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(54) Title: SMOKING ARTICLE

(57) Abstract: The invention relates to a smoking article comprising tobacco, suction resistance and a chemical heat source in conjunction with the tobacco. According to the invention, the heat source comprises a heat chamber and is activated by external excitation. The invention relates further to a method for producing the smoking article.

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SMOKING ARTICLE

FIELD OF THE INVENTION

The invention relates to a smoking article as defined in the preamble of claim 1 and to a method for preparing a smoking article as defined in the preamble of claim 16 and 21.

BACKGROUND OF THE INVENTION

It is very hard for a smoker to give up smoking entirely due to the addictive nature of nicotine in the tobacco. An acceptable alternative has been to arrange the nicotine in some other form or some other way instead of smoking.

Known articles used to replace cigarettes and/or to assist in giving up smoking include chewing gums, plasters, nasal sprays or lozenges with added nicotine.

A problem with these articles is that their use does not provide a smoking experience. Smokers want to have the actual smoking experience, whereby they want e.g. to feel the taste of tobacco and smoke in their mouth.

Patent publication US 7290549 discloses a smokeless smoking article. The smoking article contains tobacco and a smokeless chemical heat source that heats and volatilizes the tobacco providing the tobacco aroma or a tobacco-aromized aerosol. The heat chamber of the heat source comprises a heat cartridge which contains a chemical compound (such as magnesium and iron) capable of producing heat, and an activating solution (such as a solution of potassium chloride and nitrate) separated by a frangible partition. In the article, the heat producing reaction is provided by combining the heat cartridge and the activating solution by breaking the partition.

A problem with the smokeless smoking article is the slow rising of the temperature to the optimum volatilization temperature region of tobacco, which is about 125 to 150°C. In addition, the smoking article requires that two separate chambers be combined to start the heat producing reaction.

Patent publication EP 0371285 discloses a smoking article comprising tobacco, a filter element and a heat source. The heat source contains material (e.g. metal oxides and anhydrous metal sulfates) which is capable of exothermic reaction when contacted with water. The contact between water and the components of the heat source forms heat which warms and volatilizes the tobacco. The water required in the reaction may be injected into the heat source, it may be incorporated in a separate rupturable capsule or it can be incorporated in a solid salt, a salt hydrate.

Patent publication US 5285798 discloses a smoking article comprising tobacco, a filter element and a heat source. The chemical agents of the heat source, which comprise at least two metallic agents, interact electrochemically when contacted with an electrolyte solution, e.g. water. The electrochemical interaction produces heat which warms and volatilizes the tobacco.

A problem with the above-mentioned smoking articles is that the water which provides the exothermic reaction must be separated from the co-reacting compounds in the smoking articles. These smoking articles always require a separate water capsule, water injection or release of water from a hydrous salt to provide the exothermic heat producing reaction.

OBJECTIVE OF THE INVENTION

The objective of the invention is to disclose a new type of smokeless smoking article which is sim-

ple in structure and operation and wherein the heat source quickly reaches the temperature of the optimum volatilization region of tobacco without a separate addition or chamber of liquid/water. A further objective of the smoking article of the invention is to provide a smoking experience to the smoker without combusting tobacco or other ingredients, without outside smoke and without generating any combustion products, such as carbon monoxide. One specific objective of the invention is to alleviate the problems referred to above.

One further objective of the invention is to disclose a method for producing the smoking article.

SUMMARY OF THE INVENTION

The smoking article according to the invention is characterized by what has been presented in claim 1.

The method for producing the smoking article according to the invention is characterized by what has been presented in claim 16 and 21.

The smoking article according to the invention comprises tobacco, suction resistance and a chemical heat source in conjunction with the tobacco. The chemical heat source comprises a heat chamber formed from one continuous volume and is activated by external thermal and/or oxygen excitation. The chemical heat source is based on exothermic reaction.

The heat chamber may be closed.

The heat which is forming in the heat chamber reaches the preferred volatilization region of 125 to 150°C of tobacco quickly and keeps the temperature in this region. The heat volatilizes the aroma and nicotine from the tobacco. The tobacco aroma and other active agents, such as nicotine, can be best released

without combustion or production of smoke in the preferred volatilization region.

The heat chamber contains chemical compounds which are capable of producing heat. The chemical compounds normally include a metal/metals and/or a strong oxygen-containing oxidizer. The metal may be a transition metal, alkali metal, alkali earth and/or a metal of some other group. Examples of typical applicable metals include iron (Fe), aluminum (Al), magnesium (Mg), lithium (Li), cobalt (Co), platinum (Pt), palladium (Pd), copper (Cu), silicon (Si), preferably iron. The strong oxygen-containing oxidizer may be a metal oxide, metal peroxide and/or metal oxide salt, for example potassium permanganate, manganese dioxide, lead-3-tetraoxide, barium peroxide, bromates, chlorates etc. The strong oxygen-containing oxidizer is preferably potassium permanganate ($KMnO_4$) or oxygen.

The chemical compounds are selected so as to produce a safe reaction and so that the temperature produced by the reaction rises quickly to the maximum temperature which is not too high, and so that the heat production in the reaction lasts for a long time.

