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(54) Cigarette.

(57) A vented filter cigarette comprises a filter (14) having a fiber filter material (20) and a plug wrap paper (18) wrapping the fiber filter material, a tobacco rod (12), and tipping paper (16) having a plurality of pores (22) and connecting the filter and the tobacco rod. An embossment (24) is formed in a region of the plug wrap paper (18) corresponding to the pores (22) of the tipping paper (16). The embossment (24) creates a slight gap between the tipping paper (16) and the circumference of the filter (14) around the pores (22), with the result that the tightness between the tipping paper (16) and the circumference of the filter (14) is loosened, the filter ventilation is increased, and the variation in the filter ventilation is decreased.

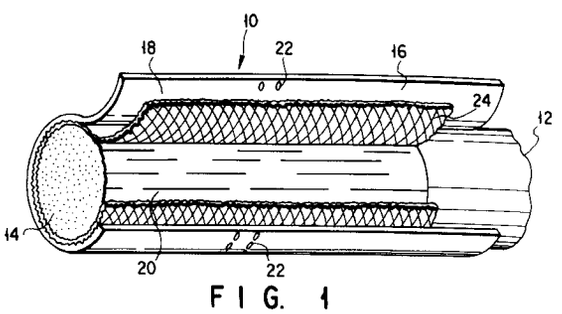

FIG. 1

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The present invention relates to a cigarette and, more specifically, to an improvement in plug wrap paper used for a cigarette capable of reducing a variation in the amount of air flow from a filter (filter ventilation).

A conventional cigarette filter is cylindrically formed of a fiber filter material such as cellulose diacetate wrapped by a plug wrap paper. A tipping paper is used to connect a filter rod and a tobacco rod. Vented filters each made by the combination of an air-permeable plug wrap paper and a tipping paper having pores formed by means of static electricity, a laser beam, etc. have recently been used widely to allow air to enter through the periphery of the filter and reduce the yield of smoke effusing through the filter rod. With the vented filter having the above-described structure, dilution air is inhaled into the smoker's mouth from the outer portion of the mouth end face of the filter, whereas tobacco smoke is inhaled into the mouth from the center portion of the mouth end face.

It has been confirmed that the conventional cigarette described above entails the problem of a large variation in filter ventilation even though the filter fiber, plug wrap paper, and tipping paper of the cigarette are made of the same material. Since the filter ventilation is greatly correlated with the amount of smoke inhaled, the variation in the filter ventilation is undesirable.

It is accordingly an object of the present invention to provide a cigarette capable of reliably controlling its filter ventilation.

To attain the above object, variation in filter ventilation of vented filter cigarettes was researched, and a variety of tests on the filter ventilation was carried out. The following results were obtained. The variation in filter ventilation is correlated with the variation in tightness between the plug wrap paper (or the circumference surface of a filter, in the case where no plug wrap paper is used) and tipping paper, rather than the variation in permeability of materials of the cigarettes. Depending on the degree of the tightness, the ventilation area of the permeable plug wrap paper through which dilution air passes varies from product to product, with the result that the filter ventilation cannot be controlled uniformly even though the same material is used.

In consideration of the above results, the inventors further carried out a number of tests and have discovered that the filter ventilation is increased and the variation therein is reduced by separating the pores of the tipping paper from the plug wrap paper of the filter by means of an embossment formed on the plug wrap paper and corresponding to the pores.

A vented filter cigarette according to the present invention comprises: a filter having a fiber filter material and a plug wrap paper wrapping the fiber filter material; a tobacco rod; and tipping paper having a plurality of pores and connecting the filter and the tobacco rod. An embossment is formed in a region of the plug wrap paper corresponding to the pores of the tipping paper.

With the above structure, the embossment creates a slight gap between the tipping paper and the plug wrap paper around the pores, with the result that the tightness between the tipping paper and the plug wrap paper is loosened, the filter ventilation is increased, and the variation in the filter ventilation is decreased.

