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Smoking Article



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The invention relates to a ventilated filter cigarette according to the preamble of patent claim 1.

Filter structures for insertion into tobacco smoke filters which consist of several material properties are included in the prior art for the solution of various tasks set. In addition, ventilation of filters is used in order to ensure a milder smoke and a lower intake of harmful substances.

The **EP 474 940 B2** as well as the **EP 608 047 B1** describe smoke filters in which a middle core segment consists of a different filter material from the envelope. These smoke filters are designated as core or co-axial filters. In an embodiment **EP 474 940 B2** (*Fig.5*), the filter consists of two longitudinal filter sections, namely the ventilated strand side core filter part and a mouth side mono filter part, where the mouth side mono filter part has as its aim an aesthetic effect. A disadvantage of the named smoke filter is that in each case the outer wrapping of the inner core of the core filter section consists of a material which is permeable to smoke so that the smoke can flow vertically to the barrier surface between core and envelope of the core filter.

The **EP 0 558 166 B1** describes a ventilated filter cigarette which also possesses a mono filter section at the mouth end and a strand side core filter section. This filter cigarette however possesses an empty chamber between the two filter elements and which is filled with a adsorption medium (e.g. activated carbon). This has as a consequence the effect that through the adsorption medium the taste of the smoke and the composition of the smoke components are drastically altered, which is not acceptable to many smokers.

The **EP 0 880 904 A1** and the **DE 39 01 226 C1**, with the aid of a coaxial arrangement both of the tobacco strand and the filter, fulfil the task of achieving a cigarette with particularly low condensation values, which is attained in the first instance by means of the coaxial structure of the tobacco strand. But a disadvantage of this construction is the high costs incurred for special manufacturing plant which is necessary for the production of the coaxial strand.

The **EP 539 191 B1** has as its aim the preparation of a ventilated cigarette with particularly light weight. In this case the disadvantage is that the thicknesses of the materials included (both tobacco strand and filter) must be minimized, so as to achieve a particularly lightweight cigarette, when the possibilities for variation of the make-up of the cigarette are extremely limited. In this instance the ventilation zone is to be found in the strand side filter part.

The **problem** of the invention is to create a filter cigarette that does not have the above mentioned disadvantages and whose filter elements bring about a reduction of the particle phase of the smoke (e.g. nicotine) and thereby cause simultaneously a disproportionate drop in the gas phase smoke components, when the filtered smoke should contain a composition that has an acceptable taste for the consumer.

Furthermore, the above mentioned advantages of the filter should make possible great scope for variation of its sensory, tactile and visual formation.

A further problem is to de-couple the draw resistance of the filter from its retention, i.e. achieving an increase of the capacity for holding back the smoke content substances, without having to put up with also sharply raising the draw resistance, which is unavoidable with conventional filter construction methods.

A further problem of the invention is to prepare a product with the above named advantages for markets in which chamber filters and in particular those

which are filled with activated carbon, are rejected both for reasons of taste and feel.

For the **solution** of this problem a filter cigarette of the type named earlier will suffice, which further has the characterizing features of patent claim 1.

The invention is described hereafter in connection with embodiments :

Figure 1 shows a diagrammatic view of a filter cigarette according to the invention.

Figure 2 shows a diagrammatic view of a further embodiment of the filter cigarette according to the invention.

This filter cigarette consists of a strand part 10 and a filter 20. The strand part 10 is formed from a one-part tobacco strand 11 and an envelope 12 surrounding the tobacco strand 11. Filter 20 consists of at least two filter parts 22 and 23 and is connected with the strand part 10 with a wrapping paper 13, that is at least 3mm longer than filter 20. Furthermore, the tobacco strand 11 is measured between 55 and 75 mm long, whereas the length of the filter 20 measures 21 to 27 mm.

The filter 20 is ventilated in the area of the mouth side filter part. The volume of ventilation can be selected in the range 10 to 90%.

