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(54) **SMOKING ARTICLE WITH CONTROLLED FLAVOR RELEASE**

RAUCHARTIKEL MIT KONTROLLIERTER DUFTSTOFFFREISETZUNG

ARTICLE À FUMER AVEC LIBÉRATION D'ARÔME CONTRÔLÉE

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Description

BACKGROUND

[0001] Flavorants are frequently added to tobacco products, including smoking articles or smokeless, oral tobacco products, to achieve desirable organoleptic sensations. Typically, the flavors are added to the tobacco material or filter component. Document WO2007/036814 for example discloses a cigarette with the filtering system having encapsulated flavorants.

SUMMARY

[0002] As described herein, smoking articles include a controlled flavor release product that provides prolonged and varied organoleptic sensation.

[0003] Provided is a controlled flavor release product including at least a first time-release flavorant and a second time-release flavorant. Additional time-release flavorants may also be included.

[0004] Preferably, the first time-release flavorant and the second time-release flavorant contain different flavorants, but they may contain the same flavorants. In an embodiment, the first time-release flavorant and the second time-release flavorant contain the same flavorant. According to the invention, the first time-release flavorant and the second time-release flavorant are released at different times during smoking to provide continuous enjoyment and a variety of flavors. Also preferably, the time release of the second time-released flavorant overlaps release of the first time-released flavorant.

[0005] In a preferred embodiment, the first time-release flavorant and the second time-release flavorant are incorporated into controlled release microcapsules. The microcapsules may be embedded in a format to create a controlled flavor release product. Each microcapsule can contain the first time-release flavorant, the second time-release flavorant or both.

[0006] In another embodiment, the microcapsules form the controlled flavor release product that can be used in a smoking article. Preferably, the controlled flavor release product includes at least a first time-release flavorant and a second time-release flavorant.

[0007] Suitable microcapsules for controlled release of flavorants are those developed by Salvona LLC of Dayton, New Jersey. (e.g. MultiSal™ and NanoSal™).

[0008] MultiSal™ is a free flowing powder matrix with high concentrations of functional ingredients encapsulated in nanospheres. NanoSal™ is a liquid formula encapsulated in solid, hydrophobic nanospheres. Each microcapsule can incorporate different oil based flavors for controlled delivery over time. The microcapsules provide enhanced bioadhesive properties such that the flavorants bind to mucous in the mouth cavity to prolong flavor enjoyment. The microcapsules may also be designed to target specific areas of the mouth.

[0009] In a preferred embodiment, the controlled flavor

release product has controlled diffusion mechanisms. The first time-release flavorant and the second time-release flavorant may be released by the same or different mechanisms. Additional time-release flavorants may be used, and may be triggered by different methods at different times.

[0010] In one embodiment, the first time-release flavorant and the second time-release flavorant are released by exposure to moisture from the lips or mouth. In another embodiment, heat from igniting the smoking article or from the user's mouth may cause the release of the first time-release flavorant and the second time-release flavorant. In yet another embodiment, the first time-release flavorant and the second time-release flavorant are released by a change in pH. The change in pH may occur when the controlled flavor release product is placed in an environment such as a human's mouth. Alternatively, a substance may be added to a microcapsule that changes the pH and causes the release of another microcapsule.

[0011] Preferably, the first time-release flavorant and the second time-release flavorant are embedded in a format to create a controlled flavor release product. In a preferred embodiment, the controlled flavor release product is in the form of a lip balm type formulation. The lip balm type formulation may be made of a wax with the first time-release flavorant and the second time-release flavorant embedded therein. In another embodiment, the controlled flavor release product is in the form of a film having a first time-release flavorant and a second time-release flavorant embedded therein. The films can be formed by conventional means known in the art, and may be dissolvable and/or disintegrable. Preferably the film is adhered to the downstream end of the smoking article.

[0012] In an embodiment, the first time-release flavorant may include a different flavorant than the second time-release flavorant so that the user is provided with at least two flavors during the smoking experience. Also, since the first time-release flavorant and the second time-release flavorant are released at separate times, the organoleptic sensations are prolonged thereby providing the user with more flavor over a longer period of time.

[0013] Suitable flavorants for use in the controlled flavor release product include, without limitation, mint, such as peppermint and spearmint, vanillin, chocolate, licorice, citrus and other fruit flavors, spice flavors, such as cinnamon, methyl salicylate, linalool, bergamot oil, geranium oil, lemon oil, ginger oil, tobacco flavors and other agents commonly used to impart flavor and aroma to tobacco products.

