 50 to 150 μ m diameter) or granular (e.g. particles of 0.15 to 1.0 mm diameter). Examples of suitable particulate additives include flavourants or sorbents - e.g. activated carbon, zeolite, ion exchange resin (e.g. a weakly basic anion exchange resin), sepiolite, silica gel, alumina, molecular sieves, carbonaceous polymer resins and diatomaceous earths.

[0017] The filter or filter element may include more than one type of staple fibre. For example, staple fibres which are fibres (of e.g. cellulose pulp) which have been fiberized via a hammermill may be included in the filter in addition to (e.g. mixed with) staple fibres formed from a filamentary tow.

[0018] The staple fibres (e.g. of fibre tow, e.g. cellulose acetate tow) may be plasticised. In other words, the substantially homogeneous filtering material may optionally include a plasticiser. The formation of plasticised tow is well known in the art. The plasticiser (which plasticises the staple fibres) may be, for example, triacetin, triethyleneglycol diacetate (TEGDA) or polyethylene glycol (PEG). The staple fibres may be fibres of plasticised cellulose acetate tow. The staple fibres may be cellulose acetate tow which has been plasticised with e.g. triacetin.

[0019] The circumference of the cylindrical plug may be for example between 14.0 mm and 23.2 mm, for example between 16 and 23.2 mm, for example between 16.0 mm and 20mm, for example between 16.2mm and 20mm, for example between 16.2 mm and 17 mm.

[0020] The plurality of randomly oriented staple fibres may form a porous matrix providing a labyrinth of passages in

the filtering material. The labyrinth passages may function as passages for smoke when utilised as a cigarette filter.

[0021] The tobacco smoke filter or filter element may have substantially uniform physical characteristics throughout any cross-section thereof, rather than the more uneven structure that results from formation from a sheet of filter material.

[0022] In filters and filter elements according to aspects of the invention, the tobacco smoke filtering material may be over wrapped with a wrapper or plugwrap, for example a wrapper of paper, for example a wrapper of an air-permeable paper. Particulate additives such as those discussed above may be applied to the wrapper or plugwrap surrounding the filter material, for example as described in GB 2261152.

[0023] According to the invention in a further aspect there is provided a multiple rod comprising a plurality of filters or filter elements as described above and/or herein integrally joined end-to-end in a mirror image relationship.

[0024] A filter element according to the invention may be used as a segment of a multi-segment slim filter, e.g. a dual, triple, other multiple filter. Such filters are well known in the art. If the filter element is used as or in a segment of a multi-segment filter, it may be used at (or in) the mouth or buccal end segment of the filter, or as (or in) any other segment of the filter. A filter element according to the invention may be used on its own e.g. as a single segment slim filter (e.g. in the same way as a monoacetate filter). Such filters are well known in the art.

[0025] In a filter cigarette according to the invention, a filter of the invention (or a filter which includes a filter element of the invention) is joined to a wrapped tobacco rod with one end of the filter towards the tobacco. The filter may, for example, be joined to the wrapped tobacco rod by ring tipping [which engages around just the adjacent ends of a (wrapped) filter and rod to leave much of the filter wrap exposed] or by a full tipping overwrap (which engages around the full filter length and the adjacent end of the tobacco rod). Any filter or filter cigarette according to the invention may be unventilated, or may be ventilated by methods well known in the art, e.g. by use of a pre-perforated or air-permeable plugwrap, and/or laser perforation of plugwrap and tipping overwrap.

[0026] The present invention will now be illustrated with reference to the following Examples and the attached drawings in which FIGURE 1 is a plan view, not to scale, of an individual filter in an embodiment of the invention; and FIGURE 2 shows a cross-section of the filter of Figure 1.