In a preferred embodiment of the invention the chemical compounds are anhydrous.

The heat chamber may also contain a reaction catalyzing agent, for example carbon.

It is also possible to add inert filler material in conjunction with the chemical starting compounds in the heat chamber. The inert filler material may also contain typical additives, such as binder, which may for example accumulate heat.

The heat chamber is made from a material which holds the temperatures generated by the heat chamber reaction, and typically temperatures of about 220°C. Polymer-, paper-, natural fiber -, ceramic-, glass- and/or metal-based materials, which stand the

temperature and pressure generated in the reaction and the compounds formed in the reaction, can be used for making the heat chamber. The polymer-based materials may include polypropylene, polyethylene, other polyolefins, polyesters and/or other equivalent polymeric materials and/or mixtures thereof. The paper-based material may include paper and/or coated paper and/or other material based on natural fibers.

The material of the heat chamber is impermeable to oxygen when oxygen is used as the oxidizer.

The heat chamber may be provided with a heat insulating and/or heat accumulating layer. The heat chamber is preferably provided with an insulating layer when it is made from heat-conducting material, such as for example aluminum. The insulating layer may be made from natural or synthetic polymeric material, such as textile, paperboard or polystyrene or from ceramic, glass- or metal-based material. The heat accumulating layer enables to obtain steady and longer-lasting optimum heat. The heat accumulating layer may be made for example from wax.

The external excitation which activates the heat source is heat and/or oxygen. The heat is provided by fire for example using a match or a lighter, by electricity using for example an electrically heated resistance wire, by a detonator and/or other starting heat providing excitation. The applied oxygen may normally be oxygen contained in the air contacted with the heat source for example by breaking the wall of the airtight heat chamber which is impermeable to oxygen, by removing, in a smoking article covered by a protective film/package that is impermeable to oxygen, this film/package, and/or by contacting the heat chamber which is impermeable to oxygen with air in an equivalent manner.

In one preferred embodiment of the invention, the heat source contains iron and potassium permanganate as the chemical compounds. Reaction between the staring materials is initiated by introducing starting heat to the mixture by a match, lighter, detonator and/or resistance wire. Oxygen is not required in starting the reaction.

Reaction rate and heat produced in the reaction can be adjusted by weight ratios of the chemical compounds. The weight ratio is also selected according to thermal conductivity of the coating material in the heat chamber.

In one preferred embodiment of the invention, the weight ratio between potassium permanganate and iron ranges from 5/95 to 95/5, preferably from 25/75 to 50/50 and is more preferably 30/70.

In a further preferred embodiment of the invention, the heat chamber contains iron, sodium sulfide and carbon, which are contacted with each other in the presence of oxygen or air according to the following reaction:

$$Na_2S \times H_2O + C + Fe + CaO + O_2 \rightarrow$$
$$Na_2SO_4 + CaCO_3 + Fe_nO_m \text{ (iron oxides)}$$

By the catalyzing effect of carbon, iron heats up and raises further the heat produced in the reaction. The sodium sulfide may be hydrous or anhydrous. Calcium oxide reacts with the sodium suplhide crystal water and temperature produced in the reaction raises more quickly. Material of the heat chamber is impermeable to oxygen.

The tobacco may include one type of tobacco and/or a mixture of tobacco, which may have been processed by the raw tobacco processing methods known in the tobacco industry. The tobacco and/or the mixture

thereof may include tobacco which has been processed in many different ways, such as tobacco fine cut, tobacco strands, tobacco flakes, tobacco dust, processed tobacco, extruded tobacco, reconstructed tobacco, tobacco extracts and equivalent processed forms of tobacco used in the tobacco industry. Tobacco extracts include for example tobacco essences, aromatic oils of tobacco, spray-dried and freeze-dried tobacco extracts and the corresponding tobacco extracts used in preparing the tobacco raw material.

Also flavoring agents, such as menthol, vanillin, cocoa, licorice, cinnamic aldehyde and the like, as well as tobacco aroma modifiers and other modifiers, additives and fillers used in producing tobacco, and nicotine may be added to the tobacco.

The amount of nicotine included in the tobacco of the smoking article is typically 0.1 to 1.0mg.

Suction resistance of the smoking article provides resistance when drawing on the cigarette, and the smoker is, in this manner, able to use the sucking rhythm to control his or her smoking rhythm. Suction resistance is preferably disposed at one end of the smoking article.

In a preferred embodiment of the invention, suction resistance is a filter which prevents the tobacco from being contacted with the smoker and/or filters any harmful products which are formed during volatilization of the tobacco, such as tar.

The smoking article may further comprise a heat-providing element in conjunction with the heat source used to activate the heat source. The heat-providing element may be a detonator whereby the heat chamber is activated for example by snapping the smoking article, or a resistance wire, for example wolfram, which heats up intensely when current is being

conducted to the wire, a fuse and/or a firing tape to introduce the starting heat to the heat chamber.

