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(54) Concentric smoking filter having discrete tow and web filter media.

(57) A concentric smoking filter (12) in which one of the filter media (20 or 21) is a fibrous tow, such as fibrous cellulose acetate tow, and one of the filter media (21 or 20) is a web material, such as paper, is provided. The filter improves the taste, particularly, of "ultra-light" cigarettes.

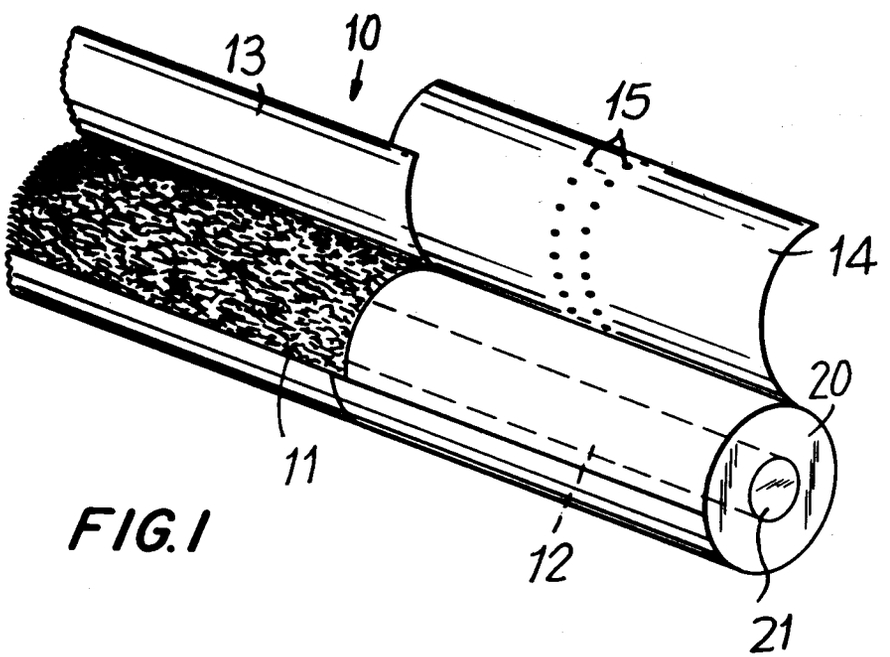

FIG.1

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Background of the Invention

This invention relates to smoking filters, and particularly to concentric smoking filters. More particularly, this invention relates to concentric smoking filters having tow and web filter media portions arranged concentrically.

Most smoking filters, particularly cigarette filters, sold commercially as part of cigarettes consist of a cylindrical rod or "plug" of a "tow" of plasticized cellulose acetate fibers. Some filters are variants of the standard filter, having recessed mouth ends, or being made of two plugs placed end-to-end with a space in between, the space being either empty or filled with another material such as charcoal. It is also known to provide such filters having multiple plugs abutting one another, the different plugs differing in density or other characteristics.

Similarly, it is known to provide filtering media other than cellulose acetate. One such medium is an appropriate sheet or web material. The web material, which is gathered into a cylindrical plug, can be paper or any other web material, including cellulose acetate in sheet form. When such web materials are used as filters, they are frequently corrugated before being gathered. Paper webs may also be creped to improve tensile strength.

Some of these different materials and different constructions have been combined. For example, it is known to provide filters having two or more abutting plugs, at least one of which is cellulose acetate tow, and at least one of which is a web material.

Finally, it is known to provide "concentric filters" in which two different forms of cellulose acetate tow -- differing, e.g., in density -- are formed in to a filter. One cellulose acetate tow forms a cylindrical "core", while the other tow forms an annular peripheral layer.

Smoking filters are characterized by various parameters, including pressure drop, which is referred to as resistance-to-draw ("RTD") and usually measured as the height of a column of water, and efficiency, which is measured as the percentage of the total particulate matter ("TPM") in the unfiltered smokestream that is trapped by the filter. The RTD of a filter affects how smokers perceive the filter in terms of how hard they must draw on it to receive a desired amount of smoke, while the filter efficiency controls the amount of TPM delivered in the smoke.