[0027] The filter 1 shown in Fig.1 includes a porous elongated cylindrical plug 2 of circumference 16.9 mm and length 27 mm, which comprises a plurality of randomly oriented individual or staple filamentary fibres 3 formed from a 5Y30,000 cellulose acetate tow plasticised with triacetin. As shown in Figs. 1 and 2 the staple fibres 3 generally extend transversely to the longitudinal axis of the element and tie back slightly to form a multiplicity of contact points at which the staple fibres 3 are bonded to each other. The bound fibres provide a substantially homogeneous filtering material which forms the plug 2. The substantially homogeneous filtering material so-formed may be described as a porous matrix, which provides a labyrinth of smoke passages when used as a cigarette filter. The filter element 1 has substantially uniform physical characteristics throughout the cross-section.

[0028] The filter may be manufactured by known methods, for example the method disclosed in US 3, 552, 400. Thus, a raw tow of the cellulose acetate is passed through a conventional banding device so as to separate the individual filaments thereof, and a further conventional banding device, which may be utilised to spread the tow into a relatively thin filamentary layer. The filamentary layer is then passed through a conventional plasticising device wherein a suitable plasticiser (triacetin in the present example) is sprayed by suitable jets onto one or both sides of the filamentary layer to form a plasticised tow. A conventional feeding means such as a pair of rollers is utilised to deliver the plasticised tow to a processing apparatus for making staple fibres and forming these into a continuous rod. A suitable apparatus is described in full detail in US 3,552,400 and shown in Fig.1 of that document. The plasticised tow is fed through a funnel to a chopper which severs the continuous tow into a multiplicity of discrete staple fibres, the length of which depends upon the relationship between the speed of the chopper and the rate of the feed of the continuous tow into the chopper. The staple fibres produced by the chopper are sucked from the chopper by means of a turbulent air stream which disperses the staple fibres (and provides or increases their random orientation) and directs these through a porous frusto-conical screen, the smaller or outlet end of which feeds onto a moving porous belt. Particulate or other additives (not shown) may, if desired, be fed into the turbulent air stream and dispersed throughout the filter material at this stage. The porous enclosing means is tapered and slows the speed of the staple fibres passing therethrough, and also tends to dispose the staple fibres so the length of a portion of fibres is disposed substantially transversely to the longitudinal axis of the product filter rod. The staple fibres are fed onto the porous belt, which moves the fibres longitudinally into a steam treating chamber. A bore at the entrance to the steam-treating chamber forms the longitudinal edges of the porous belt about the staple fibres as the belt and fibres thereon are drawn longitudinally through the bore. The drawing of the belt around the fibres thus completes the formation of the staple fibres into a rod surrounded by the porous belt. Steam is applied to the porous surface of the belt and passes continuously and directly therethrough to treat the staple fibres held therein. The bonding constituents of the staple fibres (e.g. the triacetin) are thus activated by the steam while the fibres are carried in cylindrical rod shaped form enclosed by the belt. It is noted that this processing is well known in the art and is described in the US patent mentioned above. The belt and staple fibres entrained therein are then drawn through a cooling station as is also well known in the art and thus the drying and cooling of the element (and setting of the bonding constituents) takes place in the cooling station. The cylindrical rod so-formed may be wrapped in a plugwrap

paper (not shown) and sealed with a lap adhesive by means that are well-known in the prior art. The resulting dried and cooled continuous cylindrical rod formed of randomly oriented staple fibres is peeled from the belt as it leaves the cooling station, [the belt being substantially flattened and continuously orbited back to a position in the region of the screen to gather further additional staple fibres from the screen and draw these into the steam chamber]. The initial continuous cylindrical rod formed of randomly oriented staple fibres as it issues continuously from the machine outlet is cut into finite lengths for subsequent use. It may be severed by cutting means for example to form single filters (such as filter 1 of Figure 1) each of which is then attached to an individual wrapped tobacco rod to form a filter cigarette, or to form individual filter elements. More usually, however, the continuously issuing rod is first cut into double or higher multiple (usually quadruple or sextuple) length rods of filters 1 (or filter elements) for subsequent use. The formation of multiple length filters (and their subsequent incorporation into filter cigarettes) is well known in the art.

