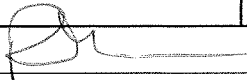


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UTILITY PATENT APPLICATION TRANSMITTAL <i>(Only for new nonprovisional applications under 37 CFR 1.53(b))</i>	Attorney Docket No.	13211-713.303
	First Named Inventor	Adam BOWEN
	Title	NICOTINE SALT FORMULATIONS FOR ...
	Express Mail Label No.	FILED VIA EFS ON 10/28/2015

APPLICATION ELEMENTS <i>See MPEP chapter 600 concerning utility patent application contents.</i>	Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450
1. ☐ Fee Transmittal Form (PTO/SB/17 or equivalent) 2. ☐ Applicant asserts small entity status. See 37 CFR 1.27 3. ☐ Applicant certifies micro entity status. See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent. 4. ☒ Specification [Total Pages <u>93</u>] Both the claims and abstract must start on a new page. (See MPEP § 608.01(a) for information on the preferred arrangement) 5. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets <u>8</u>] 6. Inventor's Oath or Declaration [Total Pages <u>2</u>] (including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e)) a. ☐ Newly executed (original or copy) b. ☒ A copy from a prior application (37 CFR 1.63(d)) 7. ☒ Application Data Sheet * See note below. See 37 CFR 1.76 (PTO/AIA/14 or equivalent) 8. CD-ROM or CD-R in duplicate, large table, or Computer Program (Appendix) ☐ Landscape Table on CD 9. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. – c. are required) a. ☐ Computer Readable Form (CRF) b. ☐ Specification Sequence Listing on: i. ☐ CD-ROM or CD-R (2 copies); or ii. ☐ Paper c. ☐ Statements verifying identity of above copies	ACCOMPANYING APPLICATION PAPERS 10. ☐ Assignment Papers (cover sheet & document(s)) Name of Assignee _____ 11. ☐ 37 CFR 3.73(c) Statement ☐ Power of Attorney (when there is an assignee) 12. ☐ English Translation Document (if applicable) 13. ☐ Information Disclosure Statement (PTO/SB/08 or PTO-1449) ☐ Copies of citations attached 14. ☐ Preliminary Amendment 15. ☐ Return Receipt Postcard (MPEP § 503) (Should be specifically itemized) 16. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed) 17. ☐ Nonpublication Request Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent. 18. ☒ Other: Certification and Request for Prioritized Examination (Track 1), Fee Transmittal _____ _____ _____

*Note: (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

19. CORRESPONDENCE ADDRESS				
☒ The address associated with Customer Number: <u>66854</u> OR ☐ Correspondence address below				
Name				
Address				
City	State	Zip Code		
Country	Telephone	Email		
Signature			Date	October 28, 2015
Name (Print/Type)	Richard D. Shoop		Registration No. (Attorney/Agent)	45,763

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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**CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION
UNDER 37 CFR 1.102(e) (Page 1 of 1)**

First Named Inventor:	Adam BOWEN	Nonprovisional Application Number (if known):	
Title of Invention:	NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

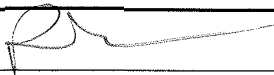
1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently \$0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.
2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.
3. The applicable box is checked below:

I. ☒ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)

- i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.
---OR---
(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.
- ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, or the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)

- i. A request for continued examination has been filed with, or prior to, this form.
- ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
- iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
- iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
- v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature 	Date October 28, 2015
Name (Print/Typed) Richard D. Shoop	Practitioner Registration Number 45,763
Note: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.*	
☒ *Total of <u>one</u> forms are submitted.	

CERTIFICATE OF TRANSMISSION UNDER 37 CFR 1.8

I hereby certify that this correspondence is being transmitted to the USPTO via EFS-Web on October 28, 2015.

