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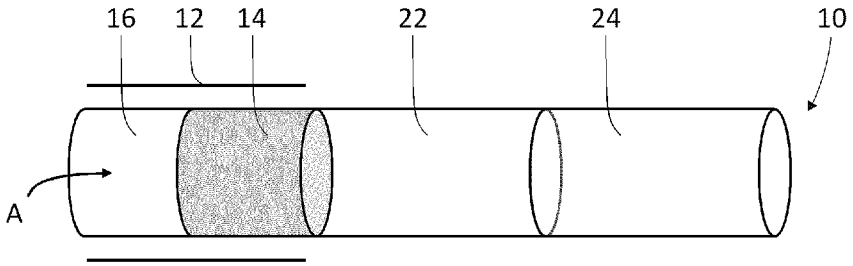


Fig. 1

(57) **Abstract:** An aerosol generating article (10) for a non-combustion aerosol generating device comprises an air inlet end forming an upstream end and a mouth end forming a downstream end of the article (10) and an aerosol generating substrate positioned between the upstream end and the downstream end, wherein the substrate comprises a first aerosol generating portion (14) and at least one second aerosol generating portion (16) positioned closer to the upstream end than the first aerosol generating portion (14) so that the air flow is configured to pass through the second aerosol generating portion (16) before passing through the first aerosol generating portion (14), wherein the first aerosol generating portion (14) comprises tobacco material and the second aerosol generating portion (16) comprises a foam containing foam-forming agent and aerosol forming agent in a non-free liquid state in the foam configured to produce aerosol upon heating and is positioned closer to the upstream end than any aerosol generating portion (14) comprising tobacco material.

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AEROSOL GENERATING ARTICLE

Technical Field

The invention relates to an aerosol generating article.

Technical Background

Aerosol generating articles have become popular as a replacement for conventional smoking articles. Such articles are expected by consumers to contain nicotine and/or tobacco and at the same time produce visible vapor.

In this context, US 11 083 215 B2 is related to a heat-not-burn tobacco product, in which a first heating section distal from a mouth end contains a liquid aerosol precursor existing as a free liquid in an unbound form. A similar device is derivable from EP 3 818 866 A1.

Nevertheless, there remains a need for an aerosol generating article, which is improved with regard to handling convenience.

Summary of the Invention

Therefore, the present invention provides an aerosol generating article, which is improved with regard to handling convenience.

This is achieved by the subject matter of claim 1.

Accordingly, the novel aerosol generating article is configured for being heated but not burned and comprises an air inlet end forming an upstream end and a mouth end forming a downstream end of the article and an aerosol generating substrate positioned between the upstream end and the downstream end.

The substrate comprises a first aerosol generating portion and at least one second aerosol generating portion positioned closer to the upstream end than the first aerosol generating portion so that the air flow is configured to pass through the second aerosol generating portion before passing through the first aerosol generating portion,

wherein the first aerosol generating portion comprises tobacco material and the second aerosol generating portion comprises a foam containing aerosol forming agent in a non-free liquid state in the foam configured to produce aerosol upon heating and is positioned closer to the upstream end than any aerosol generating portion comprising tobacco material.

By means of the aerosol generating portion comprising tobacco material, tobacco taste and nicotine can be delivered, and by means of the second aerosol generating portion, the tobacco material can be infused. In this context, the foam contained in the aerosol generating reservoir can also be called a mousse or an e-mousse as it carries e-liquid similar to liquid of e-cigarettes. As a side aspect, the tobacco substrate is essentially solid, preferably formed as a gathered sheet, shreds, strips, granules and combinations thereof and the like with high tobacco content, preferably tobacco is in the form of agglomerated powder, and is at least preferably neither a tobacco mousse nor a capillary tobacco substrate.

The foam in the second aerosol generating portion retains the aerosol forming agent in the mousse in a non-free liquid state and/or prevents it from leaking. In other words, there is no aerosol precursor in free-liquid state and preferably also no solid matrix or carrier in the aerosol generating reservoir. Thus, the desired effect of producing visible vapor, in particular more visible vapor than conventional products, and infusing the tobacco can be obtained without the risk of undesirable leakage of liquid of any kind from this reservoir. At the same time, by not requiring any solid matrix or carrier, (such as ceramic or porous plastic) the structure can be kept comparably simple, easily insertable in a paper wrapper (i.e., more deformable or shapable) and biodegradable. The foam is formed of a multitude of air bubbles which are free of aerosol forming agent.

At least preferably, there is no thermal barrier between the second aerosol generating portion comprising the foam and the first aerosol generating portion comprising the solid tobacco material. The first and second aerosol generating portions are preferably adjacent or at a small distance or in contact.

The invention essentially provides an aerosol generating article which advantageously comprises in the form of a foam an aerosol generating portion essentially corresponding to previously used e-liquids, and is a single article, which can be disposable as a whole,

containing both the tobacco and the foam for producing an aerosol upstream of the tobacco and subsequently infusing same. This avoids the previous need of the user having to refill two separate portions, namely, conventionally, a cartridge containing an e-liquid and a tobacco portion. Moreover, leakage of the e-liquid can advantageously be avoided by means of the foam according to the invention. Moreover, different refilling schedules for the e-liquid capsule on the one hand and the tobacco capsule on the other hand can be avoided. Rather, the aerosol generating article described herein integrates the two required aerosol generating portions and can, consequently, be used in a manner similar to known so-called heat sticks, which contain tobacco and are to be heated for producing an aerosol containing tobacco flavour. In other words, the article described herein allows for a single vaping session which is close to that of a conventional tobacco heat stick but with the taste advantage and low Total Particulate Matter (TPM) release of vapor-infused tobacco. In particular, the article described herein can advantageously be used together with established aerosol generating devices, into which the article is to be inserted. Thus, the maintenance of a single device has to be managed.