[0014] Other suitable flavors and aromas may include flavor compounds selected from the group consisting of an acid, an alcohol, an ester, an aldehyde, a ketone, a pyrazine, combinations or blends thereof and the like. Suitable flavor compounds may be selected, for example, from the group consisting of phenylacetic acid, solanone, megastigmatrienone, 2-heptanone, benzylalcohol, cis-3-hexenyl acetate, valeric acid, valeric aldehyde, ester, ter-

pene, sesquiterpene, nootkatone, maltol, combinations thereof and the like. The first and second flavorants may contain a cooling agent.

[0015] Additives such as chemesthesis agents may also be included in the controlled release flavor product. Suitable chemesthesis agents include, without limitation, capsaicin, tannins, mustard oil, wintergreen oil, cinnamon oil, allicin, quinine, citric acid, and salt.

[0016] In one embodiment, complimentary flavors may be chosen for the first time-release flavorant and the second time release flavorant to provide a combined flavor. For instance, a cherry vanilla flavor may be provided by choosing a cherry flavorant for the first time-release flavorant and a vanilla flavorant for the second time-release flavorant. In an embodiment, the release of the first time-release flavorant and the second time-release flavorant can overlap so that the complimentary flavorants can be enjoyed together.

[0017] The term "smoking article" includes cigarettes, pipes, cigars, and cigarillos. Non-traditional cigarettes such as cigarettes using electrical smoking systems are also included in the definition of smoking articles or cigarettes generally.

[0018] A traditional cigarette typically contains two sections, a tobacco-containing portion sometimes referred to as the tobacco rod, and a filter portion which may be referred to as a filtration zone. Tipping paper typically surrounds the filter, which forms the mouth end of the cigarette. The tipping paper overlaps with the tobacco rod in order to hold the filter and tobacco rod together. The tobacco rod includes a paper wrapper in which the tobacco is wrapped and an adhesive holding the seams of the paper wrapper together. The tobacco rod has a first end which is integrally attached to the filter and a second end which is lit or heated for smoking the tobacco. When the tobacco rod is lit or heated for smoking, the smoke travels from the lit end downstream to the filter end of the tobacco rod and further downstream through the filter.

[0019] The "upstream" and "downstream" relative positions between filter segments and other features are described in relation to the direction of mainstream smoke as it is drawn from a tobacco rod and through a multi-component filter during a puff.

[0020] In a preferred embodiment, the smoking article is a cigarette. The cigarette may contain tobacco material, a filter, and a controlled flavor release product. In an embodiment, the cigarette may also contain at least one sorbent.

[0021] The term "sorbent" as used herein refers to an adsorbent, an absorbent, or a substance that can function as both an adsorbent and an absorbent. Preferred sorbents include various forms of activated carbon, molecular sieves, such as zeolites, and mixtures thereof.

[0022] Examples of suitable types of tobacco materials that may be used include, but are not limited to, flue-cured tobacco, Burley tobacco, Maryland tobacco, Oriental tobacco, rare tobacco, specialty tobacco, blends

thereof and the like. The tobacco material may be provided in any suitable form, including, but not limited to, tobacco lamina, processed tobacco materials, such as volume expanded or puffed tobacco, processed tobacco stems, such as cut-rolled or cut-puffed stems, reconstituted tobacco materials, blends thereof, and the like. Tobacco substitutes may also be used.

[0023] In an embodiment, the tobacco material can include at least one humectant, such as glycerin, at least one sweetener or at least one non-tobacco flavorant, or combinations thereof, dispersed throughout the tobacco material.

BRIEF DESCRIPTION OF THE FIGURES

[0024]

Figure 1 is an illustration of a smoking article including a controlled flavor release product in the form of a lip balm type formulation coating the tipping paper. Figure 2 is an illustration of a smoking article including a controlled flavor release product in the form of a lip balm type formulation coating the end of the smoking article.

Figure 3 is an illustration of a smoking article including a controlled flavor release product in the form of a film coating the tipping paper.

Figure 4 is an illustration of a smoking article including a controlled flavor release product in the form of a film coating the end of the smoking article.

Figure 5 is an illustration of a filterless smoking article including a controlled flavor release product.