/Jennifer Capizzi/
Jennifer Capizzi

October 28, 2015
Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. : Unassigned Confirmation No. : Unassigned
First Named Inventor : Adam BOWEN
Filing Date : Herewith
Art Unit : Unassigned
Examiner : Unassigned
Title : NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES
AND METHODS THEREOF
Customer No. : 66854

FEE TRANSMITTAL

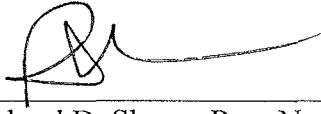
Transmitted herewith are the following fees:

(1) Basic Filing Fee - Utility	\$280
(2) Utility Search Fee	\$600
(3) Utility Examination Fee	\$720
(4) Claims in Excess of 20 (0 x \$80)	\$0
(5) Independent Claims in Excess of 3 (0 x \$420)	\$0
(6) Processing fee (1.17(i))	\$140
(7) Prioritized Examination Fee (Track 1) (1.17(c))	\$4,000
(8) Application Size Fee (0 x \$400)	\$0
Total	\$5,740

- ☒ The above fees have been paid via EFS to Deposit Account No. 50-4050. Please also deduct from or credit to said Deposit Account any other fees attendant with this matter.

Respectfully submitted,

Dated: October 28, 2015

By: 

Richard D. Shoop, Reg. No. 45,763

SHAY GLENN LLP
2755 CAMPUS DRIVE, SUITE 210
SAN MATEO, CA 94403
TELEPHONE: 650.212.1700
FACSIMILE: 650.212.7562

SG Docket No.: 13211-713.303

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF
--------------------	--

As the below named inventor, I hereby declare that:

This declaration is directed to: ☐ The attached application, or ☒ United States application or PCT international application number 14/271,071 filed on May 6, 2014

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

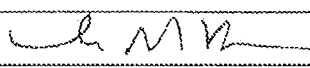
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Adam Bowen Date (Optional): 5/14/14

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**

Title of Invention	NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF
-----------------------	---

As the below named inventor, I hereby declare that:

This declaration is directed to: ☐ The attached application, or

☒ United States application or PCT international application number 14/271,071
filed on May 6, 2014

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

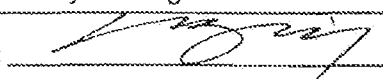
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Chenyue Xing Date (Optional): 05/19/14

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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UNITED STATES PATENT APPLICATION

**NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND
METHODS THEREOF**

Inventor(s):

Adam BOWEN

Chenyue XING

ShayGlennLLP

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(650) 212-1700 Telephone
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CERTIFICATE OF TRANSMISSION UNDER 37 CFR 1.8

I hereby certify that this correspondence is being transmitted to the
USPTO via EFS-Web on October 28, 2015.

/Jennifer Capizzi/
Jennifer Capizzi

October 28, 2015
Date

NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF

CROSS REFERENCE

[0001] This application is a continuation of U.S. Patent Application No. 14/512,311, filed October 10, 2014, titled “NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF,” now U.S. Patent Application Publication No. 2015-0020824-A1, which is a continuation of U.S. Patent Application No. 14/271,071, filed May 6, 2014, titled “NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF,” now U.S. Patent Application Publication No. 2014-0345631-A1, which claims the benefit of U.S. Provisional Patent Application No. 61/820,128, filed May 6, 2013, and U.S. Provisional Patent Application No. 61/912,507, filed December 5, 2013, all of which are incorporated herein by reference in their entirety.

SUMMARY OF THE INVENTION

[0002] Provided herein is a method of delivering nicotine to a user comprising operating an electronic cigarette to a user wherein the electronic cigarette comprises a nicotine salt formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C, and inhaling an aerosol generated from the nicotine salt formulation heated by the electronic cigarette.

[0003] Provided herein is a method of delivering nicotine to a user comprising operating an electronic cigarette to a user wherein the electronic cigarette comprises a nicotine salt formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C, and inhaling an aerosol generated from the nicotine salt formulation heated by the electronic cigarette.

[0004] Provided herein is a method of delivering nicotine to a user comprising operating an electronic cigarette wherein the electronic cigarette comprises a nicotine salt formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C,

and at least a 50-degree difference between the melting point and the boiling point, and inhaling an aerosol generated from the nicotine salt formulation heated by the electronic cigarette.

[0005] Provided herein is a method of delivering nicotine to a user comprising providing an electronic cigarette to a user wherein the electronic cigarette comprises a nicotine salt formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point, and inhaling an aerosol generated from the nicotine salt formulation heated by the electronic cigarette.