It has been found that while web filters, and particularly paper filters, are more efficient than tow filters, the web material, especially paper, adds an off taste to the smoke which decreases smoker satisfaction. In addition, the appearance of the visible deposited smoke components on the end of a paper filter is much less regular, and more spotty, than on a cellulose acetate tow filter, again affecting the aesthetic impact on the smoker. This difference in appearance is believed to result from the channelling of deposited material in the channels formed by the corrugation and gathering of the web during plug making.

As consumer preferences tend toward lower delivery cigarettes, the need for higher efficiency filters, which allow lower delivery without increased filter RTD, increases. However, the higher efficiency of paper filters could not previously be taken advantage of because of the negative consumer impacts of paper filters.

It would be desirable to be able to provide a high efficiency filter which produced low delivery while also delivering acceptable taste, RTD and other aesthetic impacts.

Summary of the Invention

It is an object of this invention to provide a high efficiency filter which produces low delivery while also delivering acceptable taste, RTD and other aesthetic impacts.

In accordance with this invention, there is provided a smoking filter comprising a first filter plug having a central core of a first filter material and a peripheral layer of a second filter material surrounding the central core. One of the first and second filter materials is cellulose acetate tow and the other of the first and second filter materials is a gathered corrugated web material. When the filter is attached to a smoking article and delivers, when the smoking article is smoked, a particular level of total particulate matter, the taste of the smoking article is a taste associated with a level of total particulate matter higher than that particular level.

Brief Description of the Drawings

The above and other objects and advantages of the invention will be apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

FIG. 1 is a mouth end perspective view of a cigarette having a first embodiment of a filter according to the present invention;

FIG. 2 is a radial cross-sectional view of the filter of FIG. 1;

FIG. 3 is a mouth end perspective view of a cigarette having a second embodiment of a filter according to the present invention;

FIG. 4 is a radial cross-sectional view of the filter of FIG. 3;

FIG. 5 is a mouth end perspective view of a

cigarette having a third embodiment of a filter according to the present invention; and

FIG. 6 is a mouth end perspective view of a cigarette having a fourth embodiment of a filter according to the present invention.

Detailed Description of the Invention

In accordance with the present invention, it has unexpectedly been found that when a concentric filter is made with paper or other web material in the core, and cellulose acetate tow in the periphery, or vice-versa, not only is high filtration efficiency achieved without the introduction of an off taste from the paper, but a cigarette with low TPM delivery can be produced which has the taste of a cigarette with a higher TPM delivery.

As shown in FIGS. 1 and 2, cigarette 10 includes a tobacco rod 11 and a first preferred embodiment of a filter 12 according to this invention. Tobacco rod 11 is wrapped in conventional wrapper 13, while filter 12 is wrapped by conventional tipping 14. Filter 12 includes cellulose acetate tow peripheral layer 20 and central paper core 21. Cellulose acetate peripheral layer 20 is a conventional cellulose acetate tow, preferably wrapped by porous plug wrap 22, although self-supporting filter rod technology, such as steam bonding or spray coating of the outer surface of peripheral layer 20, can be used to make a filter that need not be wrapped, if desired. Paper core 21 is a paper web that has been corrugated and gathered into cylindrical form and wrapped with plug wrap paper 23.

Plug wrap 23 improves the processibility of core 21 as well as its aesthetic appearance, and also helps to assure substantially perfect concentricity. Flavorants or other additives, such as soluble tobacco components, could be applied to plug wrap 23 to enhance the subjective impact of the filtered smoke. A similar result might be achieved by forming plug wrap 23 from a tobacco-containing material, such as reconstituted tobacco sheet. Plug wrap 23 is preferably porous, to allow smoke and air to freely move radially between peripheral layer 20 and core 21. At the same time, the presence of plug wrap 23 helps prevent channelling of smoke along the interface between peripheral layer 20 and core 21.