DETAILED DESCRIPTION

[0025] - As illustrated in Figure 1, a smoking article 10 has an upstream end 12 and a downstream end 14. The smoking article 10 includes a filtration zone 40 that lies at the downstream end 14. The filtration zone 40 includes a filter 42 surrounded by a portion of tipping paper 18. The filtration zone 40 is attached to a tobacco rod 20. In one embodiment, the filter 42 is made of cellulose acetate fibers. The smoking article 10 preferably includes a controlled flavor release product 16. In one embodiment, the controlled flavor release product 16 includes a first time-release flavorant 24 and a second time-release flavorant 26.

[0026] Preferably, the controlled flavor release product 16 coats the tipping paper 18 that surrounds the filter 42 at the downstream end 14 of the smoking article 10. Also preferably, the controlled flavor release product 16 is in the form of a lip balm type formulation 15. The lip balm type formulation 15 may be made of a wax with the first time-release flavorant 24 and the second time-release flavorant 26 embedded therein.

[0027] In another embodiment, as seen in Figure 2, the controlled flavor release product 16 is in the form of a lip balm type formulation 15 that coats the end 22 of

the filter 42 of the smoking article 10. The lip balm type formulation 15 is transferred to a user's mouth upon contact with the downstream portion 14.

[0028] In one embodiment, as illustrated in Figure 3, the smoking article 10 has an upstream end 12, a downstream end 14, a tobacco rod 20, a filtration zone 40, including a filter 42 covered with tipping paper 18, and a controlled flavor release product 16.

[0029] Preferably, the controlled flavor release product 16 is in the form of a film 30. The film 30 is formed by conventional means known in the art. In a preferred embodiment, the film 30 is dissolvable or disintegrable. Preferably, a first time-release flavorant 24 and a second time-release flavorant 26 are embedded in the film 30. The film 30 is wrapped around the tipping paper 18 and adhered thereto.

[0030] In another embodiment, as shown in Figure 4, the smoking article 10 has an upstream end 12, a downstream end 14, a tobacco rod 20, a filtration zone 40 including a filter 42 covered with tipping paper 18, and a controlled flavor release product 16. Preferably, the controlled flavor release product 16 is in the form of a film 30 that is affixed to the end 22 of the filter 42.

[0031] In a preferred embodiment; the film 30 is adhered to the tipping paper 18 or the end 22 of the filter 42 by any known adhesive. For instance, the film 30 may be glued onto the tipping paper 18.

[0032] In one embodiment, the smoking article 10 does not include a filtration zone. As seen in Figure 5, the smoking article 10 may be a cigar without a filtration zone or a filterless cigarette. The controlled flavor release product 16 may coat the downstream end 14 of the wrapper 100 or the end 200 of the smoking article 10. In an embodiment, the controlled flavor release product 16 may be a film that is wrapped around the downstream end 14 of the smoking article 10.

[0033] Also provided is a method for manufacturing a smoking article including a controlled flavor release product.

[0034] In a preferred embodiment, the method for manufacturing includes contacting a wrapper with a controlled flavor release product, surrounding tobacco with the wrapper, and sealing the wrapper to form a smoking article. The method may also include sealing a filter to the rod and then cutting the rod to a specified length.

[0035] In another embodiment, the method for manufacturing a smoking article having a controlled flavor release product includes coating a tipping paper with the controlled flavor release product and wrapping a filter with the tipping paper. The coating may take place by dipping or brushing on the controlled flavor release product. The method may also include the step of fitting the filter to a tobacco rod to form a cigarette.

[0036] In yet another embodiment, the method includes coating the end of a filter with a lip balm type formulation having an embedded first time-release flavorant and a second time-release flavorant. The filter may be made by conventional methods known in the art and at-

tached to a tobacco rod to form a cigarette. The end of the filter is then coated by dipping, spraying, or otherwise applying the lip balm type formulation to the end of the cigarette.

[0037] In a preferred embodiment, the method includes adhering a film having an embedded first time-release flavorant and a second time-release flavorant to the end of a filter of a smoking article. The film is cut to an appropriate size and adhered to the end of the filter.

[0038] In another embodiment, the method includes adhering a film having an embedded first time-release flavorant and a second time-release flavorant to the tipping paper of a smoking article. The film is formed or cut to about the size of the tipping paper and adhered thereto.

[0039] In another embodiment, the method includes adhering a film having an embedded first time-release flavorant and a second time-release flavorant to the wrapper of a smoking article.

[0040] Variations and modifications of the foregoing will be apparent to those skilled in the art. Such variations and modifications are to be considered within the purview and scope of the claims appended hereto.