[0006] Provided herein is a method of delivering nicotine to the blood of a user, said method comprising providing an aerosol that is inhaled by the user from an electronic cigarette that comprises a nicotine salt formulation wherein providing the aerosol comprises the electronic cigarette heating the formulation thereby generating the aerosol, wherein the aerosol is effective in delivering a level of nicotine in the blood of the user that is at least 5ng/mL at about 1.5 minutes after a first puff of ten puffs of the aerosol, each puff taken at 30 second intervals.

[0007] Provided herein is a nicotine salt liquid formulation in an electronic cigarette for generating an inhalable aerosol upon heating in the electronic cigarette, the formulation in the cigarette comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C.

[0008] Provided herein is a nicotine salt liquid formulation in an electronic cigarette for generating an inhalable aerosol upon heating in the electronic cigarette, the formulation in the cigarette comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C.

[0009] Provided herein is a nicotine salt liquid formulation in an electronic cigarette for generating an inhalable aerosol upon heating in the electronic cigarette, the formulation in the cigarette comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point.

[0010] Provided herein is a nicotine salt liquid formulation in an electronic cigarette for generating an inhalable aerosol upon heating in the electronic cigarette, the formulation in the cigarette comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point.

[0011] Provided herein is a nicotine salt liquid formulation for generating an inhalable aerosol upon heating in the electronic cigarette, the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C.

[0012] Provided herein is a nicotine salt liquid formulation for generating an inhalable aerosol upon heating in the electronic cigarette, the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C.

[0013] Provided herein is a nicotine salt liquid formulation for generating an inhalable aerosol upon heating in the electronic cigarette, the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point.

[0014] Provided herein is a nicotine salt liquid formulation for generating an inhalable aerosol upon heating in the electronic cigarette, the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point.

[0015] Provided herein is a nicotine salt liquid formulation for use in an electronic cigarette the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C.

[0016] Provided herein is a nicotine salt liquid formulation for use in an electronic cigarette the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C.

[0017] Provided herein is a nicotine salt liquid formulation for use in an electronic cigarette the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point.

[0018] Provided herein is a nicotine salt liquid formulation for use in an electronic cigarette the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point.

[0019] Provided herein is a use of a nicotine salt formulation for delivery of nicotine to a user from an electronic cigarette wherein the nicotine salt formulation comprises a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C, and the nicotine salt formulation is heated by the electronic cigarette to generate an aerosol inhalable by the user.

[0020] Provided herein is a use of a nicotine salt formulation for delivery of nicotine to a user from an electronic cigarette wherein the nicotine salt formulation comprises a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C, and the nicotine salt formulation is heated by the electronic cigarette to generate an aerosol inhalable by the user.

[0021] Provided herein is a use of a nicotine salt formulation for delivery of nicotine to a user from an electronic cigarette wherein the nicotine salt formulation comprises a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point, and the nicotine salt formulation is heated by the electronic cigarette to generate an aerosol inhalable by the user.

[0022] Provided herein is a use of a nicotine salt formulation for delivery of nicotine to the blood of a user from an electronic cigarette, wherein the nicotine salt formulation in the electronic cigarette is heated to form an aerosol which delivers a level of nicotine in the blood of the user that is at least 5 ng/mL at about 1.5 minutes after a first puff of ten puffs of the aerosol, each puff taken at 30 second intervals.

[0023] Provided herein is a use of a nicotine salt formulation for delivery of nicotine to a user from an electronic cigarette wherein the nicotine salt formulation comprises a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point, and the nicotine salt formulation is heated by the electronic cigarette to generate an aerosol inhalable by the user.

[0024] Provided herein is a cartomizer for an electronic cigarette comprising:

- a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C;
- an atomizer comprising a heating element in fluid communication with the nicotine salt liquid formulation; and
- a fluid storage compartment that stores the nicotine salt liquid formulation.

[0025] Provided herein is a cartomizer for an electronic cigarette comprising:

- a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C;
- an atomizer comprising a heating element in fluid communication with the nicotine salt liquid formulation; and
- a fluid storage compartment that stores the nicotine salt liquid formulation.