The smoking article may further comprise a cooling part which cools down the fume drawn in and breathed by the user and formed by volatilization of the tobacco. The cooling part also enables one to adjust the amount of fume deriving from the fine cut tobacco. The flow section of the cooling part is equal or substantially smaller than the flow section of the smoking article. Adjusting the cross-section of the cooling part to be smaller than the cross-section of the smoking article reduces the amount of fume to be drawn in and extends the time of use of the smoking article. The cooling part is preferably disposed between suction resistance and the tobacco.

Material of the cooling part includes any heat insulating and resistant material, preferably heat resistant plastic.

In one embodiment of the invention, the heat chamber is surrounded by the tobacco in the smoking article. The heat chamber may be a bar- or spiral-shaped, accordion-shaped or waved structure or one which has been folded in any other form. By shaping the structure of the heat chamber to the above-mentioned form it is possible to fit a longer heat chamber in the smoking article. A longer heat chamber provides steadier and longer lasting optimum heat and longer time of use for the smoking article.

In a further embodiment of the invention, the tobacco is surrounded by the heat chamber in the smoking article. The heat chamber is tubular.

The smoking article may be coated with tobacco paper and/or other material which is similar to tobacco paper.

Surface of the tobacco paper may be treated with a colorant, such as thermochrome pigment which

changes color by the effect of heat. This makes the cigarette look like burning.

The smoking article may be in the form of a substantially tubular/bar-shaped object of a substantially round cross-section. The cross-section may also be angular or flattened. The smoking article is preferably in the form of a traditional cigarette.

The smoking article is produced by

forming the heat chamber by combining the chemical compounds and enclosing them inside the heat chamber,

contacting a layer of tobacco with the heat chamber,

disposing suction resistance at one end of the smoking article, and

coating the heat chamber contacted with the layer of tobacco.

The heat chamber may be formed as a structure which is either substantially bar-shaped, spiral, accordion-shaped, waved or folded in any other form, or as a tubular structure.

The layer of tobacco can be disposed to surround the heat chamber which is substantially bar-shaped, spiral, accordion-shaped, waved or folded in any other form, or inside the substantially tubular heat chamber.

Where required, a heat insulating and/or accumulating layer is disposed between the heat chamber and the tobacco.

An insulating layer may be disposed, if necessary, onto the layer of tobacco or the heat chamber before coating or in conjunction with the coating. The smoking article is typically coated with tobacco paper.

If desired, a cooling part may be disposed at one end of the smoking article. The cooling part is

preferably disposed between suction resistance and the tobacco.

The smoking article according to the invention wherein the tobacco is surrounded by the heat chamber can also be produced by gluing/fixing the reaction starting materials, the chemical compounds, on a planar structure which is rolled to form a tubular structure. A protective film, insulator and/or accumulating layer may be disposed onto the starting materials for example by lamination. The tobacco is disposed inside or outside the tubular structure. The planar structure may be formed by tobacco paper, an insulating layer and/or heat-accumulating layer.

Production of the heat source requires a substantially oxygen-free atmosphere including for example nitrogen, carbon dioxide or argon gas when oxygen is used as the external heat source excitation. The production is carried out as a batch process. In this case, the chemical compounds are mixed and the heat chamber seamed in an entirely closed oxygen-free space filled with nitrogen or argon gas. Airtightness should be maintained from production to the user. The smoking article may be packed in an airtight individual pack.

The smoking article according to the invention is immediately ready to use when the smoker activates the exothermic heat chamber reaction by the starting heat or oxygen. The temperature of the heat chamber quickly rises to the volatilization temperature of tobacco and volatilizes nicotine and aromas of the tobacco and/or flavoring agents added to the tobacco. The smoker is able to sense the volatilized nicotine and aromas of the tobacco and have the smoking experience without smoke when drawing in tobacco through the filter. The heat chamber produces heat sufficiently and quickly to volatilize the components of the tobacco while maintaining the temperature in

the preferred volatilization region for minutes. The smoking article and its heat chamber are simple is structure and operation. No combining of chemical compounds with water for example by injecting water into the heat chamber, breaking a separate liquid capsule or using hydrous salts is required in the production of energy in the heat chamber. When handled, the smoking article feels the same as a real smoking article, such as a cigarette or cigar, and has the same visual appearance. In addition, the smoking article has good storage endurance. Reaction products of the smoking article are not toxic and can be safely disposed of with normal household waste.

LIST OF FIGURES

Fig. 1 shows a smoking article according to the invention as seen from the side,

Fig. 2 shows a second smoking article according to the invention as seen from the side,

Fig. 3 shows a third smoking article according to the invention as seen from the side,

Fig. 4 shows a cross-section of the smoking article according to the invention,

Fig. 5 the effect of the chemical compounds in the heat chamber and their weight ratio on the heating rate, maximum temperature and temperature changes in time.

Fig. 6 shows a fourth smoking article according to the invention as seen from the side,

Fig. 7 shows a fifth smoking article according to the invention as seen from the side, and

Fig. 8 shows a sixth smoking article according to the invention as seen from the side.