This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is an exploded perspective view showing part of a cigarette according to a first embodiment of the present invention;

Fig. 2 is an exploded perspective view showing part of a cigarette according to a second embodiment of the present invention;

Fig. 3 is an enlarged schematic view showing the pattern of an embossment formed on the plug wrap paper of the cigarettes shown in Figs. 1 and 2;

Fig. 4 is an enlarged schematic view showing the pattern of another embossment formed on the plug wrap paper;

Fig. 5 is an enlarged schematic view showing the pattern of still another embossment formed on the plug wrap paper;

Fig. 6 is an enlarged schematic view showing the pattern of still another embossment formed the plug wrap paper;

Fig. 7 is an exploded perspective view showing part of a cigarette according to a third embodiment of the present invention;

Fig. 8 is an exploded perspective view showing part of a cigarette according to a fourth embodiment of the present invention;

Fig. 9 is an exploded perspective view showing part of a cigarette according to a fifth embodiment of the present invention; and

Fig. 10 is an exploded perspective view showing part of a cigarette according to a sixth embodiment of the present invention.

Fig. 1 shows part of a cigarette according to a first embodiment of the present invention. In Fig. 1, a cigarette 10 comprises a tobacco rod 12 and a filter 14. The filter 14 is made of a fiber filter material 20 such as cellulose

diacetate wrapped by a plug wrap paper 18. Further, a tipping paper 16 is used to connect the filter 14 and the tobacco rod 12 with each other.

Since the cigarette 10 is of a vented filter type, it employs highly permeable plug wrap paper 18 having a Coresta permeability of 1000 or more in order to reduce the yield of smoke flowing out of the mouth end of the filter. Further, the tipping paper 16 has a number of ventilation pores 22 formed thereon in one or plural rows (two rows in this embodiment) or irregularly along the circumferential direction of the cigarette. The pores 22 of the tipping paper 16 can be formed by a known technique using static electricity, a laser beam, etc. With the cigarette 10 of this type, dilution air is inhaled into the. smoker's mouth from the outer portion of the mouth end face of the filter, and tobacco smoke from the center portion thereof.

A rhombic grid-patterned embossment 24 is formed on the entire surface of the plug wrap paper 18. Since the embossment 24 is printed by means of, for example, a knurling tool, it provides ruggedness all over the plug wrap paper 18.

In the cigarette having the foregoing structure according to the present invention, the embossment 24 serves to create a slight gap between the tipping paper 16 and the plug wrap paper 18 around the pores 22, with the result that the tightness between the papers 16 and 18 is loosened, and the permeability of a combination of the pores 22 and the plug wrap paper 18 is improved. In addition, the embossment 24 reduces the variation in the air permeability of the combination of the papers 16 and 18. Consequently, the filter ventilation is increased, and the variation in the filter ventilation is decreased.

It is desirable that the depth of the pattern of the embossment 24 falls within a range between 0.01 and 1.00 mm, preferably between 0.02 and 0.06 mm. If the depth exceeds the range, a problem in cigarette making can occur, whereas if the depth does not reach the range, the effect of the embossment 24 cannot be obtained sufficiently. The depth of the embossment 24 can be measured by using a three-dimensional surface roughness measuring instrument (SE-3AK manufactured by Kosaka Laboratory Ltd.).

It is also desirable that the embossment 24 should be disposed such that the surface thereof, which is brought into contact with the pattern press die, faces the tipping paper 16. If the contact surface of the embossment faces the tipping paper 16, the pores 22 of the tipping paper 16 can be separated sufficiently from the plug wrap paper 18 of the filter 14. In the contrary case, the effect of the embossment is slightly lessened as compared to the former case.

Fig. 2 shows part of a cigarette according to a second embodiment of the present invention. In Fig. 2, the elements corresponding to those of the first embodiment shown in Fig. 1 are denoted by the same numerals as those in Fig. 1, and the description thereof is omitted.