The most preferred embodiment of filter 12 has a circumference of about 24.45 mm and an average weight of about 258 mg. The cross-sectional area of core 21 preferably makes up about 60% of the total cross-sectional area of filter 12. Filter 12 preferably has an RTD of between about 130 mm W.G. and about 160 mm W.G., with the RTD of central core 21 being between about 350 mm W.G. and about 450 mm W.G.. More preferably, filter 12 has an RTD of about 146 mm W.G., with the RTD of central core 21 being about 400 mm W.G.

In the particularly preferred embodiment, the cellulose acetate tow of peripheral layer 20 is preferably an 8.0/30000 cellulose acetate tow having a denier per fiber of 8, a total denier of 30,000, and a "Y" cross-sectional shape. The web of core 21 is preferably a 100% cellulose semi-creped softwood pulp paper with 10% crosswise creping for added tensile strength. Such a paper is available from Tela Papierfabrik AG, of Balsthal, Switzerland.

Cigarette 10 is preferably ventilated to between about 65% and about 75% ventilation, and more preferably about 67% ventilation, with appropriate ventilation holes 15 provided in tipping 14. If the surface of filter 12 is not air permeable, appropriate holes would also be provided in filter 12.

FIGS. 3 and 4 show a cigarette 30 having a second preferred embodiment of filter 31 similar in construction to filter 12, except that core 40 is a tow material and peripheral layer 41 is a web material. Similarly, in this embodiment plug wrap 42 is necessary to contain the web material of peripheral layer 41, while plug wrap or other permeable wrap 43 around tow core 40 is optional, as tow core 40 could be made using self-supporting filter rod technology, as above.

The most preferred embodiment of filter 31 has a circumference of about 24.45 mm and an average weight of about 240 mg. The cross-sectional area of core 40 preferably makes up about 60% of the total cross-sectional area of filter 31. Filter 31 preferably has an RTD of between about 165 mm W.G. and about 195 mm W.G., with the RTD of central core 40 being between about 285 mm W.G. and about 385 mm W.G. More preferably, filter 31 has an RTD of about 182 mm W.G., with the RTD of central core 40 being about 334 mm W.G.

In this embodiment, the cellulose acetate tow of core 40 is preferably a 1.6/35000 cellulose acetate tow having a denier per fiber of 1.6, a total denier of 35,000, and a "Y" cross-sectional shape. The web of peripheral layer 41 is preferably the same 100% cellulose semi-creped softwood pulp paper, with 10% crosswise creping for added tensile strength, that is used in core 21 of filter 12.

Cigarette 30 is preferably ventilated to between about 65% and about 75% ventilation, and more preferably about 67% ventilation, with appropriate ventilation holes 15 provided in tipping 14, as in cigarette 10.

FIG. 5 shows a cigarette 50 having a third preferred embodiment of a filter 51 according to the invention. Filter 51 is a so-called "dual" filter, made up of two abutting filter segments 52, 53. Filter segment 52, which is adjacent tobacco rod 11, is a concentric filter as discussed above, in which one of core 54 and peripheral layer 55 is of

a web material and the other of core 54 and peripheral layer 55 is of a tow material. Filter segment 53, which is at the mouth end, is a conventional tow filter, such as a cellulose acetate filter, and is provided primarily for cosmetic purposes. Nevertheless, segment 53 has filtration and RTD characteristics, and segment 52 must be adjusted so that the overall filter 51 has the desired characteristics.

In a preferred form of this embodiment, segment 52 is constructed like filter 12, but has a length of only 18-20 mm, while segment 53 is a 7-9 mm long plug of 2.6/42000 cellulose acetate for tow having a denier per fiber of 2.6, a total denier of 42,000, and a "Y" cross-sectional shape. Total filter RTD is between about 125 mm W.G. and about 175 mm W.G., preferably about 141 mm W.G. The RTD of segment 53 is between about 15 mm W.G. and about 45 mm W.G., preferably about 36 mm W.G. The RTD of segment 52 is between about 85 mm W.G. and about 175 mm W.G., preferably about 93 mm W.G. The RTD of the paper core 54 of segment 52 is between about 250 mm W.G. and about 450 mm W.G., preferably about 267 mm. W.G. Cigarette 50 made with this embodiment of filter 51 is ventilated to between about 65% and about 75% ventilation, preferably about 71% ventilation, with appropriate ventilation holes 15 in tipping 14.