In the area of the mouth side filter part 22, there is provided the wrapping paper 13 with ventilation holes 14 as the means of ventilation, which are arranged in the form of 1 to 3 rows, preferably 2 rows of holes round about the filter 20, while in the area of the strand side filter part 23 the wrapping paper 13 however is completely impermeable. During smoking, ventilating air is sucked through the ventilation holes 14 into filter 20, which leads to the result that in comparison with a drop in the particle phase a disproportionate drop is attained in the gas phase components of the tobacco smoke. In one embodiment the ventilation medium can protrude a little, up to about 2 mm,

beyond the mouth side filter part into the strand side filter part 22. In this way the ventilating air is also sucked into the mouth side filter part 22 after a diversion.

The expert is familiar with the way in which ventilation holes are produced, for example by mechanical or electrostatic methods or through laser perforations. Other ventilation means that are familiar are tubes, canals or gaps in material.

The mouth side filter part 22 consists of at least one filter segment. The mouth side filter part can also consist of two or more filter plugs, as is shown in **Figure 2.** By this means a greater possibility of variation of the filter materials is given, as for example the possibility, in addition to the ventilated filter element 22b on the mouth side of including a further filter element 22a, which may present on its visible cross-section surface an imprint or a colouring.

The strand side filter part 23 forming a coaxial filter part has a core 24 and a sleeve 26 surrounding coaxially the core. The pressure drop of core 24 can be between 10 and 50 mm WS. The sleeve 26 is formed in such a way that its pressure drop is greater by at least a factor of 2 than that of the core 24. The sleeve 26 can also be essentially impermeable to smoke. The surface 25 of core 24 is made essentially impermeable to smoke or enveloped in such a way as to be impermeable to smoke.

The construction of the strand side filter part 23 has the effect that the smoke flows primarily through the core 24. As a result of the cross-sectional restriction the speed of the smoke flow within this core segment is considerably increased, which inherently involves an increased draw resistance with a relatively lower retention. A similar effect is achieved if the cross-sectional restriction of the material through which the smoke flows is caused by the core of the coaxial filter plug being formed almost impermeably, and then all the smoke flows exclusively through the sleeve.

Only if there is a manifold increase in the speed of the smoke flow in the strand side filter part 23 does there occur in the mouth side filter part 22 in

great quantity any intake of ventilating air with the aid of ventilation means 14. In this way there is achieved a disproportionate drop of the gas phase components in relation to the particulate matter phase, whereby at the same time acceptable draw resistances are ensured for the smoker.

In contrast to the prior art the variation possibilities of formation within the given problem set are extremely numerous, as with the filter cigarette of the invention the disproportionate drop of the gas phase takes place without any essential influence on efficiency, so that for example there is excluded a typical effect designated "air taste" by smokers.

The materials available for filtering with filter 20 there are flat, fibrous or granular filter materials, such as cellulose, cellulose ester, preferably cellulose acetate, melt-blown filter material, for example as produced according to WO97/33026, air-laid filter material for example produced according to US 4,375,447, filter materials comprising additives, tobacco e.g. according to DE 199 25 968, reconstituted tobacco, other easily decomposable filer materials or thermoplastic filter fibres.

The addition of additives can help to improve the cigarette according to the invention as to taste, touch or look, and/or have an additional effect on selective retention. Thus for example a filter element of filter part 22 can be provided with activated carbon particles in order to increase adsorption of the gas phase. In order to increase the acceptability of the cigarette for consumers with the additional help of visual means, it is possible for example to colour the mouth side filter.. By including acids or bases one can influence the pH-values of the particle spectrums and thereby the taste.

Additives can be added by sprinkling or spraying them on to the filter materials, e.g. fibres, or else by direct injection into the material strand.

Possible additives for the filter material are: flavouring agents, acids or bases in suspended or dissolved form, or additives with selective retention effect, adsorbents such as activated carbon or SiO_2. Further additives with selective

retention effect are organic acids, bases e.g. hydroxycarboxylic acids and their salts, metals and metal oxides, nitrogen components, ion exchange systems (e.g. zeolites), alcohols, polyphenols and porphyrin derivatives.