In the second embodiment, the embossment 24 of the plug wrap paper 18 is disposed so as to be located along the rows of the pores 22 of the tipping paper 16. The embossment 24 is printed in a band-like region such that the pores 22 of the tipping paper 16 are arranged substantially along the imaginary center line of the region, by means of, for example, a knurling tool. Thus, the embossment 24 provides ruggedness in the entire area of the band-like region around the pores 22 of the tipping paper 16.

If the embossment 24 is formed on only part of the plug wrap paper 18 as in the second embodiment, it is desirable that the edge of the embossment 24 should be at least 1 mm apart from either side of the pore rows, that is, L shown in Fig. 3 should be 1 mm or more, preferably L should be 2 mm or more. If the width is less than 1 mm, it is difficult to create a gap sufficiently between the pores 22 and the plug wrap paper 18.

The pattern of the embossment 24 is not limited to the rhombic grid-patterned grooves shown in Figs. 1 and 2, which is enlargedly shown in Fig. 3, but can be replaced with various patterns. Some of the basic examples are shown in Figs. 4 to 6. Fig. 4 shows an embossment 25 having a pattern of grooves arranged parallel to the rows of the pores 22, Fig. 5 shows an embossment 26 having a pattern of grooves arranged perpendicular to the rows of the pores 22, and Fig. 6 shows an embossment 27 having a pattern of a square grid.

Figs. 7 and 8 show part of cigarettes according to third and fourth embodiments of the present invention, respectively. In Figs. 7 and 8, the elements corresponding to those of the first and second embodiments shown in Figs. 1 and 2 are denoted by the same numerals as those in Figs. 1 and 2, and the description thereof is omitted.

In the third embodiment shown in Fig. 7, the embossment 24 is formed all over the plug wrap paper 18 as in the first embodiment. In the fourth embodiment shown in Fig. 8, the embossment 24 is formed on part of the plug wrap paper 18 as in the second embodiment.

In the third and fourth embodiments, the filter 14 has a so-called dual-filter structure including a first filter element 28 having a length of, e.g., 15 mm and a second filter element 29 having a length of, e.g., 10 mm. The first filter element 28 is generally called an acetate filter which is formed of a fiber filter material such as cellulose diacetate wrapped by its own plug wrap paper and serves as a filter plug. In other words, the first filter element 28 is arranged inside the plug wrap paper 18. The second filter element 29 is generally called a charcoal filter which is formed of a fiber filter material such as cellulose diacetate containing charcoal wrapped

by its own plug wrap paper and serves as a filter plug . In other words, the second filter element 29 is also arranged inside the plug wrap paper 18.

The first and second filter elements 28 and 29 are integrated with each other as one element by the embossed plug wrap paper 18. The plug wrap paper 18 is therefore called "forming paper". The terminologies "filter" and "embossed plug wrap paper" used in this specification include the above-described dual-structure filter, the undermentioned triple-structure filter, and the plug wrap paper (forming paper) used in these filters.

Figs. 9 and 10 show part of cigarettes according to fifth and sixth embodiments of the present invention, respectively. In Figs. 9 and 10, the elements corresponding to those of the first and second embodiments shown in Figs. 1 and 2 are denoted by the same numerals as those in Figs. 1 and 2, and the description thereof is omitted.

In the fifth embodiment shown in Fig. 9, the embossment 24 is formed all over the plug wrap paper 18 as in the first embodiment. In the sixth embodiment shown in Fig. 10, the embossment 24 is formed on part of the plug wrap paper 18 as in the second embodiment.

In the fifth and sixth embodiments, the filter 14 has a so-called triple-filter structure including first and second filter elements 31 and 32, and an intermediate section 33 formed between them. The first and second filter elements 31 and 32 are generally called an acetate filter which is formed of a fiber filter material such as cellulose diacetate wrapped by its own plug wrap paper and serves as a filter plug. In other words, the first and second filter elements 31 and 32 are arranged inside the plug wrap paper 18. The intermediate section 33 is formed by filling a gas absorbent such as activated carbon between the filter elements 31 and 32 separated from each other. The first and second filter elements 31 and 32 and the intermediate section 33 are integrated with one another as one element by the embossed plug wrap paper 18.