FIG. 6 shows a cigarette 60 having a fourth embodiment of a filter 61 according to the invention. Filter 61 is a recessed filter, made up of filter segment 62 recessed into tipping 14 at 63. Filter segment 62, which is adjacent tobacco rod 11, is a concentric filter as discussed above, in which one of core 64 and peripheral layer 65 is of a web material and the other of core 64 and peripheral layer 65 is of a tow material.

The filter parameters discussed herein are given for 85 mm cigarettes. It is to be understood that filters according to the present invention can also be used with longer cigarettes. If a longer cigarette is provided, the filter parameters would have to be adjusted, in accordance with the knowledge of those skilled in the art.

EXAMPLE I

A filter according to the most preferred embodiment discussed above in connection with FIGS. 1 and 2, except that the tow in the peripheral layer was an 8.0/25000 cellulose acetate tow having a denier per fiber of 8.0 and a total denier of 25000, was prepared and mated to an "ultra-light" tobacco rod having the following characteristics:

Tobacco
487 mg
Total RTD
107 mm W.G.
Filter RTD
146 mm W.G.
Ventilation
67%
Tipping length
32.0 mm

The cigarette was smoked in a smoking machine under FTC conditions with the following results:

TPM	1.8 mg
Nicotine	0.16 mg
Water	0.21 mg
"Tar"	1.5 mg
Puff Count	6.2

The cigarette, which generates 1.5 mg of "tar", was also smoked by expert smokers, who reported that the cigarette had the taste of a cigarette that generates 4-5 mg of "tar". At 67% ventilation, the filter has an efficiency of about 76%. If there had been no ventilation, the efficiency would have been about 61%.

The cigarette also exhibited a pattern of visible deposition of filtrate on the end of the filter much more like a tow filter as opposed to a web filter, even though most of the filtrate was deposited on the web core. This is believed to be the result of the smoke being forced into core 21 as the ventilation air is introduced at holes 15, and then trying to spread back into peripheral tow layer 20 through permeable wrapper 23.

EXAMPLE II

A filter according to the preferred form of the embodiment of FIG. 5 was prepared and mated to an "ultra-light" tobacco rod having the following characteristics:

Tobacco
429 mg
Total RID
93 mm W.G.
Filter RID
141 mm W.G.
Ventilation
71%
Tipping length
32 mm

The cigarette was smoked in a smoking machine under FTC conditions with the following results:

TPM	1.6 mg
Nicotine	0.13 mg
Water	0.10 mg
"Tar"	1.4 mg
Puff Count	5.3

As in the case of Example I, this cigarette was smoked by expert smokers who reported that the cigarette had the taste of a cigarette that generates 4-5 mg of "tar".

The filter of this invention will improve the taste of low delivery cigarettes. It is also possible that the filter of this invention may offer similar performance at higher deliveries. For example, a medium delivery cigarette may be perceived as a full-flavor cigarette.

Thus it is seen that a high efficiency filter which produces low delivery while also delivering acceptable taste and other aesthetic impacts is provided. One skilled in the art will appreciate that the present invention can be practiced by other than the described embodiments, which are presented for purposes of illustration and not of limitation, and the present invention is limited only by the claims which follow.

Claims

1. A smoking filter comprising:

a filter plug (12,31,52,62) having:

a central core (21,40,54,64) of a first filter material, and

a peripheral layer (20,41,55,65) of a second filter material surrounding said central core; characterised in that:

one of said first and second filter materials is a fibrous tow and the other of said first and second filter materials is a gathered corrugated web material;

said filter materials being adapted, when said filter is attached to a smoking article and delivers during smoking a particular level of total particulate matter, to cause said smoking article to have a taste associated with a level of total particulate matter higher than said particular level.