[0026] Provided herein is a cartomizer for an electronic cigarette comprising:

- a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further

characterized by a melting point $<160^{\circ}\text{C}$, a boiling point $>160^{\circ}\text{C}$, and at least a 50-degree difference between the melting point and the boiling point;
an atomizer comprising a heating element in fluid communication with the nicotine salt liquid formulation; and
a fluid storage compartment that stores the nicotine salt liquid formulation.

[0027] Provided herein is a cartomizer for an electronic cigarette comprising:

a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point;
an atomizer comprising a heating element in fluid communication with the nicotine salt liquid formulation; and
a fluid storage compartment that stores the nicotine salt liquid formulation.

[0028] Provided herein is an electronic cigarette for generating an inhalable aerosol comprising:

a fluid storage compartment;
a heater; and
a nicotine salt liquid formulation in the fluid storage compartment, the liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure $>20\text{ mmHg}$ at 200°C ;
a battery; and
a mouthpiece.

[0029] Provided herein is an electronic cigarette for generating an inhalable aerosol comprising:

a fluid storage compartment;
a heater; and
a nicotine salt liquid formulation in the fluid storage compartment, the liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200°C ;

a battery; and
a mouthpiece.

[0030] Provided herein is an electronic cigarette for generating an inhalable aerosol comprising:

a fluid storage compartment;
a heater; and
a nicotine salt liquid formulation in the fluid storage compartment, the liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point $<160^{\circ}\text{C}$, a boiling point $>160^{\circ}\text{C}$, and at least a 50-degree difference between the melting point and the boiling point;
a battery; and
a mouthpiece.

[0031] Provided herein is an electronic cigarette for generating an inhalable aerosol comprising:

a fluid storage compartment;
a heater; and
a nicotine salt liquid formulation in the fluid storage compartment, the liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point;
a battery; and
a mouthpiece.

[0032] Provided herein is a cartridge in an electronic cigarette comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure $>20\text{ mmHg}$ at 200°C .

[0033] Provided herein is a cartridge in an electronic cigarette comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation

comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C.

[0034] Provided herein is a cartridge in an electronic cigarette comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point.

[0035] Provided herein is a cartridge in an electronic cigarette comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point.

[0036] Provided herein is a kit comprising:

- (a) an electronic cigarette for generating an inhalable aerosol comprising
 - i. a device body comprising a cartridge receptacle;
 - ii. a cartridge comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C;
 - iii. a heater;
 - iv. a battery; and
 - v. a mouthpiece; and
- (b) instructions for using the electronic cigarette to generate an inhalable aerosol.

[0037] Provided herein is a kit comprising:

- (c) an electronic cigarette for generating an inhalable aerosol comprising
 - i. a device body comprising a cartridge receptacle;
 - ii. a cartridge comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a

nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C;

- iii. a heater;
 - iv. a battery; and
 - v. a mouthpiece; and
- (d) instructions for using the electronic cigarette to generate an inhalable aerosol.

[0038] Provided herein is a kit comprising:

- (e) an electronic cigarette for generating an inhalable aerosol comprising
 - i. a device body comprising a cartridge receptacle;
 - ii. a cartridge comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point;
 - iii. a heater;
 - iv. a battery; and
 - v. a mouthpiece; and
- (f) instructions for using the electronic cigarette to generate an inhalable aerosol.

[0039] Provided herein is a kit comprising:

- (g) an electronic cigarette for generating an inhalable aerosol comprising
 - i. a device body comprising a cartridge receptacle;
 - ii. a cartridge comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point;

- iii. a heater;
 - iv. a battery; and
 - v. a mouthpiece; and
- (h) instructions for using the electronic cigarette to generate an inhalable aerosol.

INCORPORATION BY REFERENCE

[0040] All publications, patents and patent applications mentioned in this specification are herein incorporated by reference to the same extent as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated by reference.