Example 2 Phenol Reduction

[0029] The following Table 1 compares Sample A, a filter made according to the method of US 3, 552, 400, and which includes a filtering material formed from a plurality of randomly oriented staple fibres of plasticised cellulose acetate, with a prior art monoacetate filter of the same dimensions. The hardness values (defined as the compressed diameter of the filter rod as a percentage of the initial rod diameter, the compression of the rod being caused by a known weight applied through a circular foot for a specific period of time) and pressure drop (PD) (expressed in mm Water Gauge) were measured for the samples. The yields of phenolic compounds were measured for all samples smoked under ISO conditions; cresols are the combined yields of o-, m- and p-cresol, whilst Di Hydroxy Phenols are the combined yields of Hydroquinone, Resorcinol and Catechol. The tar yields from the cigarettes were also measured in order that the changes in the ratios of phenols to tar could be assessed. The values for Sample A are expressed as a % value of that for the prior art monoacetate filter (i.e. the value for the monoacetate filter is taken as 100, and that for Sample A expressed as a percentage of that value).

Table 1

Parameter	Sample A	Monoacetate
Tow Weight	77.5	100
Rod Hardness	99.9	100
Pressure Drop	100.6	100
Tar yield*	103.1	100
Nicotine yield*	95	100
CO yield*	103.8	100
Phenol yield*	78.1	100
Total Cresols yield*	78.5	100
Di Hydroxy Phenols yield*	95.9	100
Phenol+Cresols**	75.7	100
Di Hydroxy Phenols** (μg per mg of tar)	92.9	100
Phenol Reduction per unit weight tow	141	100
Total Cresols Reduction per unit weight tow	145	100
* based on results expressed as "absolute" figures (i.e. mass/cigarette)		
** based on results expressed as μg per mg of tar		

[0030] As indicated above, it is desirable to reduce the levels of phenolic compounds in cigarette smoke. It is known that cellulose acetate exhibits a selective filtration effect towards phenols, so it would be expected that filters according to the invention which include randomly oriented staple fibres of cellulose acetate would be less effective in removing phenols than comparable monoacetate filters of similar pressure drop and hardness, because the former contain e.g. 20 to 30% less cellulose acetate. In fact, the results show that, surprisingly, Sample A gave reduced yields of phenolic compounds expressed on both an absolute basis and per mg of tar than an equivalent monoacetate product. The reductions in phenolic compounds in Sample A are even more significant when the lower weight of cellulose acetate in Sample A (which includes the filtering material formed from a plurality of randomly oriented staple fibres of plasticised

cellulose acetate) compared to the monoacetate product is taken into account (Sample A includes 77.5% by weight of the amount of tow of the monoacetate filter).

[0031] The results indicate that filters and filter elements of the invention provide a surprising and marked selective reduction of phenolic compounds.

Example 3 Degradability

[0032] Different types of cigarette filters were placed in wire mesh cages on a rooftop site and their weights monitored periodically over a 12-month period. After 12-months, it was found that the weight of standard monoacetate filters had reduced by 23-30%, whilst the weight of a dimensionally comparable filter which includes a filtering material formed from a plurality of randomly oriented staple fibres of plasticised cellulose acetate had reduced by 46%. This is surprising because it would have been expected that a similar weight loss would have occurred.

Example 3 - type of tow

[0033] The properties of two superslim multiple filter rods A and B (each comprising four 27mm length filters of the invention of structure similar to the embodiment of Figs 1 and 2), and a comparable standard monoacetate superslim product "Control" are given below:

	A	B	'Control'
Tow Item	5Y30,000	4.2Y33,000	6Y17,000
Rod Length (mm)	108	108	108
Circumference (mm)	16.9	16.9	16.8
Rod Weight (g)	0.291	0.281	0.416
Rod Hardness (%)	88	89	91
27mm Tip Pressure Drop (mm)	102	100	115
27mm Tip Tar Retention (%)	29.4	30.5	33.6
27mm Tip Nicotine Retn (%)	27.1	29.7	29.3

[0034] The tows used in samples A and B are the same as those used in any standard (c. 24.5 mm) circumference product; whereas the above monoacetate control superslim sample required a more expensive low total denier tow. This example illustrates that filters of the invention provide acceptable characteristics using much higher total denier cellulose tows than for a conventional superslim product.

