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(54) **FILTER CIGARETTE AND METHOD OF
MAKING FILTER CIGARETTE FOR AN
ELECTRICAL SMOKING SYSTEM**

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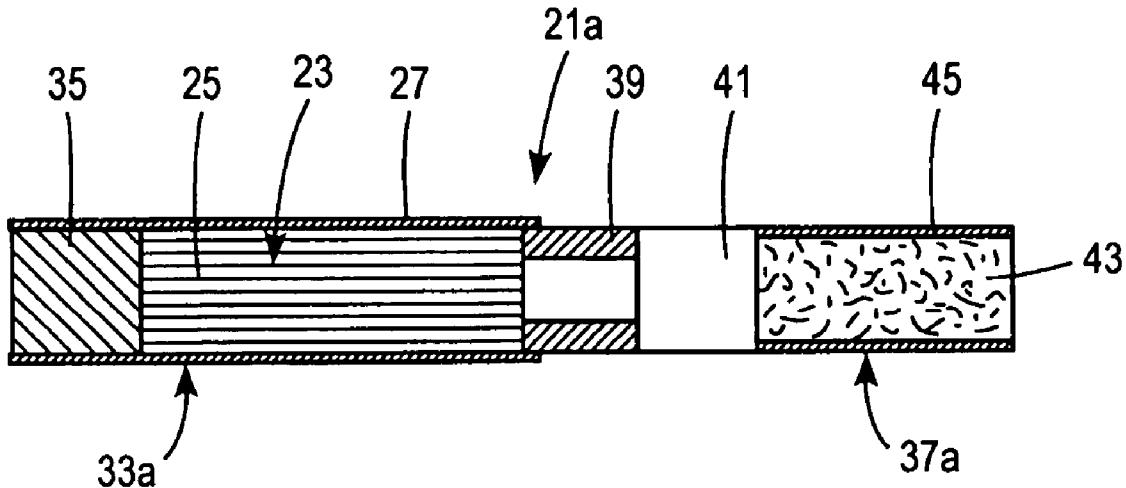
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ABSTRACT

A cigarette of an electrical smoking system includes a filter tipping including a web including added filtering material and a tubular wrapper around the web, and a tobacco rod portion adapted to generate a puff of smoke upon being heated by one or more heating elements during smoking, the tobacco rod portion being attached to the filter tipping.