DETAILED DESCRIPTION OF THE INVENTION

The smoking article (1) according to Fig. 1 is formed as a cigarette. The smoking article comprises a substantially bar-shaped heat source (2), which is a closed heat chamber surrounded by a layer of tobacco (3). At one end of the smoking article there is suction resistance (4) which is normally a filter. The heat source (2) contains chemical compounds which provide an exothermic reaction, preferably an oxidizable metal Fe and a strong oxygen-containing oxidizer $KMnO_4$. The compounds of the heat chamber may be present in an inert filler. The smoking article (2) has been coated with tobacco paper (7).

In the smoking article (1) according to Fig. 2 tobacco (3) is surrounded by the bar-shaped closed heat source (2). In other respects, the smoking article is similar to that described above.

In the smoking article (1) of Fig. 3 and 4 a heat accumulating layer (5) has been disposed between the heat source (2) and the layer of tobacco (3), releasing heat more steadily and maintaining the temperature for a longer period of time in the desired volatilization region of tobacco. The heat accumulating layer (5) is a layer that contains for example metal, such as aluminum. Further, the layer of tobacco (3) has been coated with a heat insulating layer (6), for example a polystyrene-based material, which has low ability of conducting heat, so that the cigarette would not feel too hot in the hand.

Instead of the heat accumulating layer (5) there may be disposed, in the position of the layer or in conjunction with the layer, a heat insulating layer, if the material of the heat chamber is heat conductive and/or the reaction of the heat chamber produces heat which exceeds the volatilization temperature of tobacco.

Alternatively, in the smoking article according to Fig. 3 and 4, the heat source (2) may be disposed in the position of the tobacco (3) and the tobacco (3) in the position of the heat source (2). In this case, the tobacco is surrounded by the heat source and the heat accumulating layer (5) is disposed between them. In addition, the heat source is coated by a heat insulating layer (6).

In the smoking article (1) according to Fig. 6 the bar-shaped heat source (2) has been bent to a spiral form and the heat source is surrounded by the tobacco (3). A longer heat chamber keeps the temperature longer in the desired volatilization region.

In the smoking article (1) according to Fig. 7 the bar-shaped heat source (2) has been folded in accordion form and the heat source is surrounded by the tobacco (3). Disposed between suction resistance (4) at one end of the smoking article and the part which forms the tobacco (3) and the heat chamber (2) there is a cooling part (8) which is smaller in cross-section than the smoking article and cools down the fume that passes through it volatilizing from the tobacco, reducing the amount of fume drawn in and thereby extending the time of use of the smoking article. The cooling part (8) is normally made from heat resistant plastic. The section (9) which surrounds the cooling part (8) normally contains air.

The cross-section of the cooling part (8) may also be equal to that of the smoking article, in which case the cooling part merely cools down the fume that volatilizes from the tobacco to be suitable for the user.

In the smoking article (2) according to Fig. 8 the heat chamber (3) has been formed by combining three bar-shaped heat chambers. A longer heat chamber provides longer time of use.

Example 1

The effect of the chemical compounds, starting materials, of the heat chamber on the exothermic reaction was tested in the experiments. Weight ratios of different starting materials were used in the tests to establish their effect on the heating rate, maximum temperature and temperature changes in the course of time. The heating tests were conducted with the reaction of potassium permanganate and iron in weight ratios of 30/70 and 70/30. A starting material mixture of 1.0g was used in the tests. The reactions were conducted by positioning the starting materials in aluminum or glass tubes, whereupon the reaction was actuated by an electric fuse. The temperature was followed by a thermoelement attached to the tube.

The tubes fitted inside the fine cut tobacco part of a normal-size cigarette in such manner that space was left for the fine cut tobacco. The internal and external diameter and wall thickness of the aluminum and glass tubes were: Al 4.75mm, 4.05mm and 0.35mm: glass 5.06mm, 3.06mm and 1mm. The tube length was 55mm, which is suitable for a rolling machine with filter.

The results of the conducted heating tests are shown in Fig. 5.

The results indicate that in all tests the temperature rose to the optimum volatilization region of tobacco in less than 20 seconds.

The weight ratio of 70/30% $KmnO_4$/Fe produced clearly too high a temperature, in particular if one intends to use paper as the wrapper. This weight ratio requires the use of an insulating layer.

The weight ratio of 30/70% $KmnO_4$/Fe was compared in the glass tube, aluminum tube and insulated

glass tube. According to the results, the glass tube kept the heat longer than the aluminum tube and the maximum temperature rose about 50°C higher.

Insulating the glass tube with an aluminum foil covered by a thin fabric delayed the time of reaching the maximum temperature for a few dozen seconds. Reaching the volatilization region was delayed by about 10s, but the temperature was maintained above this region 2.5 times longer than with the non-insulated tube, i.e. for about 2 minutes.

Example 2

The functionality of the smokeless smoking article was tested in the experiment. Insulated glass tube was used as the heat chamber structure. The structure was similar to that of Example 1. The thickness of the insulating layer formed by the aluminum foil and the fabric was 0.56mm.

1.0g of a mixture of potassium permanganate and iron (30/70) was introduced into the heat chamber.

The smoking article was produced by placing the heat chamber into a rolling machine with tobacco paper, filter and tobacco fine cut and by rolling the smoking article.