Moreover, by means of a defined nicotine content of the article, nicotine consumption can be monitored by the user. Further, the article can easily be made of materials which resist the heating temperatures without deforming, and any materials used in the article can be compostable.

The second aerosol generating portion further comprises a foam-forming agent to provide a porous texture to the portion.

The second aerosol generating portion further optionally comprises a foam stabilizing agent and/or at least one flavouring in order to provide stable foam and/or provide additional flavour for the user.

Preferably, the foam-forming agent is selected from the group consisting of:
- hydrocolloid selected from the group of agar, gellan gum,
an emulsifier selected from the group of lecithin, polyglycerol esters of fatty acids, glycerol esters of fatty acids, sorbitan esters of fatty acids,
- and mixtures thereof.

Preferably the foam-forming agent comprises or consists of gellan gum.

Also, preferably, the foam-stabilizing agent is selected from the group consisting of cellulose gum, hydroxyalkylated carbohydrates, derivatives thereof, and mixtures thereof, and/or the foam stabilizing agent comprises cellulose gum, in particular carboxymethylcellulose (CMC) or derivatives thereof and/or cellulose fibre.
With all of the above-mentioned substances, superior results with regard to forming and stabilizing the foam will be obtained. The foams include a porous structure which is open-pored, particularly wherein the structure is essentially formed from the foam forming agent and the foam stabilizing agent.

This also applies with regard to the forming of a sufficient amount of visible vapor, when the aerosol forming agent is present in an amount of at least 40 wt. %, preferably at least 50 wt. %, of the total weight in dry basis of the second aerosol generating portion.

Preferably, the aerosol forming agent comprises glycol derivatives, such as propylene glycol, or glycerin or glycerol or sebacate esters or a combination thereof and preferably comprises glycerol, and/or the aerosol forming agent comprises at least 30 wt. % glycerin, preferably at least 50 wt. % glycerin of the total weight in dry basis of aerosol forming agent. With these substances, in the described amount, a particularly good formation of visible vapor will be obtained.

As regards the preferred composition (in dry basis) of the second aerosol generating portion, the aerosol forming agent is comprised between 30 to 80 wt.%, preferably between 60 to 75 wt.%, of the total weight of the portion.

The foam forming agent may be comprised between 3 and 10 wt. % of the total weight of the portion.

The foam stabilizing agent may be comprised between 10 wt. % to 30 wt. % of the total weight of the portion, the flavourant is comprised between 0 wt. % to 10 wt. % of the total weight of the second aerosol generating portion. In an example, the foam-stabilizing agent comprises 6-14 wt. % of cellulose fibre and 8-14 wt. % of carboxymethylcellulose in the second aerosol generating portion. In another example, the foam-stabilizing agent comprises about 15-21 wt. % of carboxymethylcellulose in the second aerosol generating portion.

As regards the tobacco contained in the first aerosol generating portion, it is currently preferred to provide this as tobacco powder and/or tobacco cut filler.

Alternatively or in addition, the first aerosol generating portion can comprise a reconstituted tobacco substrate and/or tobacco lamina.

As regards preferred specific compositions of the first aerosol generating portion, the tobacco material may comprise reconstituted tobacco substrate (i.e., processed tobacco mixture) comprising between 50 and 80 wt. % of tobacco material, between 10 and 25 wt. % of aerosol forming agent, up to 15 wt. % of cellulose fiber and up to 10 % wt. % of a binding agent such as guar gum.

The tobacco material may be any one or a combination of: tobacco lamina, tobacco leaf, tobacco stems, expanded tobacco, and tobacco fines.

The reconstituted tobacco substrate may have any one more of the following characteristics:

- Tobacco particle size D90: between about 20 - 1000 microns, preferably between 30 and 300 microns. D90 represents the maximum particle diameter below which 90% of the sample volume exists. It is measured using Malvern Mastersizer 3000 laser diffraction instrument using dry dispersion method.
- The material is preferably formed into a sheet from a slurry by paper making process (no binding agent needed) or cast sheet or slurry or dough by extrusion/lamination process (binding agent required).
- The sheet can be inserted in a gathered form or cut or broken down into strands, shreds, strips, fragments, etc. The sheet can eventually be crimped.
    - Laminated sheet examples can be taken from: WO2021144043A1, WO2020058814
    - Paper making sheet examples are shown in WO2017051034.

Cast sheet examples are given in: WO2016050471A1, WO2016050470A1, WO2012164009A1

As mentioned above, the tobacco material is preferably formed as a gathered sheet, shreds, strips, granules and combinations thereof, which are all easily processable in the context of the present invention.

The article described herein is advantageously wrapped by an outer wrapper, in order to provide an article which is easy to handle. At the same time, due to the use of a foam rather than a liquid, normal cigarette paper will be sufficient and there is for example no necessity to use a liquid barrier membrane. The wrapper can thus for example be made of paper and can be metallized (e.g., aluminized) and can be designed so as to avoid scorching of the foam.