2. The smoking filter of claim 1 wherein said fibrous tow is cellulose acetate tow.

3. The smoking filter of claim 1 or 2 wherein said core and said peripheral layer are concentric.

4. The smoking filter of claim 1, 2 or 3 wherein said first filter material (21) is said web material and said second filter material (20) is said fibrous tow.

5. The smoking filter of claim 4 wherein said second filter material is cellulose acetate tow having a denier per filament of about 8.0 and a total denier of from 25,000 to 30,000, preferably about 30,000.

6. The smoking filter of claim 1, 2 or 3 wherein said first filter material (40) is said fibrous tow and said second filter material (41) is said web material.

7. The smoking filter of claim 6 wherein said first fibrous material is cellulose acetate tow having a denier per filament of about 1.6 and a total denier of about 35,000.

8. The smoking filter of any of claims 1 to 7 wherein said web material is paper.

9. The smoking filter of claim 8 wherein said paper is creped before being corrugated and gathered.

10. The smoking filter of any of claims 1 to 7 wherein said web material is a non-woven web.

11. The smoking filter of claim 10 wherein said non-woven web is cellulose acetate sheet.

12. The smoking filter of any of claims 1 to 5 wherein said gathered corrugated web material is wrapped in a plug wrap (23).

13. The smoking filter of claim 12 wherein said plug wrap (23) is porous.

14. The smoking filter of claim 12 or 13 wherein said plug wrap (23) contains flavor components.

15. The smoking filter of claim 14 wherein said plug wrap (23) comprises a tobacco-containing material.

16. The smoking filter of claim 15 wherein said tobacco-containing material comprises reconstituted tobacco sheet.

17. The smoking filter of claim 14 wherein said plug wrap (23) comprises plug wrap paper to which flavor components have been added.

18. The smoking filter of claim 17 wherein said flavor components comprise soluble tobacco components.

19. The smoking filter of any preceding claim having a ventilation rate of between 65% and 75%.

20. The smoking filter of any of claims 1 to 5 or 19 having a filtration efficiency of about 61% unventilated.

21. The smoking filter of claim 20 having a ventilation rate of about 67% and a filtration efficiency of about 76%.

22. The smoking filter of any preceding claim

wherein said core (21,40) has a cross-sectional area occupying about 60% of the total cross-sectional area of said filter.

23. The smoking filter of any preceding claim wherein said filter has a resistance-to-draw of between about 130 mm W.G. and about 195 mm W.G., said central core (21,40) having a resistance-to-draw of between about 285 mm W.G. and about 450 mm W.G.

24. The smoking filter of claim 4 or 5 wherein said filter has a resistance-to-draw of between about 130 mm W.G. and about 160 mm W.G., preferably about 146 mm W.G., said central core (21) having a resistance-to-draw of between about 350 mm W.G. and about 450 mm W.G., preferably about 400 mm W.G.

25. The smoking filter of claim 6 or 7 wherein said filter has a resistance-to-draw of between about 165 mm W.G. and about 195 mm W.G., preferably about 182 mm W.G., said central core (40) having a resistance-to-draw of between about 285 mm W.G. and about 385 mm W.G., preferably about 334 mm W.G.

26. The smoking filter of any of claims 1 to 22 further comprising a second filter plug (53) of cellulose acetate tow adjacent to the first-mentioned filter plug (52).

27. The smoking filter of claim 26 wherein said first filter material is said web material and said second filter material is said fibrous tow, said first filter plug (52) has a resistance-to-draw of between 85 mm W.G., and about 175 mm W.G., preferably about 93 mm W.G., said central core having a resistance-to-draw of between about 250 mm W.G., and about 450 mm W.G., preferably about 267 mm W.G., and said second filter plug (53) has a resistance-to-draw of between about 15 mm W.G., and about 45 mm W.G., preferably about 36 mm W.G., such that said filter has a resistance-to-draw of between about 125 mm W.G., and about 175 mm W.G., preferably about 141 mm W.G.