Claims

1. A controlled flavor release smoking article (10) comprising:

a tobacco rod (20);
a downstream end (14); and
a controlled flavor release product (16) including:

a first time-released flavorant (24) delivered at a first time and triggered by a first mechanism; and
a second time-released flavorant (26) delivered at a second time and triggered by a second mechanism, wherein the second time is different to the first time,

wherein the controlled flavor release product (16) contacts the downstream end (14) of said smoking article (10).

2. The controlled flavor release smoking article of Claim 1, wherein said first time-release flavorant (24), and said second time-release flavorant (26) are released by a first mechanism and a second mechanism selected from the group consisting of the addition of moisture, a change of pH, a temperature increase, and combinations thereof.

3. The controlled flavor release smoking article of Claim 1, wherein said first time-release flavorant and said second time-release flavorant are incorporated into at least one microcapsule.

4. The controlled flavor release smoking article of Claim 1, wherein said controlled flavor release product (16) is a film (30).
5. The controlled flavor release smoking article of Claim 4, wherein said film (30) is dissolvable, disintegrable or both.
6. The controlled flavor release smoking article of Claim 1, wherein said controlled flavor release product (16) is a lip balm type formulation (15).
7. The controlled flavor release smoking article of Claim 1, wherein, said controlled flavor release product is applied to an outside surface of said downstream end (14) of said smoking article (10).
8. The controlled flavor release smoking article of Claim 1, wherein said first time-release flavorant (24) and said second time-release flavorant (26) are selected from the group consisting of menthol, mint, chocolate, licorice, fruit flavors, tangerine, citrus, cherry, gamma octalactone, vanilla, ethyl vanillin, breath freshener flavors, spice flavors, cinnamon, methyl salicylate, linalool, bergamot oil, geranium oil, lemon oil, ginger oil, tobacco flavors, soothing or refreshing active compounds, bitter agents, and combinations thereof.
9. The controlled flavor release smoking article of Claim 1, wherein said first time-released flavorant (24) and said second time-released flavorant (26) each include the same flavorant.
10. The controlled flavor release smoking article of Claim 1, wherein said first time-released flavorant (24) and said second time-released flavorant (26) each include different flavorants.
11. The controlled flavor release smoking article of Claim 1, wherein said first time-released flavorant (24) and said second time-released flavorant (26) include a chemesthesis agent.
12. A method of making a controlled flavor release smoking article (10) according to claim 1, said method comprising contacting a downstream end (14) of a smoking article (10) with a controlled flavor release product (16), wherein said controlled flavor release product (16) contains a first time-release flavorant (24) and a second time-release flavorant (26).
13. The method of Claim 12, wherein said first time-release flavorant (24) includes different flavorant or flavorants to said second time-release flavorant (26).

Patentansprüche

1. Raucherartikel mit kontrollierter Geschmackstofffreisetzung (10), umfassend:

einen Tabakstock (20),
ein abströmseitiges Ende (14) und
ein Produkt mit kontrollierter Freisetzung (16),
das Folgendes aufweist:

einen ersten Geschmackstoff mit verzögerter Freisetzung (24), der zu einem ersten Zeitpunkt abgegeben wird und von einem ersten Mechanismus ausgelöst wird, und
einen zweiten Geschmackstoff mit verzögerter Freisetzung (26), der zu einem zweiten Zeitpunkt abgegeben wird und von einem zweiten Mechanismus ausgelöst wird, wobei der zweite Zeitpunkt sich von dem ersten Zeitpunkt unterscheidet,

wobei das Produkt mit kontrollierter Freisetzung (16) mit dem abströmseitigen Ende (14) des genannten Raucherartikels (10) in Kontakt kommt.
2. Raucherartikel mit kontrollierter Geschmackstofffreisetzung nach Anspruch 1, wobei der genannte erste Geschmackstoff mit verzögerter Freisetzung (24) und der genannte zweite Geschmackstoff mit verzögerter Freisetzung (26) von einem ersten Mechanismus und einem zweiten Mechanismus freigesetzt werden, die aus der Gruppe bestehend aus dem Zugeben von Feuchtigkeit, einer Änderung des pH-Wertes, einem Temperaturanstieg und Kombinationen davon ausgewählt sind.
3. Raucherartikel mit kontrollierter Geschmackstofffreisetzung nach Anspruch 1, wobei der genannte erste Geschmackstoff mit verzögerter Freisetzung und der genannte zweite Geschmackstoff mit verzögerter Freisetzung in wenigstens eine Mikrokapsel eingebunden sind.
4. Raucherartikel mit kontrollierter Geschmackstofffreisetzung nach Anspruch 1, wobei das genannte Produkt mit kontrollierter Geschmackstofffreisetzung (16) ein Film (30) ist.
5. Raucherartikel mit kontrollierter Geschmackstofffreisetzung nach Anspruch 4, wobei der genannte Film (30) auflösbar, zersetzungsfähig oder beides ist.
6. Raucherartikel mit kontrollierter Geschmackstofffreisetzung nach Anspruch 1, wobei das genannte Produkt mit kontrollierter Geschmackstofffreisetzung (16) eine Formulierung vom Lippenbalsamtyp (15) ist.