In order to further improve the vaping experience by the user, the article preferably further comprises a filter, which can be a low filtration filter and a spacing/cooling portion between the filter and the aerosol generating portions. The low filtration filter will optimize vapor and flavour delivery, and the same applies to the effect of the spacing/cooling portion. Moreover, the spacing/cooling portion will advantageously homogenize and/or cool the aerosol.

In an alternative embodiment, the article further comprises a filter adjacent to the first aerosol generating portion.

If at least one aerosol generating portion comprises at least one, preferably a plurality of airflow hollow tubes extending in the air flow direction, i.e. essentially from the second aerosol generating portion to the first aerosol generating portion, this will allow the heat to extract more flavour and nicotine.

If on the other hand, one or more airflow hollow tubes are provided so as to extend only in the second aerosol generating portion, this will maximize the production of aerosol from the foam, which will then pass through the tobacco.

The aerosol generating article described herein contains the above-described section wrapped in a wrapper. The article can further comprise a mouthpiece downstream of the tobacco-based aerosol generating substrate, which can also be contained in the wrapper. Further, the mouthpiece can comprise a filter and a spacing and/or cooling element provided between the aerosol generating section and the filter. The wrapper can for example be made from a cigarette paper and can be metallized (e.g., with an alumimium layer) or not. In either case, it can be designed to avoid scorching of the foam.

As regards the filter, this can be adapted to provide a relatively low, in any case, acceptable pressure drop, so that flavouring intensity and nicotine yield remain optimal. Additionally, the presence of the spacing and/or cooling element will, firstly, cool the generated aerosol, so that aerosol having an uncomfortably high temperature is prevented from entering the user's mouth. Moreover, by means of the spacing element, the article according to the present invention can be provided with a size adapted to well-established aerosol generating devices, with which the article can be used. Due to the fact that the article described herein can be used with present aerosol generating devices, the users have the advantage that a single device is sufficient and only one device has to be maintained.

The spacing may comprise a hollow tubular member which may be formed of paper. As well, the cooling element may comprise a hollow tubular member which may be formed of paper. As regards the length of the hollow tubular member, 10 to 25 mm and preferably 18 to 22 mm are currently preferred. A further tubular member with an inner diameter smaller than the cooling member may be positioned between the cooling tubular member 22 and the filter segment, such as described in EP3881699A1.

The mouthpiece and the aerosol generation section are preferably individually wrapped by a wrapper (e.g. plug wrap) and assembled by an assembling wrapper, i.e., tipping paper.

A ventilation zone may be provided in the mouthpiece, preferably through the spacing and/or cooling element or further tubular member. The ventilation zone may be formed by a plurality of perforations provided through the wrapper and the hollow tubular member or further tubular member.

Whereas the aerosol generating substrate can have any appropriate extension, it will keep the article described herein compact, when the aerosol generating substrate extends from the upstream end towards the downstream end of the article. A preferred total length of the article is also between 50 mm and 70 mm, more preferably between 55 mm and 65 mm, even more preferably 58 mm to 62 mm; wherein a length of the aerosol generating section is preferably about 15 mm to 25 mm and a length of the mouthpiece is preferably about 30 mm to 45 mm.
The invention also relates to a system comprising:

- an aerosol generating article for a non-combustion aerosol generating device comprising an air inlet end forming an upstream end and a mouth end forming a downstream end of the article and an aerosol generating substrate positioned between the upstream end and the downstream end,
  wherein the substrate comprises a first aerosol generating portion and at least one second aerosol generating portion positioned closer to the upstream end than the first aerosol generating portion so that the air flow is configured to pass through the second aerosol generating portion before passing through the first aerosol generating portion, wherein the first aerosol generating portion comprises tobacco material and the second aerosol generating portion comprises a foam containing a foam-forming agent and an aerosol forming agent in a non-free liquid state in the foam configured to produce aerosol upon heating and is positioned closer to the upstream end than any aerosol generating portion comprising tobacco material and,
- a heating device comprising at least one heater positioned in the region of or against of the second aerosol generating portion.

In a mode, the heating device comprises only one heater positioned only in the region of or against the second aerosol generating portion.

In another mode, the heating device comprises only one heater positioned in the region or against the first and second aerosol generating portions.

In another mode, the heating device comprises a first heater positioned in the region or against the first aerosol generating portion and a second heater positioned in the region or against the second aerosol generating portions; both heaters being controllable or controlled by a controller of the device independently from one another. In particular, the first and second heaters may be controlled at one or more of the following parameters: temperatures, power, voltage, frequency, duty cycle, heat-up time, switch-on, switch-off. The heaters may be: resistive, inductive, infra-red, microwave oven or combinations thereof.

Finally, at least one aerosol generating portion can be formed of a plurality of beads in order to also improve the extraction of flavour and nicotine.

In the present application, the percentages in weight are expressed on a dry basis

unless mentioned otherwise.

Brief description of the drawings

Hereinafter, the invention will be described with reference to non-limiting examples thereof, and with reference to the drawings, in which

Fig. 1 to 5 show various embodiments of the aerosol generating article,

Fig. 6 shows the effect obtained by the invention, and

Fig. 7 to 11 show further embodiments of the aerosol generating article.