Claims

1. A tobacco smoke filter or filter element comprising a cylindrical plug of a substantially homogeneous filtering material of circumference between 14.0 and 23.2 mm, wherein the substantially homogeneous filtering material comprises a plurality of randomly oriented staple fibres.
2. A tobacco smoke filter or filter element according to claim 1 wherein the plug of substantially homogeneous filtering material is of circumference between 16.0 and 23.2 mm.
3. A tobacco smoke filter or filter element according to claim 1 or 2 wherein the staple fibres are crimped.
4. A tobacco smoke filter or filter element according to any preceding claim wherein the staple fibres are natural and/or synthetic fibres and/or fibres formed from natural plant material(s).
5. A tobacco smoke filter or filter element according to any preceding claim wherein the staple fibres are cellulose acetate fibres or polypropylene fibres.
6. A tobacco smoke filter or filter element according to any preceding claim including two or more types of staple fibres.
7. A tobacco smoke filter or filter element according to any preceding claim further comprising a liquid additive or a particulate additive.

8. A tobacco smoke filter or filter element according to any preceding claim wherein the staple fibres are of length between 4 mm and 20 mm.
9. A tobacco smoke filter or filter element according to any preceding claim wherein the staple fibres are formed from a tow of total denier of between 14,000g and 55,000g per 9,000m length.
10. A tobacco smoke filter or filter element according to any preceding claim including staple fibres which are plasticised.
11. A tobacco smoke filter or filter element according to any preceding claim including cellulose acetate staple fibres plasticised with triacetin, triethyleneglycol diacetate (TEGDA), or polyethylene glycol (PEG).
12. A tobacco smoke filter or filter element according to any preceding claim wherein the circumference of the cylindrical plug is between 16.2 mm and 23.2 mm.
13. A tobacco smoke filter or filter element according to any preceding claim further comprising a wrapper or plugwrap.
14. A tobacco smoke filter or filter element according to any preceding claim including a particulate additive on the wrapper or plugwrap.
15. A tobacco smoke filter or filter element according to any preceding claim further comprising a water soluble binder material.
16. A filter cigarette including a filter according to any preceding claim, or a filter which includes a filter element according to any preceding claim, joined to a wrapped tobacco rod.
17. A multiple rod comprising a plurality of filters or filter elements according to any of claims 1 to 16 integrally joined end-to-end.

Patentansprüche

1. Tabakrauchfilter oder -filterelement, der/das einen zylindrischen Stab aus einem im Wesentlichen homogenen Filtermaterial mit einem Umfang zwischen 14,0 und 23,2 mm aufweist, wobei das im Wesentlichen homogene Filtermaterial eine Vielzahl von regellos ausgerichteten Stapelfasern umfasst.
2. Tabakrauchfilter oder -filterelement nach Anspruch 1, wobei der Stab aus im Wesentlichen homogenem Filtermaterial einen Umfang zwischen 16,0 und 23,2 mm hat.
3. Tabakrauchfilter oder -filterelement nach Anspruch 1 oder 2, wobei die Stapelfasern gekräuselt sind.
4. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche, wobei die Stapelfasern Natur- und/oder Kunstfasern und/oder aus (einem) natürlichen pflanzlichen Stoff(en) hergestellte Fasern sind.
5. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche, wobei die Stapelfasern Celluloseacetatfasern oder Polypropylenfasern sind.
6. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche mit zwei oder mehr Stapelfasertypen.
7. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche, der/das ferner einen flüssigen Zusatzstoff oder einen Zusatzstoff in Partikelform aufweist.
8. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche, wobei die Stapelfasern eine Länge zwischen 4 mm und 20 mm haben.
9. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche, wobei die Stapelfasern aus einem Strang mit Denier-Gesamtmaß zwischen 14.000 g und 55.000 g pro 9.000 m Länge hergestellt sind.

10. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche mit Stapelfasern, die weichgemacht sind.
11. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche mit Celluloseacetat-Stapelfasern, die mit Triacetin, Triethylenglycol-Diacetat (TEGDA) oder Polyethylenglycol (PEG) weichgemacht sind.
12. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche, wobei der Umfang des zylindrischen Stabs zwischen 16,2 mm und 23,2 mm beträgt.
13. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche, der/das ferner eine Umhüllung oder Filterbelagpapier aufweist.
14. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche mit einem Zusatzstoff in Partikelform an der Umhüllung oder dem Filterbelagpapier.
15. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche, der/das ein wasserlösliches Bindemittel aufweist.
16. Tabakrauchfilter oder -filterelement nach einem der vorhergehenden Ansprüche oder Filter, der/das ein Filterelement nach einem der vorhergehenden Ansprüche beinhaltet, das an einen umhüllten Tabakstock angefügt ist.
17. Mehrfachstock, der eine Vielzahl von Filtern oder Filterelementen nach einem der Ansprüche 1 bis 16 aufweist, die Ende an Ende einstückig aneinandergefügt sind.

Revendications

1. Filtre ou élément de filtre de fumée de tabac comprenant un bouchon cylindrique de matière de filtration sensiblement homogène d'une circonférence entre 14,0 et 23,2 mm, dans lequel la matière de filtration sensiblement homogène comprend une pluralité de fibres discontinues orientées de manière aléatoire.
2. Filtre ou élément de filtre de fumée de tabac selon la revendication 1, dans lequel le bouchon de matière de filtration sensiblement homogène est d'une circonférence entre 16,0 et 23,2 mm.
3. Filtre ou élément de filtre de fumée de tabac selon la revendication 1 ou 2, dans lequel les fibres discontinues sont frisées.
4. Filtre ou élément de filtre de fumée de tabac selon l'une quelconque des revendications précédentes, dans lequel les fibres discontinues sont des fibres naturelles et/ou synthétiques et/ou des fibres formées à partir d'une ou de matières végétales naturelles.
5. Filtre ou élément de filtre de fumée de tabac selon l'une quelconque des revendications précédentes, dans lequel les fibres discontinues sont des fibres d'acétate de cellulose ou des fibres de polypropylène.
6. Filtre ou élément de filtre de fumée de tabac selon l'une quelconque des revendications précédentes, comportant deux ou plusieurs types de fibres discontinues.
7. Filtre ou élément de filtre de fumée de tabac selon l'une quelconque des revendications précédentes, comprenant en outre un additif liquide ou un additif particulaire.
8. Filtre ou élément de filtre de fumée de tabac selon l'une quelconque des revendications précédentes, dans lequel les fibres discontinues sont d'une longueur entre 4 mm et 20 mm.
9. Filtre ou élément de filtre de fumée de tabac selon l'une quelconque des revendications précédentes, dans lequel les fibres discontinues sont formées à partir d'une mèche d'un denier total entre 14000 g et 55000 g par longueur de 9000 m.
10. Filtre ou élément de filtre de fumée de tabac selon l'une quelconque des revendications précédentes, comportant

des fibres discontinues qui sont plastifiées.