7. Raucherartikel mit kontrollierter Geschmackstofffreisetzung nach Anspruch 1, wobei das genannte Produkt mit kontrollierter Geschmackstofffreisetzung auf eine Außenfläche des genannten abströmseitigen Endes (14) des genannten Raucherartikels (10) aufgebracht ist. 5
8. Raucherartikel mit kontrollierter Geschmackstofffreisetzung nach Anspruch 1, wobei der genannte erste Geschmackstoff (24) mit verzögerter Freisetzung und der genannte zweite Geschmackstoff (26) mit verzögerter Freisetzung aus der Gruppe bestehend aus Menthol, Minze, Schokolade, Lakritz, Fruchtaromen, Mandarine, Zitrus, Kirsch, Gamma-Oktalaktone, Vanille, Ethylvanillin, Atemerfrischergeschmackstoffen, Gewürzaromen, Zimt, Methylsalicylat, Linalool, Bergamottenöl, Geraniumöl, Zitronenöl, Ingweröl, Tabakaromen, beruhigende oder erfrischende Aktivstoffverbindungen, Bitterstoffe und Kombinationen davon gewählt sind. 10 15 20
9. Raucherartikel mit kontrollierter Geschmackstofffreisetzung nach Anspruch 1, wobei der genannte erste Geschmackstoff mit verzögerter Freisetzung (24) und der genannte zweite Geschmackstoff mit verzögerter Freisetzung (26) jeweils den gleichen Geschmackstoff beinhalten. 25
10. Raucherartikel mit kontrollierter Geschmackstofffreisetzung nach Anspruch 1, wobei der genannte erste Geschmackstoff mit verzögerter Freisetzung (24) und der genannte zweite Geschmackstoff mit verzögerter Freisetzung (26) jeweils verschiedene Geschmackstoffe beinhalten. 30
11. Raucherartikel mit kontrollierter Geschmackstofffreisetzung nach Anspruch 1, wobei der genannte erste Geschmackstoff mit verzögerter Freisetzung (24) und der genannte zweite Geschmackstoff mit verzögerter Freisetzung (26) einen Chemestesiswirkstoff beinhalten. 35 40
12. Verfahren zum Herstellen eines Raucherartikels mit kontrollierter Geschmackstofffreisetzung (10) nach Anspruch 1, wobei das genannte Verfahren das Inkontaktbringen eines abströmseitigen Endes (14) eines Raucherartikels (10) mit einem Produkt mit kontrollierter Geschmackstofffreisetzung (16) aufweist, wobei das genannte Produkt mit kontrollierter Geschmackstofffreisetzung (16) einen ersten Geschmackstoff mit verzögerter Freisetzung (24) und einen zweiten Geschmackstoff mit verzögerter Freisetzung (26) enthält. 45 50
13. Verfahren nach Anspruch 12, wobei der genannte erste Geschmackstoff mit verzögerter Freisetzung (24) (einen) andere(n) Geschmackstoff(e) als der genannte zweite Geschmackstoff mit verzögerter

Freisetzung (26) beinhaltet.