Detailed Description of Preferred Embodiments

As can be taken from Fig. 1, the aerosol generating article 10 described herein is essentially rod or cylinder shaped, in which approximately a third to half of the length corresponds to an aerosol generating substrate, which can also be called a plug and can be considered semi-solid, and which is heated by a heating zone demarcated by an external heater of the aerosol generating device indicated by 12. The aerosol generating substrate comprises a first, tobacco-containing portion 14 and a second aerosol generating portion 16. Both are thus located in use in the heating zone 12. The aerosol generating article further comprises in the downstream direction of the aerosol flow path, a cooling tubular member 22 and a filter 24 at a mouth end. The cooling tubular member 22 may comprise for instance a paper tube or any other at least partially rigid hollow structure enabling to give enough space and surface to the aerosol to cool down. A further tubular member with an inner diameter smaller (i.e., a “center hole” segment) than the cooling member may be positioned between the cooling tubular member 22 and the filter, such as described in EP3881699A1. The filter 24 may comprise one or several filter segments such as made of cellulose acetate, paper sheet, charcoal and combinations thereof. The filter may contain one or more flavourant elements such as breakable capsule(s) or flavour beads. In the embodiment of Fig. 1, the substrate as a whole is essentially divided into halves by the first and second aerosol generating portions 14, 16. In other words, the first and second aerosol generating portions 14, 16 have approximately the same size. Arrows A indicate the heat flow in all figures.

Extraction of flavour and nicotine can be enhanced by a through hole 20, which can be formed by an air hole hollow tube and can essentially be at the center of the portions 14, 16 as shown in figure 2 and can have a diameter approximately one third of the plug's diameter. The through hole 20 can be formed in the material of the aerosol generating portions itself, or it can be provided by a separately inserted tube having the required permeability. This also applies to the plural through holes described below. For example, the through hole 20 has a diameter between 1 and 3.5 mm and the article has an outer diameter between 5.5 and 8 mm.

The extraction of flavour and nicotine is further enhanced by plural through holes as indicated in figure 3, which can be formed by plural air flow hollow tubes. These will typically have a smaller diameter than the through hole of the embodiment of figure 2. For example, each through hole has a diameter comprised between 0.5 and 1.5 mm and the article has an outer diameter between 5.5 and 8 mm. As a result of the surface of the through hole with the foam, the heat flow is increased, and more flavour and nicotine can be extracted. Moreover, plural through holes can be present throughout the plug, in addition to those indicated in figure 3. As a result of the higher surface of contact of the multiple through holes with the foam, the heat flow capable of transporting volatiles is further increased. Moreover, these through holes as well as the through hole 20 shown in figure 2 do not necessarily have to extend fully aligned with the axial or longitudinal direction of the plug typically having a cylindrical shape. Rather, the through holes can extend at an angle to the longitudinal direction and can comprise one or more curves or bends along their extension.

Moreover, the one or more through holes essentially forming hollow tubes for the airflow do not necessarily have to extend through both the first and the second aerosol generating portion. Rather, they can extend in the second aerosol generating portion only, which will maximize the production of aerosol from the foam, as shown in figure 4. Also in this case, a single through hole 20 as shown in figure 2 can be provided.

In the embodiment of figure 5, the foam or mousse and the tobacco containing, first aerosol generating portion is fragmented into small elements which can have the same or different shapes and sizes. The small elements may be formed as beads, e.g., of a size of one or two millimetres. In any case, plural voids will be present between the elements and enable the heat flow to pass through and extract flavour and nicotine. The

small elements may be maintained packed by the wrapper of the article. So voids are also provided between the small elements and the wrapper.

Either of the above-described embodiments leads to the flavour and nicotine release shown in figure 6, in which flavour and nicotine is released relatively intensively within a short amount of time and is still at a high and relatively constant level after reaching a certain peak.

As can be taken from figure 7, separate heaters 12 can be provided for portions 14, 16. In this case, both heaters 12 can provide the same or different heating profiles. For example, higher temperatures can be applied to the second aerosol generating portion 16 in order to produce a particularly high amount of aerosol which will infuse the tobacco containing portion 14 and contribute to heating thereof. Consequently, lower heating temperatures can be applied to the tobacco containing portion 14 which may still be high enough to extract nicotine into the aerosol. Alternatively, higher heating temperatures can be applied to the tobacco containing portion 14 in order to provide an improved sensory experience with regard to the tobacco. Nevertheless, sufficient heating temperatures will be applied to the second aerosol generation 16 in order to produce visible vapor. Finally, different heating modes can be provided by the controller of the device in order to allow users to select a heating mode in accordance with the desired vaping experience. In summary, by heating the portions 14 and 16 independently from each other, the sensory experience can be customized. In this context, it goes without saying that the embodiment shown in figure 7 including separate heaters 12 is also applicable to the embodiments of figures 2 to 5.

This also applies to the embodiments shown in figures 8 to 11. In these embodiments, which can also be appropriately provided in the embodiment of figure 1, i.e. without a through hole 20, only the second aerosol generating portion 16 is heated, and the tobacco containing portion 14 is not heated. The heater 12 may be placed only in the region of the second aerosol generating portions 16. As indicated in figures 8 to 11, the cooling tubular member 22 can then be omitted. In this case, the tobacco containing portion 14 is adjacent to the filter 24. Heat generated in the second aerosol generating portion 16 will then infuse and heat the tobacco containing portion 14. As a consequence, the aerosol passing through the tobacco containing portion 14 will be cooled, so that the cooling tubular member 22 can be omitted, as mentioned. As

indicated in figures 8 and 11 the above-described features specific to these embodiments can be applied to all embodiments of figures 1 to 5.