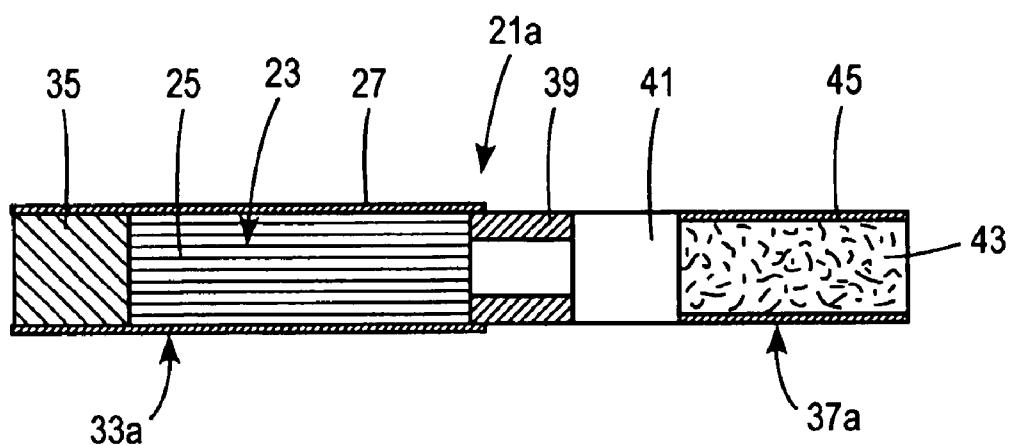


FIG. 1A

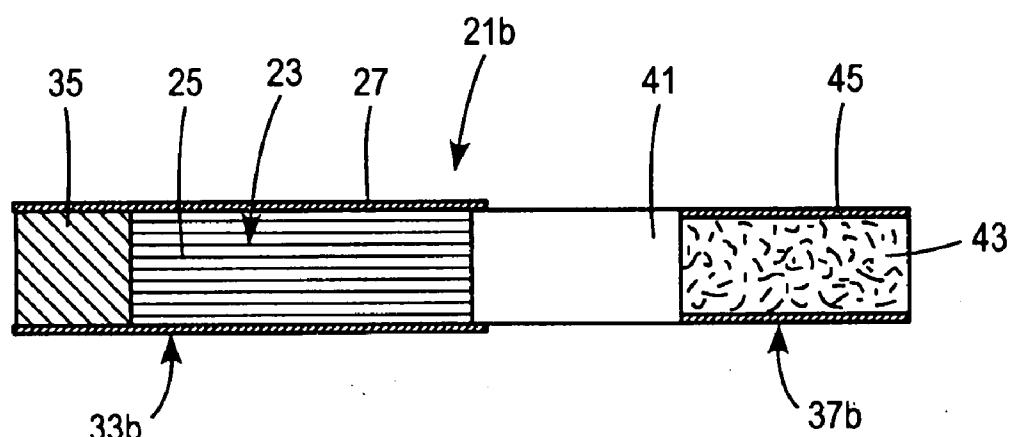


FIG. 1B

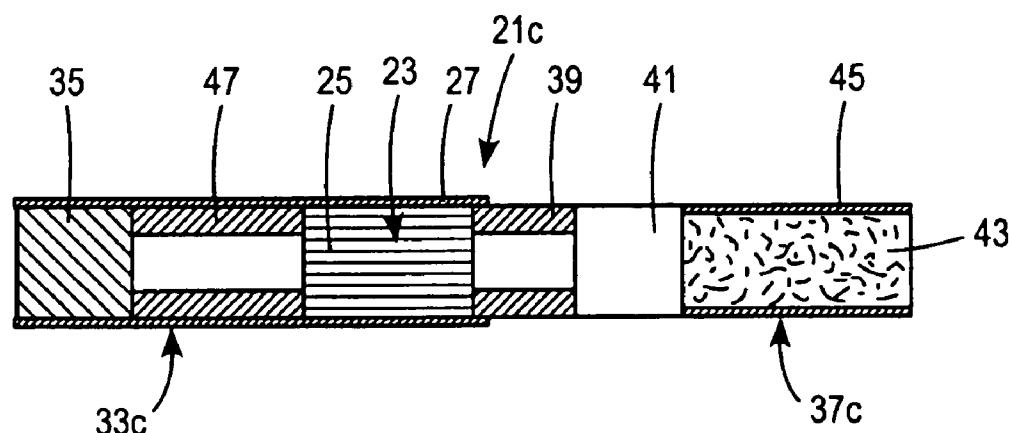


FIG. 1C

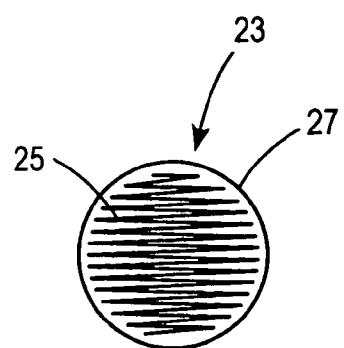


FIG. 2A

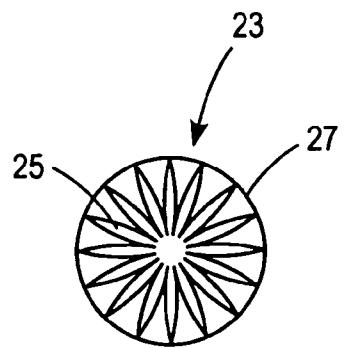


FIG. 2B

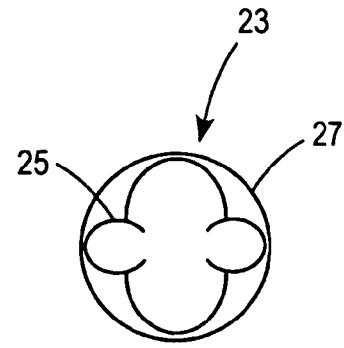


FIG. 2C

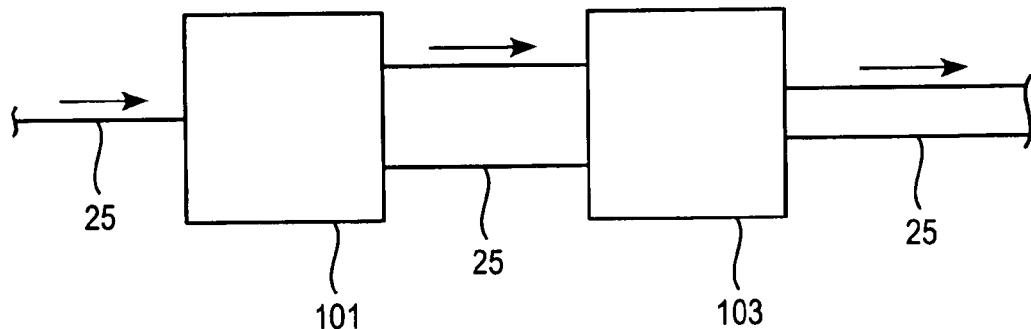


FIG. 3

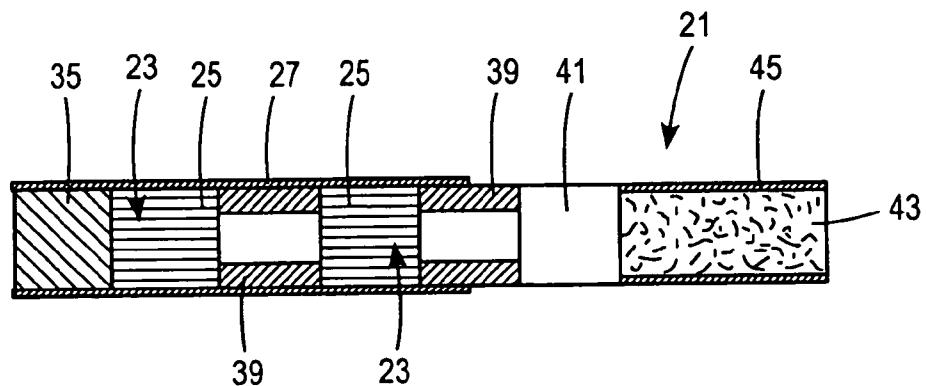


FIG. 4

FILTER CIGARETTE AND METHOD OF MAKING FILTER CIGARETTE FOR AN ELECTRICAL SMOKING SYSTEM

BACKGROUND

[0001] In cigarettes of the type used in electrical smoking systems such as are disclosed in commonly owned U.S. Pat. Nos. 5,388,594; 5,692,525; 6,209,547; 6,289,898; 6,615,840 and 6,888,313, and in U.S. Application Publication No. 20030131859, which patents and application publications are incorporated by reference in their entirety, it is generally desirable to duplicate aspects of the experience of smoking a regular cigarette, such as resistance to draw. However, the manner in which smoke is generated and air is drawn through the cigarette for the electrical smoking system is quite different from the way smoke is generated and air is drawn through a regular cigarette because of the vastly different physical structure of the smoking system versus the regular cigarette. It is desirable to provide cigarettes for use in electrical smoking systems having features that facilitate simulating the experience of smoking a regular cigarette.

SUMMARY

[0002] According to one embodiment, a cigarette for an electrical smoking system includes a filter tipping including a web including added filtering material and a tubular wrapper around the web, and a tobacco rod portion adapted to generate a puff of smoke upon being heated by at least one heating element during smoking, the tobacco rod portion being attached to the filter tipping.