28. The smoking filter of any of claims 1 to 25 further comprising tipping (14) wrapped therearound, said tipping extending beyond one end of said filter plug (62) for attaching said filter to a cigarette and extending beyond the opposite end of said filter plug, forming a mouth-end recess in said filter.

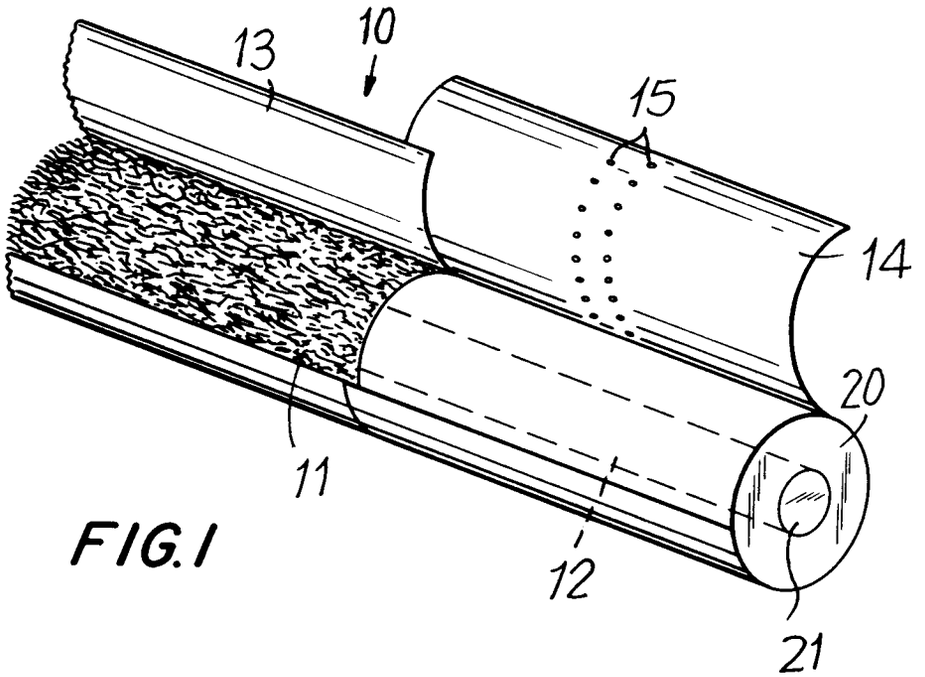


FIG.1

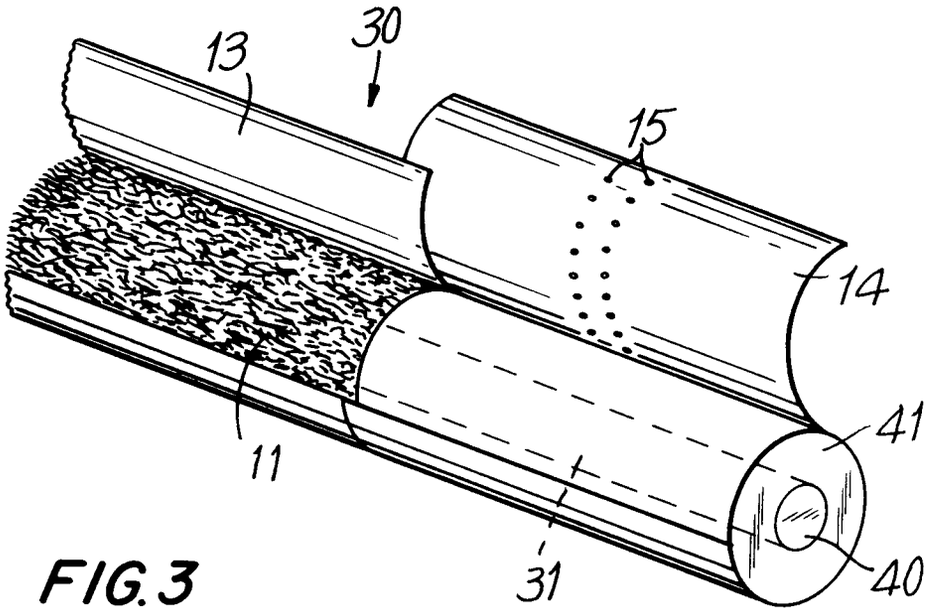


FIG.3

FIG. 2

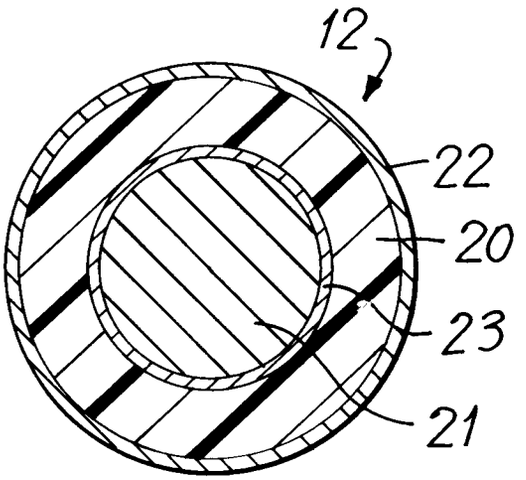
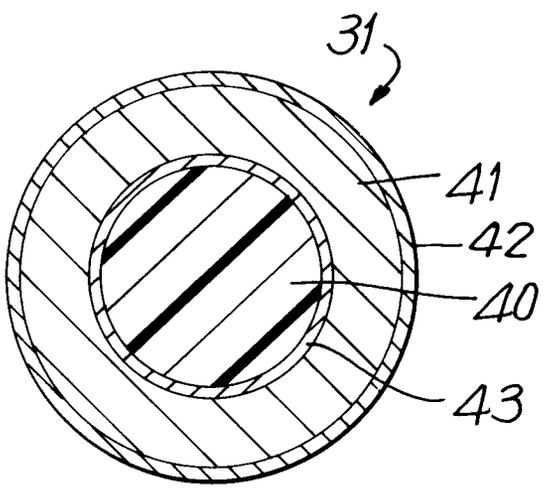