In the first to sixth embodiments described above, the tipping paper 16 has two rows of pores 22. However, the present invention is not limited to this tipping paper but can be applied to tipping paper having a larger number of pores, such as porous tipping paper. Where an though embossment is formed on the plug wrap paper in correspondence with some of the pores of the porous tipping paper, the same advantage can be obtained.

The following experiments were conducted by using cigarettes according to above embodiments.

Experiment 1

A cigarette sample B according to the first embodiment shown in Fig. 1 was prepared by using the plug wrap paper 18 on which the embossment 24 (shown in Fig. 3) having the rhombic grid-pattern was formed, and the other regular members. For the sake of comparison, a cigarette sample A having no embossment, but otherwise substantially the same as the sample B was also prepared. The conditions other than the embossment, for example, the material and the production method were common to the samples A and B under the conditions specified in Table 1. Each cigarette had a length of 84 mm, a filter length 25 mm, a circumference of 25 mm, and a draw resistance of the tobacco rod of 80 mm H_2O.

100 samples were prepared for each of the samples A and B, and the filter ventilation of these samples was measured with a ventilation meter. The results are shown in Table 1. In this Table, the air permeability of the tipping paper and plug wrap paper is indicated by the Coresta unit. Further, reference symbol X is an average of the degree of filter ventilation, reference symbol σ is a standard deviation thereof, and reference CV is a variation coefficient expressed by the following equation.

$$CV = (\sigma/X) \times 100\ (\%)$$

Table 1

Material/Permeability (Coresta)								
Tipping Paper		600	600	600	1200	1200	1200	
Plug Wrap Paper (Forming Paper)		2000	4000	10000	2000	4000	10000	
Sample/Filter Ventilation								
A	X	29.2	32.1	33.6	34.5	38.7	44.5	
	σ	2.36	3.52	3.56	2.30	3.60	3.66	
	CV	8.08	10.97	10.59	6.66	9.30	8.22	
B	X	31.4	38.8	42.8	37.3	47.8	53.1	
	σ	1.98	2.37	2.58	2.18	3.01	2.63	
	CV	6.30	6.11	6.02	5.83	6.29	4.95	

As can be seen in Table 1, it was confirmed that the sample B exhibited an increased filter ventilation and a reduced variation therein, as compared with the sample A having no embossment formed.

Experiment 2

A cigarette sample D having a dual-filter structure according to the third embodiment shown in Fig. 7 was prepared by using the plug wrap paper 18 on which the embossment 24 (shown in Fig. 3) having the rhombic

grid-pattern is formed, and the other regular members. For the sake of comparison, a cigarette sample C having no embossment, but otherwise substantially the same as the sample D was also prepared. The conditions other than the embossment, for example, the material and the production method were common to the samples C and D under the conditions specified in Table 2. Each cigarette had a length of 84 mm, a first filter element length of 15 mm, a second filter element length of 10 mm, a circumference of 25 mm, and a draw resistance of the tobacco rod of 80 mm H_2O.

100 samples were prepared for each of the samples C and D, and the filter ventilation of these samples was measured with a ventilation meter. The results are shown in Table 2. In this Table, the air permeability of the tipping paper and plug wrap paper is indicated by the Coresta unit. Further, reference symbol X is an average of the degree of filter ventilation, reference symbol σ is a standard deviation thereof, and reference CV is a variation coefficient expressed by the following equation.

$$CV = (\sigma/X) \times 100 (\%)$$

Table 2

Material/Permeability (Coresta)			
Tipping Paper		600	1200
Plug Wrap Paper (Forming Paper)		4000	4000
Sample/Filter Ventilation			
C	X	33.5	38.4
	σ	5.12	5.56
	CV	15.28	14.47
D	X	45.2	50.0
	σ	3.08	3.72
	CV	6.81	7.44

As can be seen in Table 2, it was confirmed that the sample D exhibited an increased filter ventilation and a reduced variation therein, as compared with the sample C having no embossment formed.