[0003] According to another embodiment, a method for making a cigarette for an electrical smoking system includes making a filter tipping by surrounding a web including added filtering material with a tubular wrapper, and attaching a tobacco rod portion adapted to generate a puff of smoke upon being heated by at least one heating element during smoking to the filter tipping.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] FIGS. 1A-1C are cross-sectional side views of cigarettes according to various embodiments.

[0005] FIGS. 2A-2C show end views of a cigarette filter according to various embodiments.

[0006] FIG. 3 shows a web having a three-dimensional shape being compressed and surrounded by a wrapper according to an embodiment.

[0007] FIG. 4 shows a cigarette filter that uses multiple webs according to an embodiment.

DETAILED DESCRIPTION

[0008] Cigarettes 21a-21c according to embodiments are shown in FIGS. 1A-1C. The cigarettes all include a cigarette filter 23 including a web 25 including filtering material and a tubular wrapper 27 around the web. The cigarette 21 includes a cylindrical member, e.g., a tobacco containing rod portion 37a-37c, for generating smoke attached to the cigarette filter. The cigarette 21 is of the type usable in an electrical smoking system such as is disclosed in commonly

owned U.S. Pat. Nos. 5,388,594; 5,692,525; 6,209,547; 6,289,898; 6,615,840 and 6,888,313, and in U.S. Application Publication No. 20030131859, which patents and application publications are incorporated by reference in their entirety.

[0009] The cigarette filter 23 can replace or be used together with a free flow filter. Several possible, non-limiting arrangements of components are shown in FIGS. 1A-1C. FIG. 1A shows a cigarette 21a wherein a filter 23 is disposed in a filter tipping 33a including the filter 23 positioned adjacent a filter plug 35, which can be, for example, a conventional cellulose acetate tow filter. A tobacco rod portion 37a is attached to the tipping 33a and includes a free flow filter 39, a void 41 or open space, and a tobacco plug 43 wrapped in a wrapper 45 that may include a tobacco web, although other arrangements can also be used. In the electrical smoking system, heat is applied to the wrapper 45 to heat tobacco (e.g., the tobacco web and the tobacco plug 43) during puffing of the cigarette to thereby generate smoke. In addition to removing targeted constituents from smoke, using the filter 23 instead of or in addition to conventional tubular free-flow filters can facilitate adjustment of features of the cigarette such as resistance to draw (RTD) which can be useful in simulating the experience of smoking a traditional, lit-end cigarette.

[0010] FIG. 1B shows a cigarette 21b with a tipping 33b and tobacco rod portion 37b wherein the free flow filter 39 from the cigarette 21a is eliminated. FIG. 1C shows a cigarette 21c with a tobacco rod portion 37c wherein the filter 23 is used together with a free flow filter 47 in the tipping 33c between the filter 23 and the filter plug 35. The foregoing are only several illustrative ones of numerous possible variations. There may be voids, free flow filters, filter plugs, tobacco plugs, and any other desired structures in the cigarette.

[0011] In the cigarette filter 23, the web 25 may include paper. The web 25 may include a coated paper, an impregnated paper, carbon paper, a laminate, or a laminate including paper. The web 25 may be formed into a non-planar shape, such as by folding or rolling or bending the web. As seen in FIG. 2A, the web 25 may be formed into an accordian shape. As seen in FIG. 2B, an accordian-shaped web 25 may be formed into a circular shape. As seen in FIG. 2C, the web 25 may be crimped and formed into any one of numerous possible shapes. As seen in FIG. 3, the web 25 may be formed into any desired three-dimensional shape by a suitable forming apparatus 101 and then swaged or otherwise processed by a suitable compressing apparatus 103 to compress the shape. The web 25 may exert a force on the wrapper 27 to assist in maintaining a three-dimensional shape for the filter 23. The wrapper 27 may be made from a web but may be formed from any structure suited for providing an outer covering for the web 25, such as a pre-formed tube.