Reaction starting heat was introduced to the smoking article by a resistance wire which was heated by conducting electric current to the wire.

After the test, the smoking article was examined visually and it was observed that tar had been separated from the tobacco onto the paper surface. From the filter it was visible that the heat chamber reaction had separated ingredients from the fine cut tobacco. There was no observed burning or blackening of the fine cut tobacco in the cigarette when opened after the test.

The test proved that by the contrived heat chamber composition and structure it is possible to volatilize the tobacco aroma and nicotine from the tobacco in the smoking article.

Example 3

The test comprised analyzing the volatile elements of the smokeless smoking article according to the invention, a normal cigarette and a commercial smokeless smoking article: nicotine, carbon monoxide (CO) and tar. The smoking article according to Example 2 was used as the smokeless smoking article and Philip Morris "Gold" Marlboro as the normal cigarette. A smoking article according to Woodleaf Corporation brand Aeros was used as the commercial smokeless reference smoking article, which is based on a plastic tube that has been seamed at both ends and contains a matrix including nicotine and tobacco aroma. The smoker cuts off the ends of the plastic tube, and nicotine and tobacco aroma are released into the mouth and organs of the smoker when drawing in air through the tube.

Nicotine and tar components were determined by a GC-MS-apparatus and carbon dioxide by a GC-TDC-apparatus. Two parallel assays were conducted for the cigarettes. The results of the smoking article according to the invention (SAI) have been scaled to the amount of fine cut tobacco in a normal cigarette. The results have been assembled in Table 1.

Table 1

	SAI	Marlboro	Aeros
Nicotine (mg)	0.125	1.7 ± 0.5	< 0.1
- indicated		0.6	0.05
Tar (mg)	-	9.4 ± 0.3	-

- indicated		8.0	
Carbon monoxide (mg)	0.5	12.0 ± 0.7	-
- indicated		9.0	

The invention is not limited merely to the exemplary embodiments referred to above; instead, many variations are possible within the scope of the inventive idea defined by the claims.

CLAIMS

1. A smoking article, comprising:

tobacco;

suction resistance;

chemical heat source in conjunction with the tobacco, characterized in that the heat source comprises a heat chamber formed by one continuous volume and that the heat source is activated by external heat and/or oxygen excitation.

2. The smoking article according to claim 1, characterized in that the heat chamber is closed.

3. The smoking article according to claim 1 or 2, characterized in that the heat chamber contains chemical compounds which are capable of producing heat.

4. The smoking article according to any one of the preceding claims, characterized in that the chemical compounds include a metal/metals, such as Fe, Al, Mg, Li, Co, Pt, Pd, Cu, Si and/or a strong oxygen-containing oxidizer.

5. The smoking article according to any one of the preceding claims, characterized in that the material of the heat chamber is a polymer-, paper-, natural fiber -, ceramic-, glass- and/or metal-based material.

6. The smoking article according to any one of the preceding claims, characterized in that the heat chamber is provided with a heat insulating and/or accumulating layer.

7. The smoking article according to any one of the preceding claims, characterized in that the chemical compounds in the heat chamber include iron and potassium permanganate, their reaction being activated by heat.

8. The smoking article according to any one of the preceding claims, characterized in that the weight ratio between the potassium permanganate and iron ranges from 5/95 to 95/5, preferably from 25/75 to 50/50 and is more preferably 30/70.

9. The smoking article according to any one of claims 1 to 6, characterized in that the chemical compounds in the heat chamber include Fe, Na_2S, C and CaO, their reaction being activated by oxygen.

10. The smoking article according any one of the preceding claims, characterized in that the suction resistance is a filter.

11. The smoking article according to any one of the preceding claims, characterized in that the article further comprises a starting heat providing element.

12. The smoking article according to any one of the preceding claims, characterized in that the starting heat providing element is a detonator, resistance wire, fuse and/or firing tape.

13. The smoking article according to any one of the preceding claims, characterized in that the article further comprises a cooling part.

14. The smoking article according any one of the preceding claims, characterized in that the heat chamber is surrounded by the tobacco.

15. The smoking article according to any one of claims 1 to 13, characterized in that the tobacco is surrounded by the heat chamber.

16. A method for producing the smoking article, the method comprising the steps of:

forming the heat chamber by combining the chemical compounds and enclosing them inside the heat chamber,

contacting a layer of tobacco with the heat chamber,

disposing suction resistance at one end of the smoking article, and

coating the heat chamber contacted with the layer of tobacco.

17. The method according to claim 16, characterized in that a heat insulating and/or accumulating layer is disposed between the heat chamber and the tobacco.

18. The method according to claim 16 or 17, characterized in that an insulating layer is disposed onto the tobacco or the heat chamber before coating or in conjunction with the coating.

19. The method according to any one of claims 16 to 18, characterized in that a cooling part is disposed at one end of the smoking article before coating or in conjunction with the coating.

20. The method according to claim 19, characterized in that the cooling part is disposed between suction resistance and tobacco.

21. A method for producing the smoking article, the method comprising the steps of:

fixing the chemical compounds onto a planar structure,

rolling the structure to form a tubular structure,

disposing the tobacco inside or outside the tubular structure.