FIG. 4



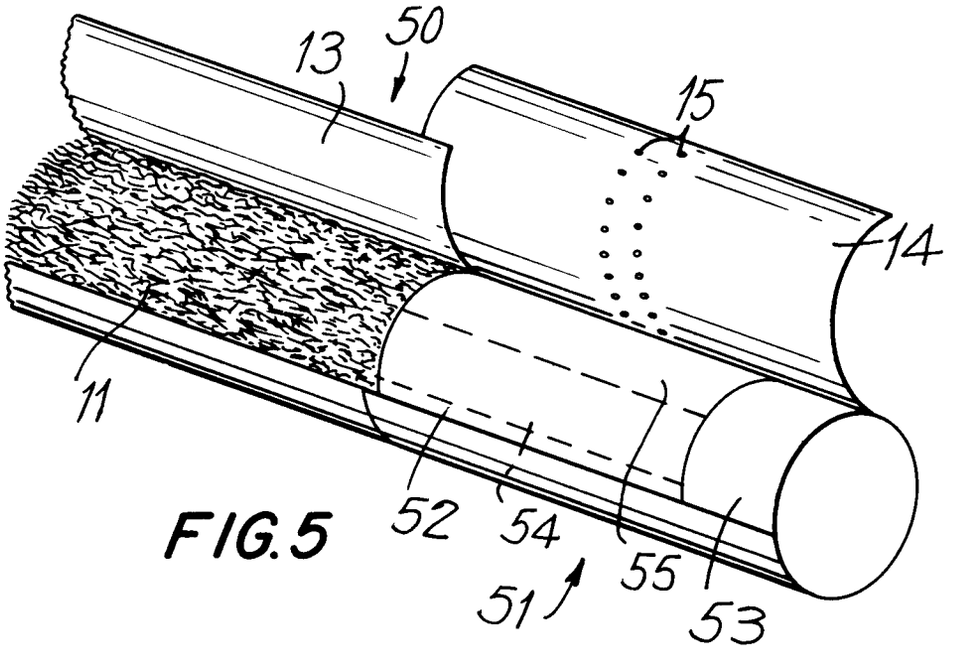


FIG.5

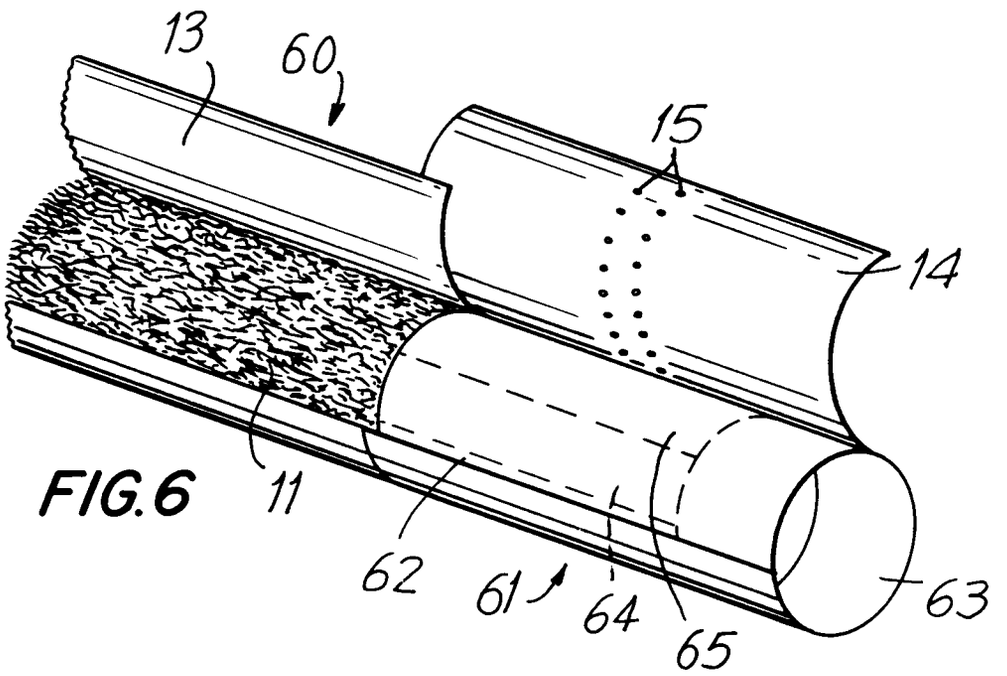


FIG.6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 31 3555

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 355 995 (BERGER) * column 4, line 55 - column 6, line 4 * * * column 8, line 63 - column 9, line 34; figures 1,4,9 * *	1-4,6,22	A 24 D 3/04 A 24 D 3/06
X	US-A-3 396 061 (BROWNE) * the whole document * *	1-4,8,9	
A	FR-A-2 524 274 (FILTRONA LIMITED) * page 4, line 12 - page 5, line 20; figure 3 * * * example 1 * *	1-3,12,13	
A	DE-A-3 207 683 (B.A.T. CIGARETTEN-FABRIKEN GMBH) * page 9, line 10 - page 10, line 5; figure 1 * *	1-3,12	
A	EP-A-0 378 788 (B.A.T. CIGARETTENFABRIKEN GMBH) * column 5, line 52 - column 6, line 40; figure 1 * *	1-3,12	
A	EP-A-0 321 740 (B.A.T. CIGARETTENFABRIKEN GMBH) * column 4, line 28 - column 5, line 45; figure 1 * *	1-3,12	
A	FR-A-2 368 905 (OLIN CORPORATION) * page 4, line 13 - line 29 * *	14,17	
A	FR-A-2 518 374 (FILTRONA LIMITED)		TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	DE-A-2 558 004 (LIGGETT & MYERS INC.)		A 24 D A 24 C

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	04 December 91	RIEGEL R.E.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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