[0012] The filtering material is any suitable material, such as a material that reacts with at least one constituent of cigarette smoke. The filtering material can include an aminepropylsilyl group covalently bonded to a non-volatile inorganic substrate. See, for example, commonly-owned U.S. Pat. Nos. 6,209,547, 6,584,979, and 6,595,218, which

are hereby incorporated by reference. The aminopropylsilyl group is preferably a 3-aminopropylsilyl group. The substrate is preferably silica gel or molecular sieve material. The material may be provided on a web 25 of paper or other suitable material.

[0013] In accordance with an embodiment, the physical and chemical properties of the filler material used to produce webs 25 of paper for making filters 23 are chosen and utilized to reduce the aldehyde content of the smoke produced during combustion/pyrolysis of the smoking article. The paper filler includes an ammonium-containing compound, which when heated evolves ammonia, which may chemically react with aldehydes in tobacco smoke and/or modify the combustion/pyrolysis reactions thereby reducing the initial formation of aldehydes, thereby decreasing the delivery of such aldehydes to a smoker. The filtering material can be an ammonium containing compound filler used in the web. See, for example, commonly-owned U.S. Pat. Nos. 6,289,898 and 6,615,840, which are incorporated by reference.

[0014] A suitable ammonium-containing compound is an inorganic ammonium metal salt, such as an ammonium-alkaline earth metal salt, such as $MgNH_4 PO_4 \cdot xH_2O$, wherein x ranges from 1 to 6 (AMP). It is preferred that the ammonium-containing compound have a low solubility in water so as to be compatible with conventional papermaking processes, e.g., the filler is substantially insoluble in an aqueous dispersion containing ingredients of the paper, such as flax, etc. That is, the ammonium-containing compound should be stable enough in a papermaking process to survive intact as filler in the final paper product. This includes sufficient thermal stability to survive the drying steps in the papermaking process. Magnesium ammonium phosphate and its hydrates are well-suited to conventional papermaking processes, and evolve ammonia during the smoking process in a manner that greatly decreases the content of certain low molecular weight aldehydes in smoke. Magnesium potassium phosphate is isostructural with magnesium ammonium phosphate and can form solid solutions therewith effective for reducing the aldehyde content in smoke. An ammonium magnesium phosphate filler that consists essentially of the monohydrate form of magnesium ammonium phosphate is especially preferred.

[0015] The ammonium-containing compound filler can also comprise one or more of the following mineral phases: dittmarite, struvite, hannayite, schertelite, mundrabillaite and swaknoite.

[0016] Ammonium-containing compounds considered useful as filler materials have a range of surface areas, a range of particle sizes (mostly in the micron range), possess appropriate opacity, have low solubility in water (required for papermaking), and possess other properties that are considered desirable in fillers for papers used in cigarettes. In similar papers used for cigarette papers, the filler preferably has a particle size below 25 μm , more preferably below 10 μm .

[0017] The filtering material can include nanoparticles. Some or all of the nanoparticles can be a filler used in the web and some or all of the nanoparticles can be disposed on a surface of the web. The nanoparticles can be capable of acting as at least one of an oxidant for converting carbon monoxide to carbon dioxide and a catalyst for converting

carbon monoxide to carbon dioxide, or both. The nanoparticles can be selected from the group consisting of metals, metal compounds, metal oxides, doped metal oxides, and mixtures thereof. Suitable nanoparticles are preferably selected from the group consisting of Fe_2O_3 , CuO , TiO_2 , CeO_2 , Ce_2O_3 , Al_2O_3 , Y_2O_3 doped with zirconium, Mn_2O_3 doped with palladium, and mixtures thereof. See, for example, commonly-owned U.S. Pat. No. 6,769,437 and U.S. Published Patent Application Nos. 20030075193 and 20030131859.

[0018] The nanoparticles preferably have an average particle size less than about 500 nm, preferably an average particle size less than about 100 nm, more preferably an average particle size less than about 50 nm, and still more preferably an average particle size less than about 5 nm. The nanoparticles preferably have a surface area of at least about $20 m^2/g$, and more preferably a surface area of at least about $200 m^2/g$.