- 5 **11.** Filtre ou élément de filtre de fumée de tabac selon l'une quelconque des revendications précédentes, comportant des fibres discontinues d'acétate de cellulose plastifiées avec de la triacétine, du diacétate de triéthylèneglycol (TEGDA), ou du polyéthylène glycol (PEG).
- 12.** Filtre ou élément de filtre de fumée de tabac selon l'une quelconque des revendications précédentes, dans lequel la circonférence du bouchon cylindrique est comprise entre 16,2 mm et 23,2 mm.
- 10 **13.** Filtre ou élément de filtre de fumée de tabac selon l'une quelconque des revendications précédentes, comprenant en outre une gaine ou un papier de gainage.
- 14.** Filtre ou élément de filtre de fumée de tabac selon l'une quelconque des revendications précédentes, comportant un additif particulaire sur la gaine ou le papier de gainage.
- 15 **15.** Filtre ou élément de filtre de fumée de tabac selon l'une quelconque des revendications précédentes, comprenant en outre une matière liante soluble dans l'eau.
- 16.** Cigarette filtre comportant un filtre selon l'une quelconque des revendications précédentes, ou un filtre comportant un élément de filtre selon l'une quelconque des revendications précédentes, joint à un bâtonnet de tabac gainé.
- 20 **17.** Bâtonnet multiple comprenant une pluralité de filtres ou d'éléments de filtre selon l'une quelconque des revendications 1 à 16 joints intégralement bout à bout.

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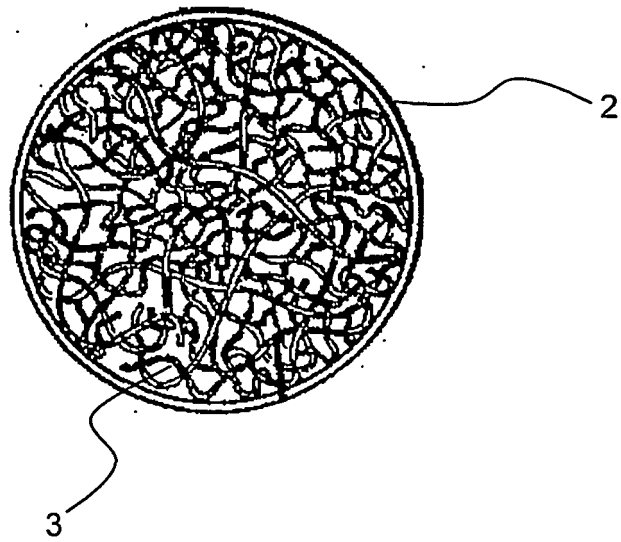
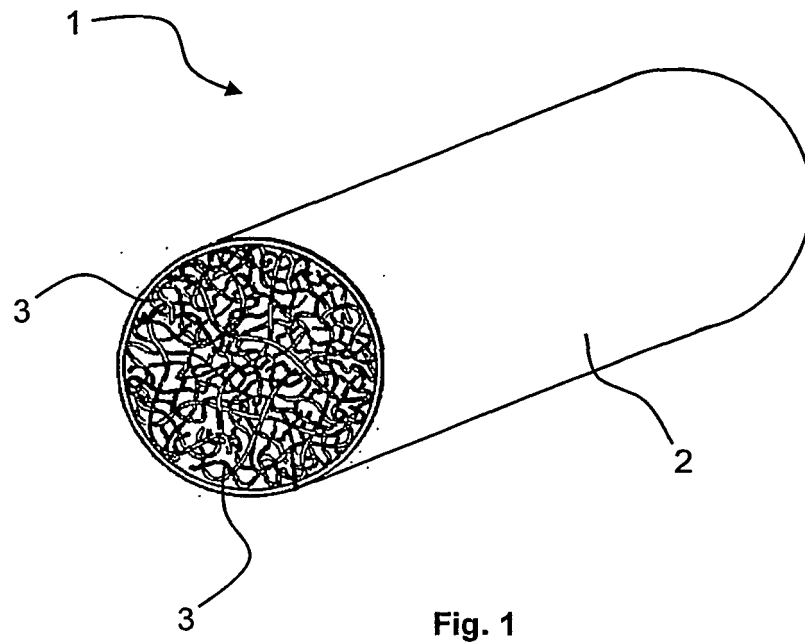
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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