Claims

1. A vented filter cigarette characterized by comprising:
   a filter (14) having a fiber filter material (20) and a plug wrap paper (18) wrapping the fiber filter material;
   a tobacco rod (12); and
   tipping paper (16) having a plurality of pores (22) and connecting said filter and said tobacco rod,
   wherein an embossment (24) is formed in a region of the plug wrap paper (18) corresponding to the pores (22) of said tipping paper (16).

2. The cigarette according to claim 1, characterized in that said embossment (24) is formed in the region having a width of 1 mm or more on either side of the pores (22).

3. The cigarette according to claim 2, characterized in that said embossment (24) is formed in the region having a width of 2 mm or more on either side of the pores (22).

4. The cigarette according to claim 3, characterized in that said embossment (24) is formed almost all over the plug wrap paper (18).

5. The cigarette according to claim 1, characterized in that said embossment (24) has a depth ranging from 0.01 to 1.0 mm.

6. The cigarette according to claim 1, characterized in that said embossment (24) has a depth ranging from

0.02 to 0.06 mm.

7. The cigarette according to claim 1, characterized in that said embossment (24) is formed by a pattern press die, and surface of said embossment (24) having contacted the pattern press die faces said tipping paper (16).

8. The cigarette according to claim 1, characterized in that said embossment (24) has grooves of a grid-pattern.

9. The cigarette according to claim 1, characterized in that said pores (22) constitute a row, and said embossment (24) has grooves of a pattern parallel to the row of the pores.

10. The cigarette according to claim 1, characterized in that said pores (22) constitute a row, and said embossment (24) has grooves of a pattern perpendicular to the row of the pores.