Further additives such as plasticizers, e.g. triacetin, triethylene glycol diacetate or citric acid diethyl ester, the additives accelerating photodegradation such as titanium dioxide, the additives favouring biodegradability, vitamins and/or colour pigments are possible for individual formation of the desired filter construction.

As a range for further embodiments of the cellulose acetate specification there present themselves: for the core 24 a single fibre fineness in the range from 3.0 to 8.0 den, preferably 8.0 den and an overall fineness in the range from 15,000 to 50,000 den, preferably 17,000 den. For the sleeve 26 a single fibre fineness in the range from 1.5 to 3.0 den, preferably 2.1 den. and an overall fineness in the range from 40,000 to 75,000 den, preferably 55,000 den.

The range for the single fibre fineness for the mouth side filter part 22 in the case of cellulose acetate as filter material, which can consist of two or several similar or dissimilar type segments 22a and 22b, can be 1.5 to 5 den and the overall fineness can be 15,000 to 60,000 den.

Example 1:

Cigarette A had a 63 mm long tobacco strand 11 and a 21 mm long multi-part filter 20.

The core 24 of the strand side filter part 23 had a diameter of 5.5 mm with a length of 8.0 mm. It consisted of cellulose acetate with a single fibre fineness of 6.0 den and an overall fineness of 17.000 den. The resistance to draw or pressure drop of the core 24 was about 27 mmWC.

The sleeve 26 surrounding coaxial the core 24 had an internal diameter of 5.5 mm and an external diameter of 7.8 mm for a length also of 8.0 mm. For material there was used cellulose acetate with a single fibre fineness of 2.1 den and an overall fineness of 55,000 den.

In total, the coaxial filter part thus had a length of 8.0 mm with a diameter of 7.8mm.

The mouth side filter part 22 was formed in one part and consisted of cellulose acetate. It had a diameter of 7.8mm with a length of 13mm. In the area of the mouth side filter part there was provided a ventilation zone in the form of a row of laser perforations. The filter ventilation of the cigarette A amounted to 35%.

Example 2:

For the purpose of evaluation of cigarette A from example 1 smoking analysis data were derived and compared with those of a cigarette V1, which was equipped with a conventional cellulose acetate filter of 21 mm in length and a single fibre fineness of 3.0 den as well as a filter ventilation of 18%, and was smoked according to ISO. Table 1 shows the results of the smoking data.

Table 1:

	Cigarette V1	Cigarette A	Delta [%]
Condense [mg/CIA.]	11.9	11.9	0.00
Nicotine [mg/CIA.]	0.86	0.9	0.04
CO [mg/CIA.]	10.5	8.4	20.0
NO [µl/CIA.]	140.6	111.9	20.4
Σ of further gas phase component parts [µg/CIA.]	2169.7	1666.1	23.2

Example 3:

Cigarette B had a 59mm long tobacco strand and a 25 mm long mullet-part filter 20.

The core 24 of the strand side filter part 23 had a diameter of 5.5 mm at a length of 10.0mm. It consisted of cellulose acetate with a single fibre fineness of 6.0 den and an overall fineness of 17,000 den. The resistance to draw or pressure drop of the core was at 25 mmWC.

The envelope 26 surrounding coaxial the core 24 had an internal diameter of 5.5 mm and an external diameter of 7.8 mm for a length also of 10.00mm. For material, use was made of cellulose acetate with a single fibre fineness of 2.1 den and an overall fineness of 55,000 den.

Thus, the coaxial filter part 23 had a length of 10.0 mm with a diameter of 7.8 mm.

The mouth side filter part 22 was formed in one part and consisted of cellulose acetate. It had a diameter of 7.8 mm and a length of 15 mm. In the area of the mouth side filter part 22 there was a ventilation zone provided in the form of a

row of ventilation holes 14, which were produced by laser perforations. The filter ventilation of cigarette **B** amounted to 51%.