Examples of recipes for the second aerosol portion, i.e., (e-)mousse or foam are:

	Ratio (wt. %)		
	Example 1	Example 2	Example 3
E-liquid	68.2 PG/VG (1:1)	63.4 PG/VG (1:1)	63.4 PG/VG (1:1)
Purified water	9.1	9.1	9.1
Gellan gum (Roeper 70f) Cas no. 71010-52-1	4.5	4.5	4.5
Cellulose fiber (Alba fiber or MCC)	-	12.0 Alba fiber	12.0 MCC
Carboxymethylcellulose sodium binder (Ceroga Roeper 4550C) Cas no. 9004-32-4	18.2	11.0	11.0

The e-mousse could comprise flavouring agents such as for example ethyl vanillin, menthol, spearmint oil, berry, fruit, root or plant extract or oil.

The e-mousse could comprise a pH adjusting agent e.g. chosen from one or more of sodium carbonate, potassium carbonate, sodium hydrogen carbonate, potassium hydrogen carbonate, etc., and mixtures thereof.

Claims

1. An aerosol generating article (10) for a non-combustion aerosol generating device comprising an air inlet end forming an upstream end and a mouth end forming a downstream end of the article (10) and an aerosol generating substrate positioned between the upstream end and the downstream end,
wherein the substrate comprises a first aerosol generating portion (14) and at least one second aerosol generating portion (16) positioned closer to the upstream end than the first aerosol generating portion (14) so that the air flow is configured to pass through the second aerosol generating portion (16) before passing through the first aerosol generating portion (14),
wherein the first aerosol generating portion (14) comprises tobacco material and the second aerosol generating portion (16) comprises a foam containing a foam-forming agent and an aerosol forming agent in a non-free liquid state in the foam configured to produce aerosol upon heating and is positioned closer to the upstream end than any aerosol generating portion (14) comprising tobacco material.

2. Aerosol generating article (10) according to claim 1, wherein the foam of the second aerosol generating portion (16) further comprises a foam stabilizing agent and/or flavouring.

3. Aerosol generating article (10) according to claim 1 or 2, wherein the foam-forming agent is selected from the group consisting of hydrocolloid selected from the group of agar, gellan gum, an emulsifier selected from the group of lecithin, polyglycerol esters of fatty acids, glycerol esters of fatty acids, sorbitan esters of fatty acids, and/or mixtures thereof, without being limited thereto.

4. Aerosol generating article (10) according to claim 2, wherein the foam-stabilizing agent is selected from the group consisting of cellulose gum, hydroxyalkylated carbohydrates, derivatives thereof, and mixture thereof.

5. Aerosol generating article (10) according to claim 2 or 4, wherein the foam stabilizing agent comprises cellulose gum, in particular carboxymethylcellulose (CMC) or derivatives thereof and/or cellulose fibre.

6. Aerosol generating article (10) according to any of claims 1-5, wherein the aerosol forming agent in the second portion (16) is in an amount of at least 40 wt. %, preferably at least 50 wt. % and preferably comprises propylene glycol, glycerin or a combination thereof.

7. Aerosol generating article (10) according to any of claims 1-6, wherein the first aerosol generating portion (14) contains tobacco powder and/or tobacco cut filler.

8. Aerosol generating article (10) according to claim 6 or 7, wherein the first aerosol generating portion (14) comprises a reconstituted tobacco substrate and/or tobacco lamina.

9. Aerosol generating article (10) according to claim 8, wherein the first aerosol generating portion (14) comprises reconstituted tobacco substrate comprising between 50 to 80 wt. % of tobacco material, between 10 and 25 wt. % of aerosol forming agent, 0 to 15 wt. % of cellulose fiber and 0 to 10 wt. % of a binding agent (e.g. guar gum).

10. Aerosol generating article (10) according to claim 9, wherein the reconstituted tobacco substrate is formed as gathered sheet(s), shreds, strips, granules and combinations thereof.

11. Aerosol generating article (10) according to any of claims 1-10, wherein the substrate (14, 16) is wrapped by an outer wrapper.

12. Aerosol generating article (10) according to any of claims 1-11, wherein it further comprises a filter (24) and a spacing/cooling portion (22) between the filter (24) and the aerosol generating portions (14, 16).

13. Aerosol generating article (10) according to any of claims 1-11, wherein it further comprises a filter (24) adjacent to the first aerosol generating portion (14).

14. Aerosol generating article (10) according to any of claims 1-13, wherein at least one aerosol generating portion (14, 16) comprises at least one, preferably a plurality of airflow hollow tubes (20) extending in the air flow direction.

15. Aerosol generating article (10) according to any of claims 1-14, wherein the aerosol generating substrate comprises a plurality of airflow hollow tubes (20) extending in the second aerosol generating portion (16) or

at least one aerosol generating portion (14, 16) is formed of plurality of beads.