Revendications

1. Article à fumer à libération contrôlée d'arôme (10) comprenant :

un bâtonnet de tabac (20) ;
une extrémité aval (14) ; et
un produit de libération contrôlée d'arôme (16) comportant :

un premier aromatisant libéré dans le temps (24) délivré une première fois et déclenché par un premier mécanisme ; et
un second aromatisant libéré dans le temps (26) délivré une second temps et déclenché par un second mécanisme, la seconde fois étant différente de la première fois,

dans lequel le produit de libération contrôlée d'arôme (16) fait contact avec l'extrémité aval (14) dudit article à fumer (10). 5 10 15 20
2. Article à fumer à libération contrôlée d'arôme selon la revendication 1, dans lequel ledit premier aromatisant libéré dans le temps (24) et ledit second aromatisant libéré dans le temps (26) sont libérés par un premier mécanisme et un second mécanisme sélectionnés dans le groupe consistant en l'ajout d'humidité, un changement de pH, une augmentation de température, et des combinaisons de ceux-ci. 25
3. Article à fumer à libération contrôlée d'arôme selon la revendication 1, dans lequel ledit premier aromatisant libéré dans le temps et ledit second aromatisant libéré dans le temps sont incorporés dans au moins une microcapsule. 30 35
4. Article à fumer à libération contrôlée d'arôme selon la revendication 1, dans lequel ledit produit de libération contrôlée d'arôme (16) est un film (30). 40
5. Article à fumer à libération contrôlée d'arôme selon la revendication 4, dans lequel ledit film (30) peut être dissout, désintégré ou les deux. 45
6. Article à fumer à libération contrôlée d'arôme selon la revendication 1, dans lequel ledit produit de libération contrôlée d'arôme (16) est une formulation du type baume pour les lèvres (15). 50
7. Article à fumer à libération contrôlée d'arôme selon la revendication 1, dans lequel ledit produit de libération contrôlée d'arôme est appliqué sur une surface extérieure de ladite extrémité aval (14) dudit article à fumer (10). 55

8. Article à fumer à libération contrôlée d'arôme selon la revendication 1, dans lequel ledit premier aromatisant libéré dans le temps (24) et ledit second aromatisant libéré dans le temps (26) sont sélectionnés dans le groupe consistant en menthol, menthe, chocolat, réglisse, arômes de fruits, mandarine, citron, cerise, gamma octalactone, vanille, vanilline éthylique, arômes rafraîchisseurs d'haleine, arômes épicés, cannelle, salicylate de méthyle, linalol, huile de bergamote, huile de géranium, huile de citron, huile de gingembre, arômes de tabac, composés actifs de lissage ou de rafraîchissement, agents amers, et des combinaisons de ceux-ci. 5
9. Article à fumer à libération contrôlée d'arôme selon la revendication 1, dans lequel ledit premier aromatisant libéré dans le temps (24) et ledit second aromatisant libéré dans le temps (26) comportent chacun le même aromatisant. 10 15
10. Article à fumer à libération contrôlée d'arôme selon la revendication 1, dans lequel ledit premier aromatisant libéré dans le temps (24) et ledit second aromatisant libéré dans le temps (26) comportent chacun différents aromatisants. 20 25
11. Article à fumer à libération contrôlée d'arôme selon la revendication 1, dans lequel ledit premier aromatisant libéré dans le temps (24) et ledit second aromatisant libéré dans le temps (26) comportent un agent de chemesthesis. 30
12. Procédé de fabrication d'un article à fumer à libération contrôlée d'arôme (10) selon la revendication 1, ledit procédé comprenant la mise en contact d'une extrémité aval (14) d'un article à fumer (10) avec un produit de libération contrôlée d'arôme (16), dans lequel ledit produit de libération contrôlée d'arôme (16) contient un premier aromatisant libéré dans le temps (24) et un second aromatisant libéré dans le temps (26). 35 40
13. Procédé selon la revendication 12, dans lequel ledit premier aromatisant libéré dans le temps (24) comporte un ou des aromatisants différents de ceux dudit second aromatisant libéré dans le temps (26). 45

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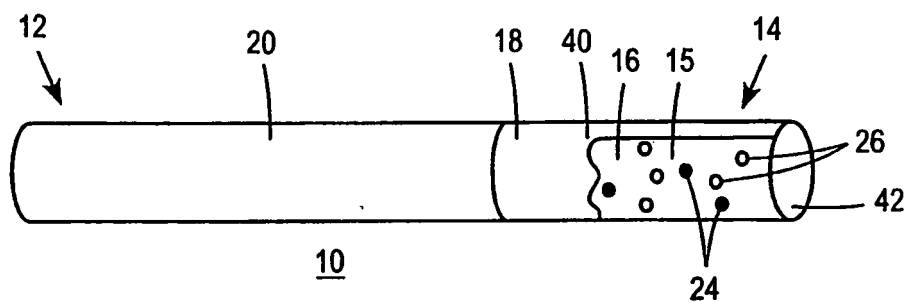