22. The method according to claim 21, characterized in that the planar structure includes tobacco paper, an insulating layer and/or a heat accumulating layer.

23. The method according to claim 21 or 22, characterized in that a protective film, in-

sulating and/or accumulating layer is disposed onto the chemical compounds preferably by lamination.

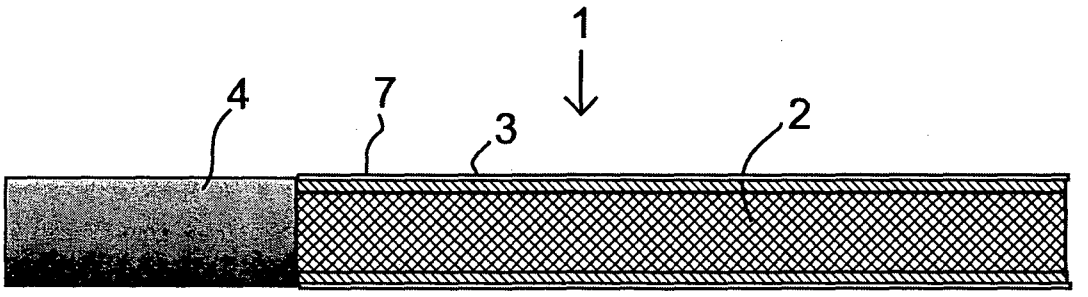

Fig. 1

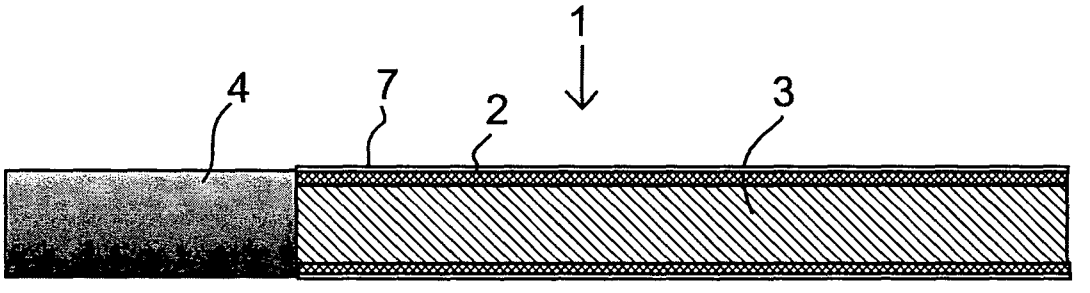

Fig. 2

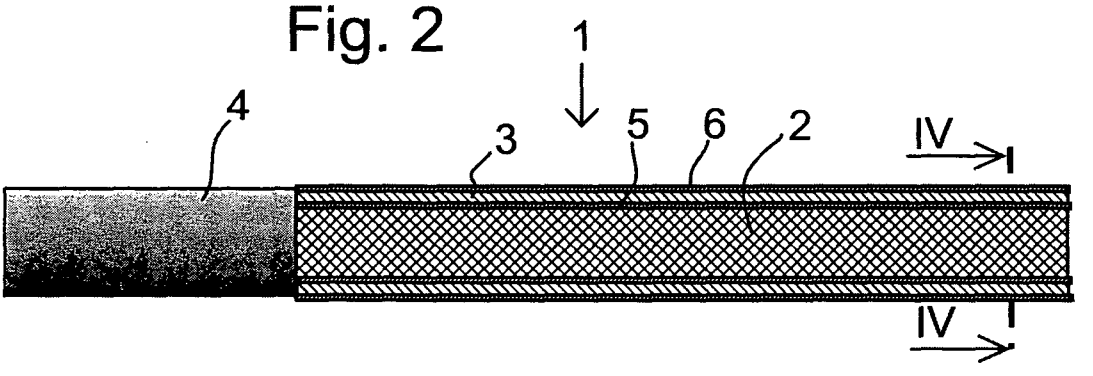

Fig. 3

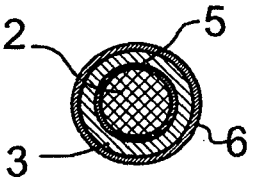

Fig. 4

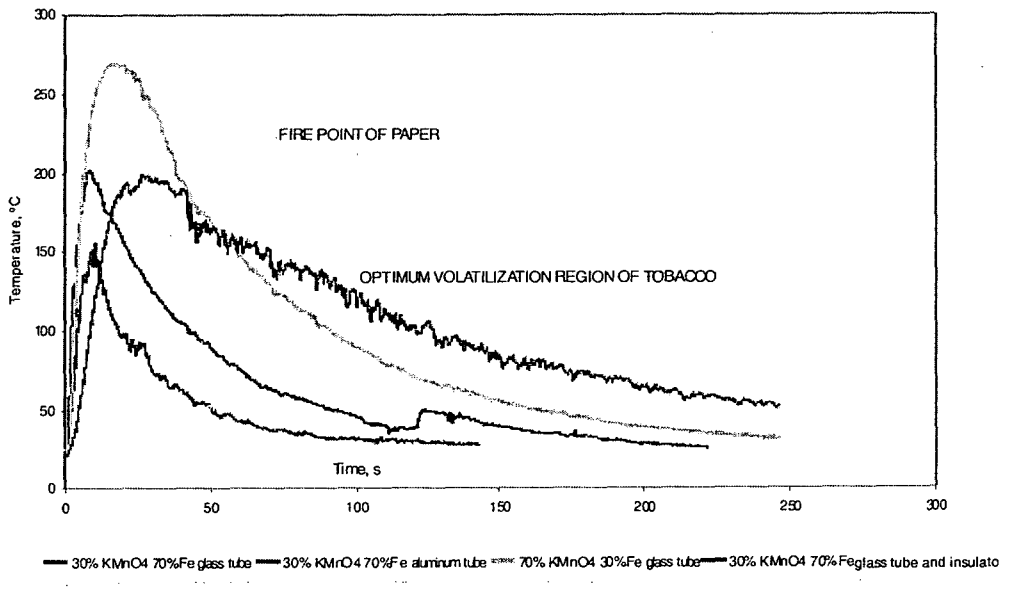
300
250
200
150
100
50
0
Temperature, °C
FIRE POINT OF PAPER
OPTIMUM VOLATILIZATION REGION OF TOBACCO
Time, s
0
50
100
150
200
250
300
30% KMnO4 70%Fe glass tube
30% KMnO4 70%Fe aluminum tube
70% KMnO4 30%Fe glass tube
30% KMnO4 70%Fe glass tube and insulato

Fig. 5

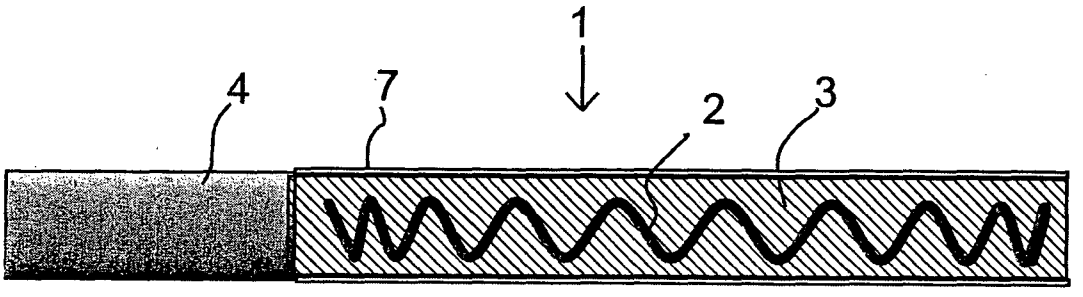