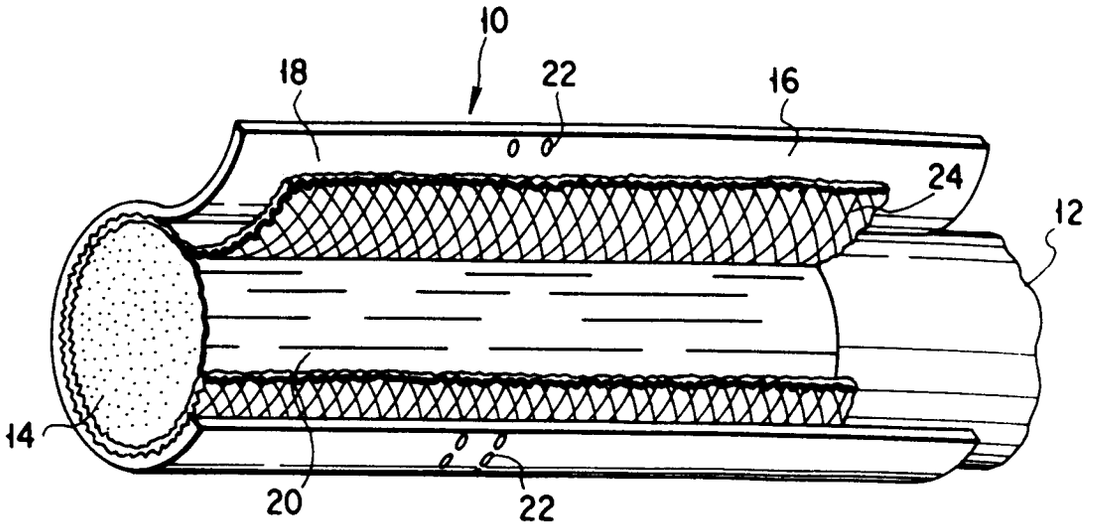

FIG. 1

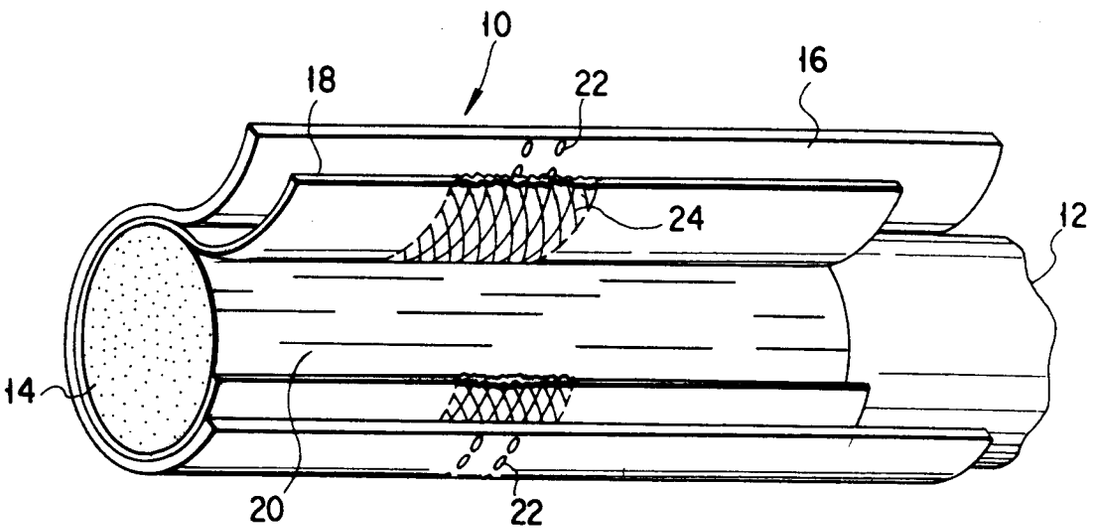

FIG. 2

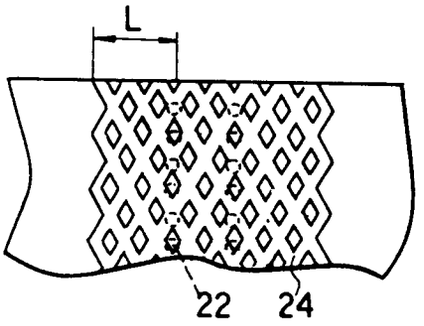

FIG. 3

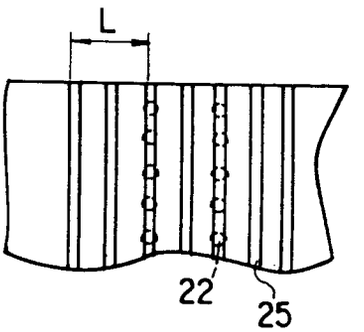

FIG. 4

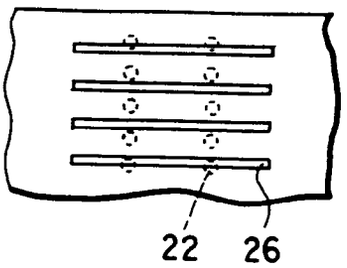

FIG. 5

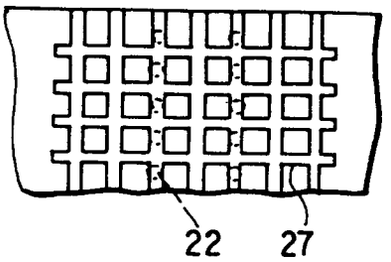

FIG. 6

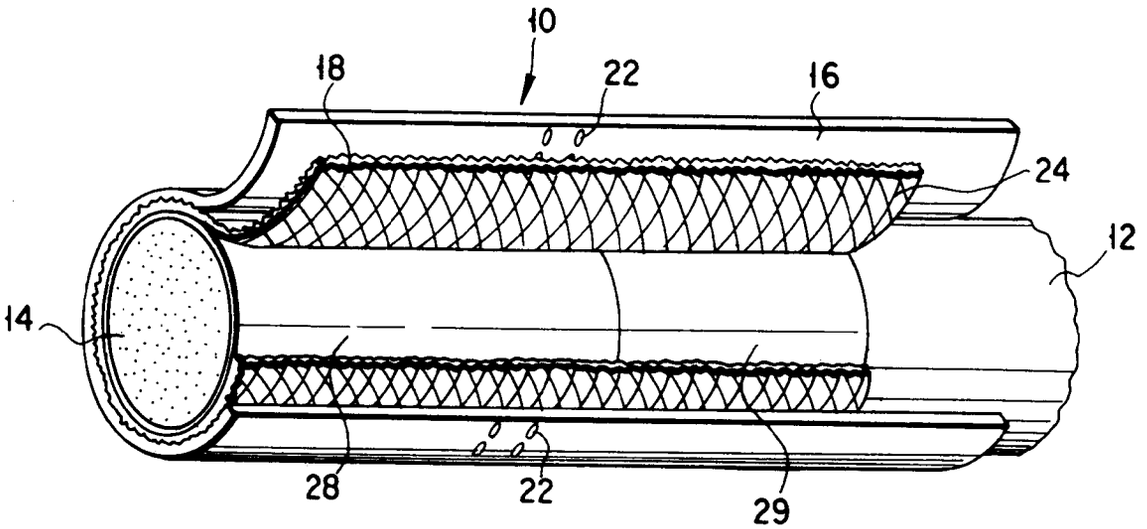

FIG. 7

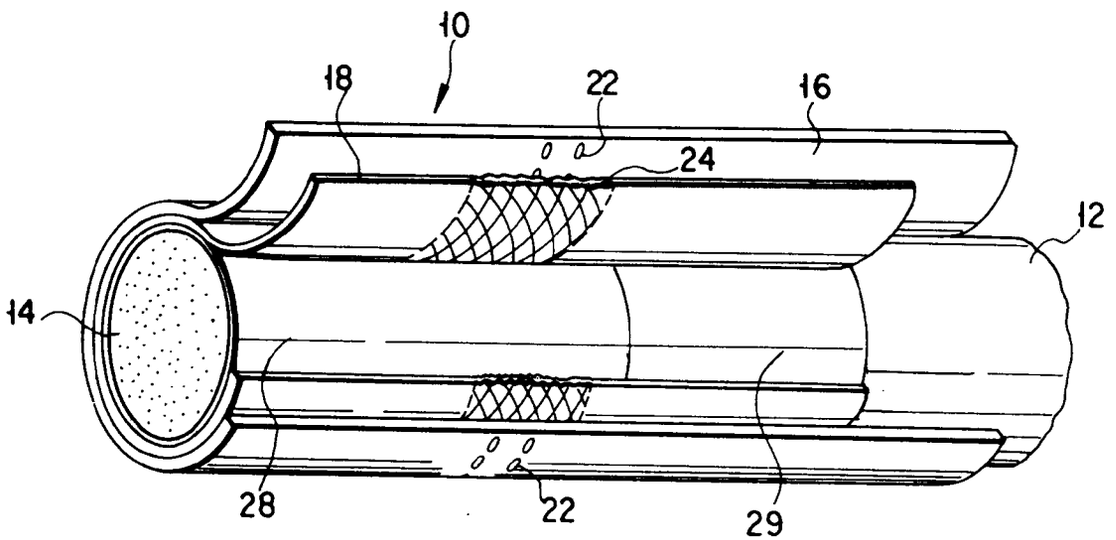

FIG. 8