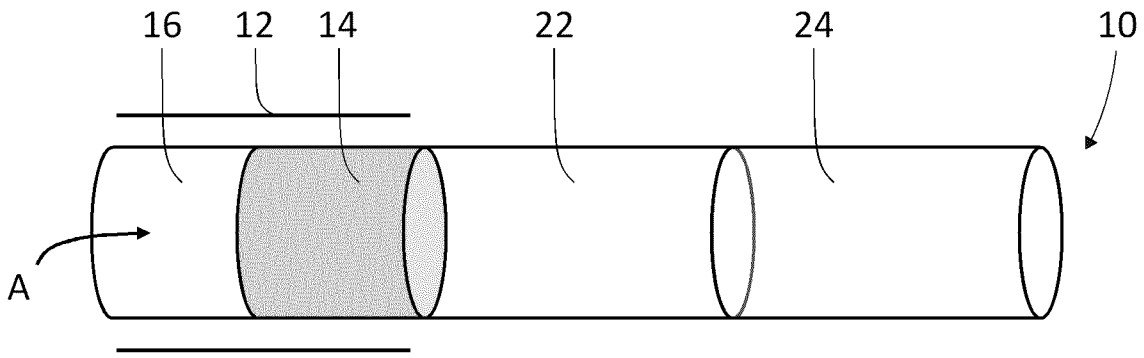


Fig. 1

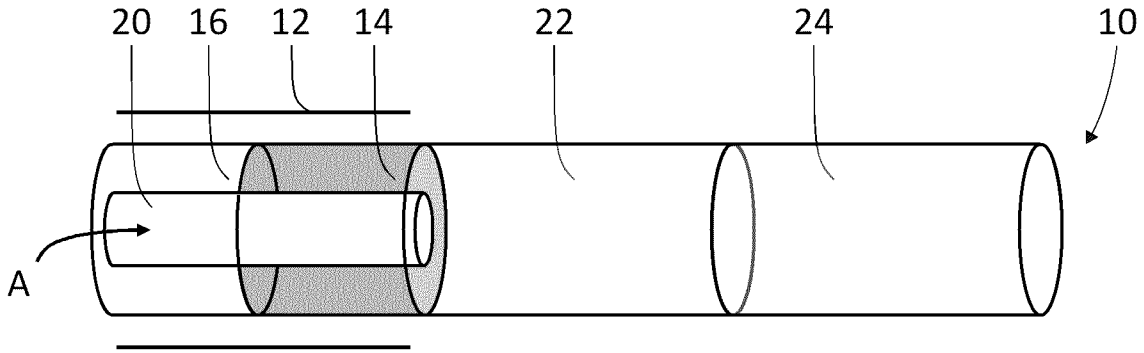


Fig. 2

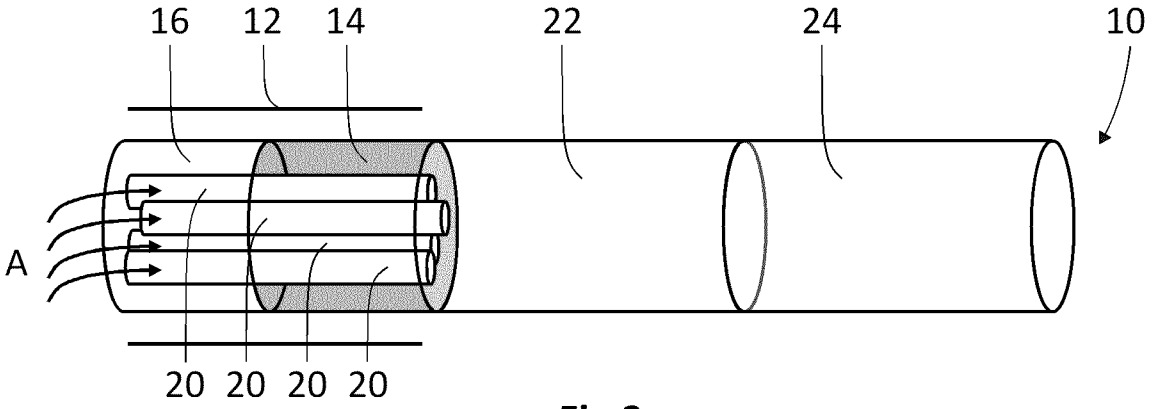


Fig.3

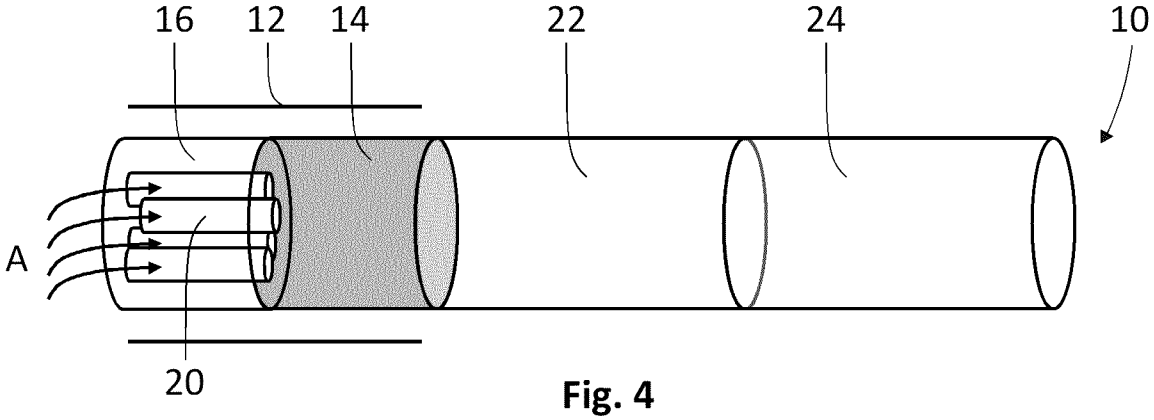


Fig. 4

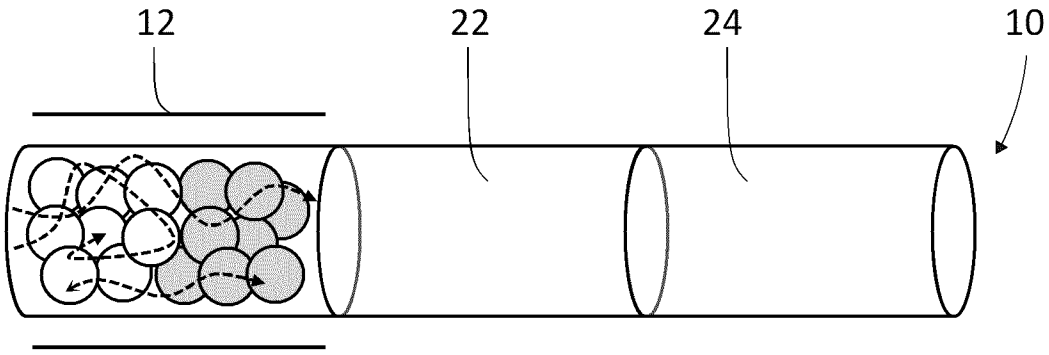


Fig. 5

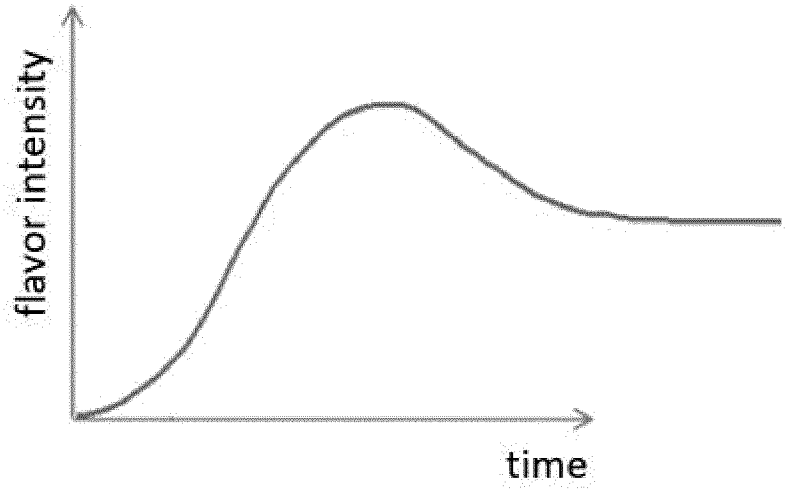


Fig. 6

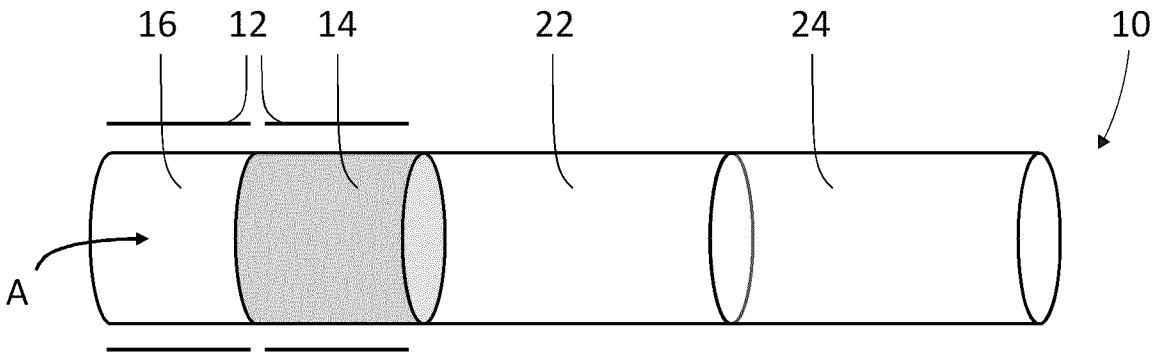


Fig. 7

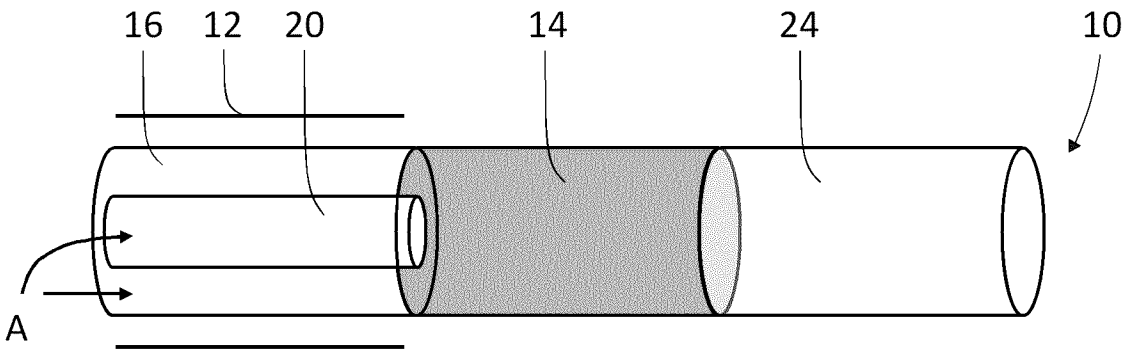


Fig. 8

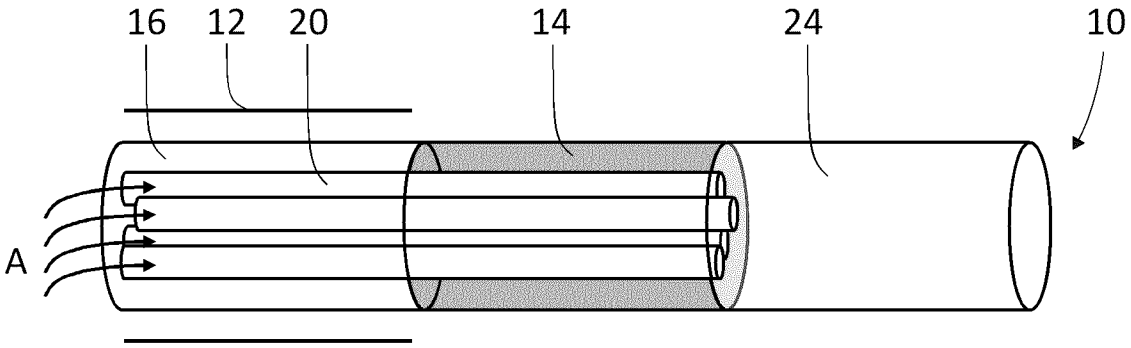


Fig. 9

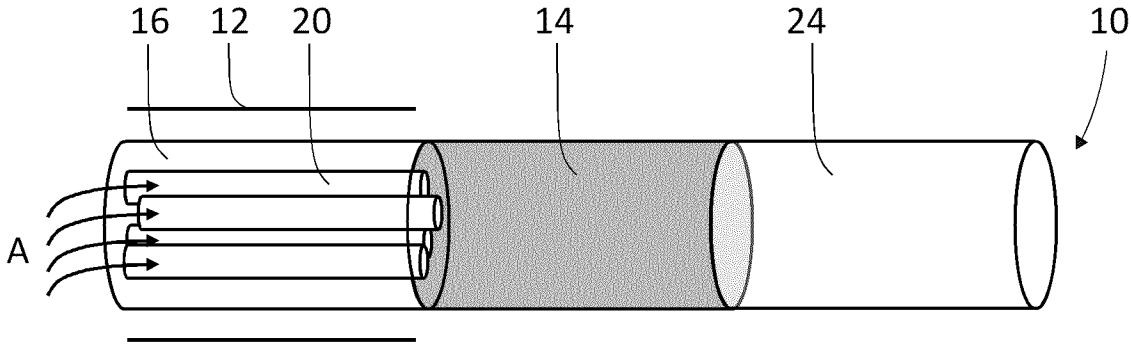


Fig. 10

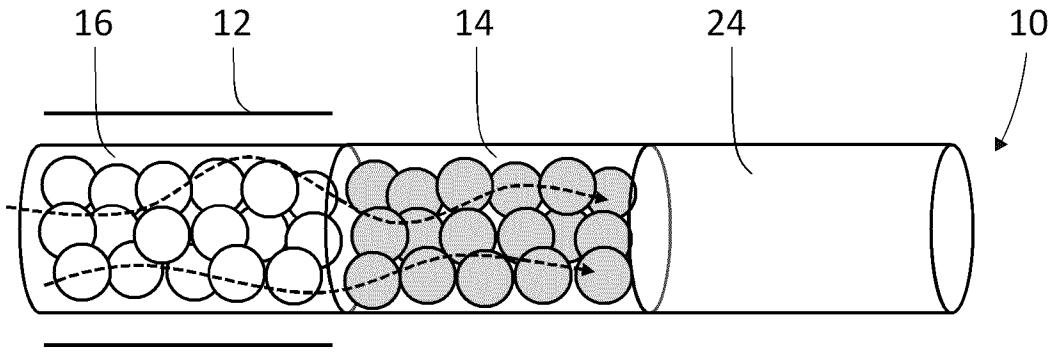


Fig. 11

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2023/057478

A. CLASSIFICATION OF SUBJECT MATTER
INV. A24D1/20 A24B15/12 A24B15/14 A24D1/18
ADD.

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 A24B A24C

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2021/118186 A2 (KT & G CORP [KR]) 17 June 2021 (2021-06-17) paragraphs [0065], [0068]; figure 4	1-15
X	WO 2022/045518 A1 (KT & G CORP [KR]) 3 March 2022 (2022-03-03) paragraphs [0050], [0051]; figure 2	1-15
X	WO 2021/170655 A1 (PHILIP MORRIS PRODUCTS SA [CH]) 2 September 2021 (2021-09-02) page 55, line 35 - page 56, line 3; figures 4a, 4b	1-15
X	WO 2022/023777 A1 (NICOVENTURES TRADING LTD [GB]) 3 February 2022 (2022-02-03) page 12, lines 6-9; figure 1 page 16, lines 9-11	1-15

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
22 May 2023	31/05/2023

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Flügel, Alexander

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2023/057478

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X,P	WO 2022/167342 A1 (PHILIP MORRIS PRODUCTS SA [CH]) 11 August 2022 (2022-08-11) claim 1	1

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Information on patent family members

International application No
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