Fig 6

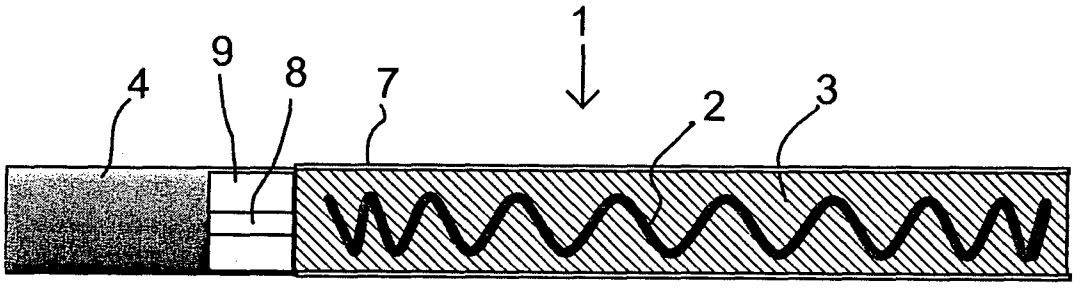

Fig 7

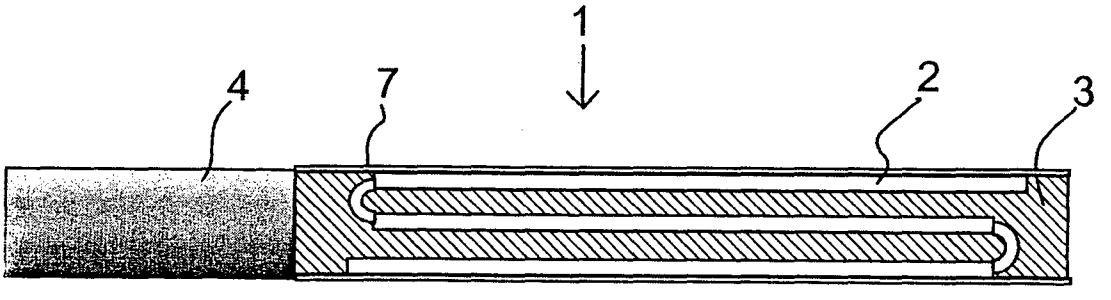

Fig 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2009/050056

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A24D, A24F, C09K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI, CAPLUS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	EP 0371285 A2 (REYNOLDS TOBACCO CO R) 06 June 1990 (06.06.1990)	
X	column 3, lines 27-41; column 6, line 21 - column 7, line 35, figure 1	1, 3-5, 10-12, 14, 15
A		7, 8
	GB 1033674 A (BATTELLE MEMORIAL INSTITUTE) 22 June 1966 (22.06.1966)	
X	page 1, lines 15-55; page 2, lines 42-60; page 5, lines 22-43; page 6, lines 97-108; claims 15 and 19	1-4, 6, 13, 14
A		9
A	US 4255157 A (YAMAGUCHI DENJIROU et al.) 10 March 1981 (10.03.1981), the abstract; column 6, lines 16-20	9
A	EP 0244837 A1 (ASAHI CHEMICAL IND) 11 November 1987 (11.11.1987)	7, 8