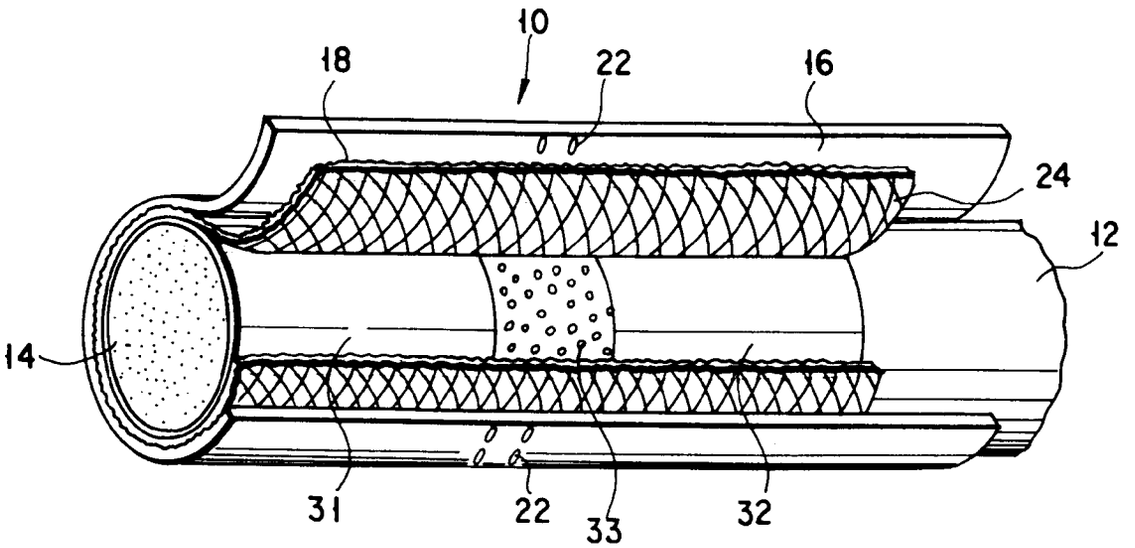

FIG. 9

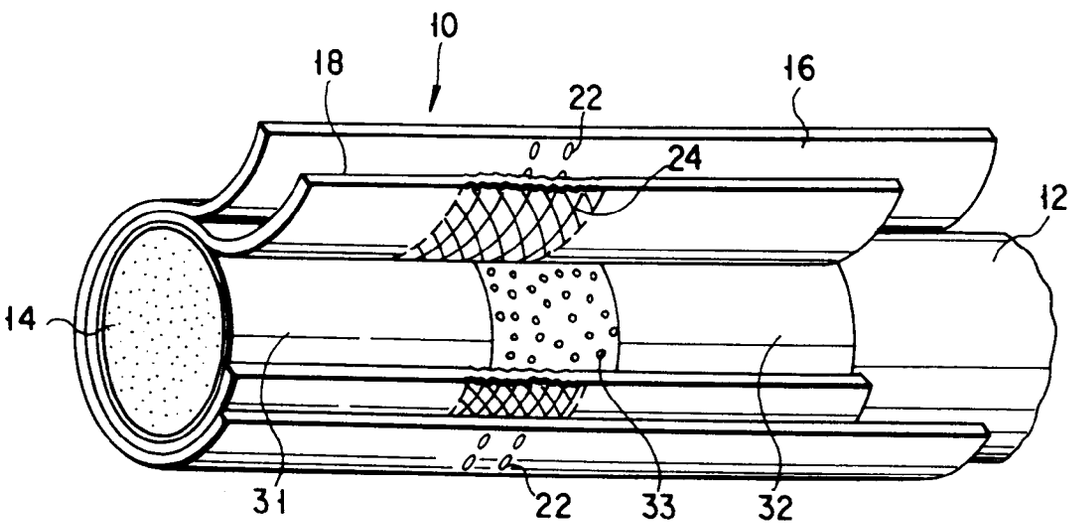

FIG. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 30 5909

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-3 596 663 (SCHULTZ) * the whole document *	1,4,5,10	A24D3/04
X	GB-A-2 133 269 (FILTRONA LIMITED) * page 4, line 6 - line 27; figures 4-6 *	1,4,5,10	
P,A	EP-A-0 536 407 (JAPAN TOBACCO INC.) * the whole document *	1-10	
A	US-A-4 488 563 (KAZUHIKO MORIFUJI) * the whole document *	1	
A	GB-A-2 090 117 (IMPERIAL GROUP LIMITED) * page 2, line 27 - page 3, line 60; figures 1-23 *	1	
A	DE-A-29 43 561 (SIHLPACK) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

A24D
A24C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 November 1993	RIEGEL, R

CATEGORY OF CITED DOCUMENTS

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