[0019] Though embodiments have been described in conjunction with a single web 25, it will be appreciated that multiple webs 25 may be used, as seen in FIG. 4. Also, more than one type of filtering material may be used on a single web or on different webs. In other embodiments (not shown) the filter may be disposed in the tobacco rod portion or in the tobacco rod portion and the tipping. Where multiple webs are used, they may occupy substantially the same volume, such as where they are layered next to one another, or may be arranged at different axial locations along the length of the cigarette that may be next to one another or not, as desired or necessary.

[0020] While this invention has been illustrated and described in accordance with a preferred embodiment, it is recognized that variations and changes may be made therein without departing from the invention as set forth in the claims.

What is claimed is:

1. A cigarette of an electrical smoking system, comprising:

a filter tipping including a web including added filtering material and a tubular wrapper around the web; and

a tobacco rod portion adapted to generate a puff of smoke upon being heated by heating elements during smoking, the tobacco rod portion being attached to the filter tipping.

2. The cigarette as set forth in claim 1, wherein the web is porous, the web includes paper, the web is a laminate, the web includes carbon paper, at least a portion of the web is formed into a non-planar shape, or an accordian shape, or the web is crimped or swaged.

3. The cigarette as set forth in claim 1, wherein the filtering material includes an aminopropylsilyl group covalently bonded to a non-volatile inorganic substrate.

4. The cigarette as set forth in claim 3, wherein the aminopropylsilyl group is a 3-aminopropylsilyl group.

5. The cigarette as set forth in claim 3, wherein the substrate is silica gel.

6. The cigarette as set forth in claim 1, wherein the filtering material is an ammonium containing compound filler used in the web.

7. The cigarette as set forth in claim 6, wherein the filler includes an ammonium magnesium phosphate filler.

8. The cigarette as set forth in claim 1, wherein the filtering material includes nanoparticles, and at least some of the nanoparticles are a filler used in the web and/or at least some of the nanoparticles are disposed on a surface of the web.

9. The cigarette as set forth in claim 8, wherein the nanoparticles are capable of acting as at least one of an oxidant for converting carbon monoxide to carbon dioxide and a catalyst for converting carbon monoxide to carbon dioxide.

10. The cigarette as set forth in claim 8, wherein the nanoparticles are selected from the group consisting of metals, metal compounds, metal oxides, doped metal oxides, and mixtures thereof.

11. The cigarette as set forth in claim 8, wherein the nanoparticles are selected from the group consisting of Fe_2O_3 , CuO , TiO_2 , CeO_2 , Ce_2O_3 , Al_2O_3 , Y_2O_3 doped with zirconium, Mn_2O_3 doped with palladium, and mixtures thereof.

12. The cigarette as set forth in claim 8, wherein the nanoparticles have an average particle size of less than about 500 nm or the nanoparticles have an average particle size of less than about 50 nm.

13. The cigarette as set forth in claim 8, wherein the nanoparticles have an average particle size of less than about 5 nm or the nanoparticles have a surface area of at least about 20 m^2/g .

14. The cigarette as set forth in claim 8, wherein the nanoparticles have a surface area of at least about 200 m^2/g .

15. The cigarette as set forth in claim 1, wherein the filtering material is reactive with at least one component of cigarette smoke.

16. The cigarette as set forth in claim 1, wherein the filter tipping includes a filter plug disposed at an end of the filter tipping opposite the tobacco rod portion.

17. The cigarette as set forth in claim 1, wherein the filter tipping includes a tubular free-flow filter having an internal opening in which the web is disposed.

18. The cigarette as set forth in claim 1, wherein the web contacts an interior surface of the wrapper.

19. The cigarette as set forth in claim 1, wherein the tobacco rod portion includes at least one of a plug portion, a free-flow filter, a void portion and a tobacco web.

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