FIG. 1

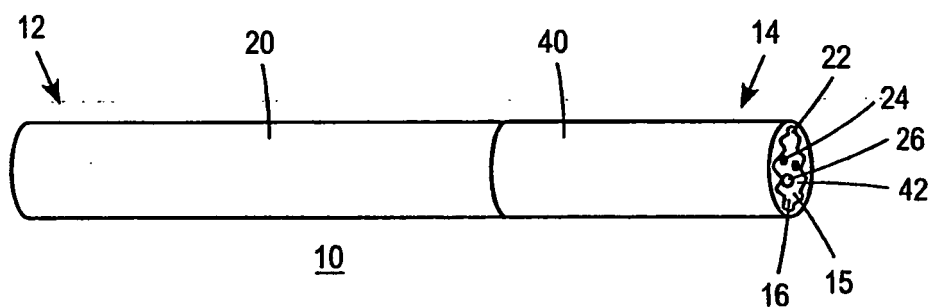


FIG. 2

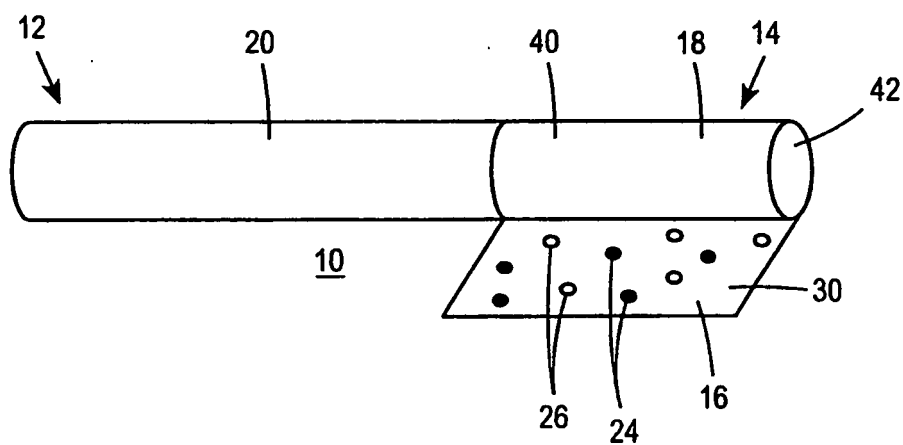


FIG. 3

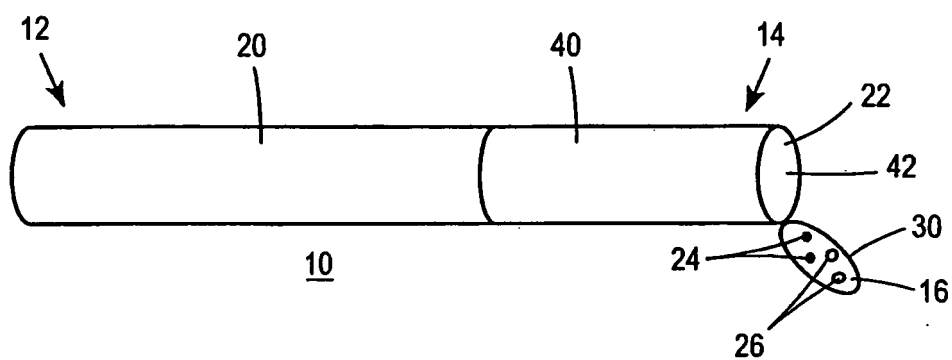


FIG. 4

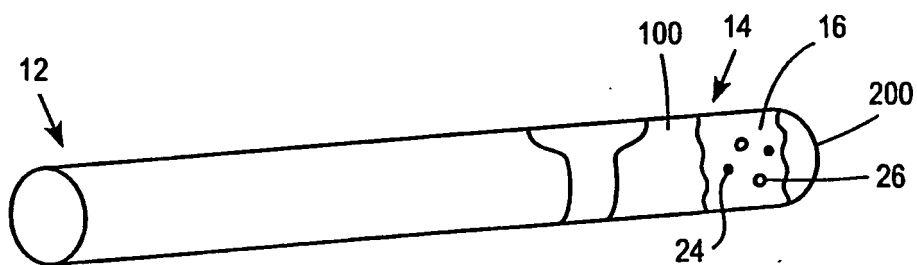


FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2007036814 A [0001]