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 July 2009 (13.07.2009)	14 July 2009 (14.07.2009)

Name and mailing address of the ISA/FI
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2009/050056

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See extra sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-15

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2009/050056

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
EP 0371285 A2	06/06/1990	BR 8906033 A	19/06/1990
		NO 894754 A	31/05/1990
		DK 602689 A	31/05/1990
		DD 298347 A5	20/02/1992
		JP 2190171 A	26/07/1990
		CN 1043076 A	20/06/1990
		PH 26388 A	02/07/1992
		AU 4456689 A	07/06/1990
		AU 608499B B2	28/03/1991
		CA 2002221 A1	31/05/1990
		US 4955399 A	11/09/1990
GB 1033674 A	22/06/1966	NL 6400344 A	20/07/1964
		AT 266669B B	25/11/1968
		FR 1388144 A	05/02/1965
		ES 295378 A1	01/06/1964
		DE 1432618 A1	16/10/1969
		CH 421786 A	30/09/1966
		BE 642543 A	04/05/1964
		LU 45180 A1	09/03/1964
US 4255157 A	10/03/1981	FR 2436806 A1	18/04/1980
		AU 5101979 A	27/03/1980
		AU 524350B B2	09/09/1982
		IT 1193808 B	24/08/1988
		IN 150810 A1	18/12/1982
		ES 484602 A1	01/09/1980
		BR 7905987 A	08/07/1980
		DE 2937721 A1	10/04/1980
		CA 1129650 A1	17/08/1982
		AR 224745 A1	15/01/1982
		GB 2030595 A	10/04/1980
		ZA 7904848 A	24/09/1980
		JP 55043132 A	26/03/1980
EP 0244837 A1	11/11/1987	KR 940001060B B1	12/02/1994
		JP 63152572 A	25/06/1988
		US 4819612 A	11/04/1989
		JP 63051491 A	04/03/1988
		JP 62261859 A	14/11/1987

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2009/050056

CLASSIFICATION OF SUBJECT MATTER

Int.Cl.
A24D 1/18 (2006.01)
A24F 47/00 (2006.01)

The application lacks unity within the meaning of Rule 13.1 PCT. According to Rule 13.1 PCT, an application shall relate to one invention only or to a group of inventions so linked as to form a single general inventive concept.

Further, according to Rule 13.2 PCT, the requirement of unity of invention is fulfilled only when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. The expression “special technical features” means those technical features that define a contribution which each of the claimed inventions, considered as a whole, makes over the prior art.

The independent claim 1 relates to a smoking article comprising tobacco, suction resistance, and chemical heat source in conjunction with the tobacco, c h a r a c t e r i z e d in that the heat source comprises a heat chamber formed by one continuous volume and that the heat source is activated by external heat and/or oxygen excitation.

The independent claim 16 relates to a method for producing a smoking article, comprising the steps of:
forming a heat chamber by combining chemical compounds and enclosing them inside the heat chamber,
contacting a layer of tobacco with the heat chamber,
disposing suction resistance at one end of the smoking article, and
coating the heat chamber contacted with the layer of tobacco.

The independent claim 21 relates to a method for producing a smoking article, comprising the steps of:
fixing chemical compounds onto a planar structure,
rolling the structure to form a tubular structure, and
disposing the tobacco inside or outside the tubular structure.

The technical feature common to the inventions according to claims 1 and 16 is the smoking article comprising tobacco, suction resistance, and, in conjunction with the tobacco, a chemical heat source in a heat chamber. This feature is disclosed in the publication EP 371285 A2 (R.J. REYNOLDS TOBACCO COMPANY) 06.06.1990 (see figures 1 and 2 with the relevant passages in the description). Accordingly, it is prior art and not a special technical feature in the sense of Rule 13.2 PCT.

The technical feature common to the inventions according to claims 16 and 21 is the method for producing the smoking article, containing chemical compounds not in admixture with tobacco. This feature is disclosed in the publication EP 371285 A2 (R.J. REYNOLDS TOBACCO COMPANY) 06.06.1990 (see column 3, lines 31-39). Accordingly, it is prior art and not a special technical feature in the sense of Rule 13.2 PCT.

The International Searching Authority considers that this international application contains at least the following inventions or groups of inventions, which are not so linked as to form a single general inventive concept under Rule 13.1 PCT and Rule 13.2 PCT:

1. The smoking article according to claims 1-15,
2. The method according to claims 16-20, and
3. The method according to claims 21-23.