Example 4:

For the purpose of evaluation of the cigarette **B** from example 3, smoking analysis data were ascertained and compared with those of a cigarette **V2**, which was equipped with conventional cellulose acetate filters of 25mm in length and a single fibre fineness of 3.0 den as well as a filter ventilation of 38%, and was smoked according to ISO. Table 2 shows the results of the smoking data.

Table 2:

	Cigarette V2	Cigarette B	Delta [%]
Condense [mg/CIA.]	6.9	6.9	0.00
Nicotine [mg/CIA.]	0.56	0.59	-5.36
CO [mg/CIA.]	5.5	4.2	23.6
NO [µl/CIA.]	59.9	44.5	25.7
Σ of further gas phase component parts [µg/CIA.]	1370.2	1070.0	21.9

It is clear from the examples that the decrease in the gas phase components of the cigarette smoke relative to those of the particle phase is disproportionately high with the new filter design.

Patent claims

1. Filter cigarette with wrapped tobacco strand and with a filter (20) having ventilation means, said filter consisting of at least two filter parts (22, 23) wherein

   - the ventilation means is provided in the area of the mouth side filter part (22); and

   - the mouth side filter part (22) is at least a one-part filter part and the tobacco strand side filter part (23) is a coaxial filter part with a core (24) and a sleeve (26);

   characterized in that

   - the tobacco strand (11) is a one-part strand; and that

   - the pressure drop of the core (24) is smaller than the pressure drop of the sleeve (26).

2. Ventilated cigarette according to claim 1, **characterized in that** the mouth side filter part (22) consists of flat-shaped, fibrous or granular or degradable filter material

3. Ventilated filter cigarette according to claim 2, **characterized in that the** filter material is cellulose, cellulose ester, preferably cellulose acetate, melt-blown filter material, air-laid filter material, filter material with additives, tobacco, other easily degradable filter materials or thermoplastic filter fibres.

4. Ventilated filter cigarette according to claim 2 or 3, **characterized in that** the filter material contains an additive.

5. Ventilated filter cigarette according to claim 4, **characterized in that** aromatic substances, acids or bases in suspension or solution, or selectively effective adsorbents such as activated carbon or Si02 are used as additives.

6. Ventilated filter cigarette according to one of claims 1 to 5, **characterized in that** the core (24) of the strand side coaxial filter part (23) consists of fibre material having a low fineness, whereby the value for a single fibre is in the range from 3.0 to 8.0 den and the overall fineness being in the range from 15,000 to 50,000 den.

7. Ventilated filter cigarette according to claim 6, **characterized in that** the single fibre fineness is at 6.0 den and the overall fineness at 17,000 den.

8. Ventilated filter cigarette according to one of claims 1 to 5, **characterized in that** the sleeve (26) of the tobacco side coaxial filter part (23) from fibre material with a single fibre fineness is in the range of 1.5 to 3.0 den and the overall fineness is in the range of 40,000 to 75,000 den.

9. Ventilated filter cigarette according to claim 8, **characterized in that** the single fibre fineness is at 2.1 den. and the overall fineness is at 55,000 den.

10. Ventilated filter cigarette according to claim 1, **characterized in that** the ratio of the pressure drop of the core (24) to the sleeve (26) is greater than 2.

11. Ventilated filter cigarette according to claim 10, **characterized in that** the ratio of the pressure drop of the core (24) to the sleeve (26) is around 6.

12. Ventilated filter cigarette according to claim 1, **characterized in that** the surface of the core (34) is wrapped in a way impermeable to air or is made up in a way impermeable to air.

13. Ventilated filter cigarette according to claim 1, **characterized in that** the reduction of gas phase components achieved through ventilation is between 10 and 90%.

14. Ventilated filter cigarette according to claim 13, **characterized in that** the reduction of the gas phase components achieved through ventilation is between 10 and 50%.

15. Ventilated filter cigarette according to claim 1, **characterized in that** the ventilation means extend beyond the mouth side part into the strand side filter part, whereby the ventilation air is diverted into the mouth side part.