BRIEF DESCRIPTION OF THE DRAWINGS

[0041] A better understanding of the features and advantages of the present invention will be obtained by reference to the following detailed description that sets forth illustrative embodiments, in which the principles of the invention are used, and the accompanying drawings of which:

[0042] **Figure 1** illustrates results of heart rate data measured for six minutes from start of puffing. Y-axis is heart rate (bpm) and X-axis represent duration of the test (-60 to 180 seconds);

[0043] **Figure 2** illustrates results of heart rate data measured for ten minutes from start of puffing. Y-axis is heart rate (bpm) and X-axis represents duration of the test (0 to 10 minutes);

[0044] **Figure 3** illustrates the calculated vapor pressures of various acids relative to nicotine;

[0045] **Figure 4** illustrates the pharmacokinetic profiles for eight test articles in a blood plasma study;

[0046] **Figure 5** illustrates the comparison of $C_{\max}$ and $T_{\max}$ for eight test articles in a blood plasma study;

[0047] **Figure 6** illustrates the comparison of $C_{\max}$ and AUC for eight test articles in a blood plasma study;

[0048] **Figure 7** depicts an example embodiment of an electronic cigarette having a fluid storage compartment comprising an embodiment nicotine salt formulation described herein; and

[0049] **Figure 8** depicts an example embodiment of an electronic cigarette cartomizer having a fluid storage compartment, a heater, and comprising an embodiment nicotine salt formulation described herein.

DETAILED DESCRIPTION OF THE INVENTION

[0050] Nicotine is a chemical stimulant and increases heart rate and blood pressure when provided to an individual or animal. Nicotine transfer to an individual is associated with a feeling of physical and/or emotional satisfaction. Conflicting reports have been published regarding the transfer efficiency of free base nicotine in comparison to mono- or di-protonated nicotine salts. Studies on the transfer efficiency of free base nicotine and nicotine salts are complex and have yielded unpredictable results. Further, such transfer efficiency studies have been performed under extremely high temperature conditions, comparable to smoking; therefore, they offer scant guidance on the transfer efficiency of free base nicotine and nicotine salts under low-temperature vaporization conditions. Some reports have posited that nicotine free base should give rise to a greater satisfaction in a user than any corresponding nicotine salt.

[0051] It has been unexpectedly discovered herein that certain nicotine salt formulations provide satisfaction in an individual superior to that of free base nicotine, and more comparable to the satisfaction in an individual smoking a traditional cigarette. The satisfaction effect is consistent with an efficient transfer of nicotine to the lungs of an individual and a rapid rise of nicotine absorption in the plasma as shown, for non-limiting example, in Example 8, at least. It has also been unexpectedly discovered herein that certain nicotine salt formulations provide greater satisfaction than other nicotine salt formulations, and such effect has been shown in blood plasma levels of example nicotine salt formulations herein, for non-limiting example, in Example 8, at least. These results show a difference in rate of nicotine uptake in the blood that is higher for some nicotine salt formulations aerosolized by an electronic cigarette than for other nicotine salt formulations, and likewise higher than nicotine freebase formulations, while the peak concentration of the nicotine in the blood and total amount of nicotine delivered appears comparable to a traditional cigarette, and do not appear to vary significantly between the various nicotine formulations. Therefore, described herein are nicotine salt formulations for use in an electronic cigarette, or the like, that provide a general satisfaction effect consistent with an efficient transfer of nicotine to the lungs of an individual and a rapid rise of nicotine absorption in the plasma. Provided herein, therefore, are devices, formulation of nicotine salts, systems, cartomizers, kits and methods that are used to inhale an aerosol generated from a nicotine salt

liquid formulation through the mouth or nose as described herein or as would be obvious to one of skill in the art upon reading the disclosure herein.

[0052] Consistent with these satisfaction effects, it has unexpectedly been found herein that there is a difference between the $C_{\max}$ (maximum concentration) and $T_{\max}$ (time at which the maximum concentration is measured) when measuring blood plasma nicotine levels of freebase nicotine formulations inhaled using a low temperature vaporization device, i.e. electronic cigarette, as compared to the $C_{\max}$ and $T_{\max}$ (similarly measuring blood plasma nicotine levels) of a traditional cigarette. Also consistent with these satisfaction effects, it has unexpectedly been found herein that there is a difference between the $C_{\max}$ (maximum concentration) and $T_{\max}$ (time at which the maximum concentration is measured) when measuring blood plasma nicotine levels of freebase nicotine formulations inhaled using a low temperature vaporization device, i.e. electronic cigarette, as compared to the $C_{\max}$ and $T_{\max}$ (similarly measuring blood plasma nicotine levels) of nicotine salt formulations inhaled using a low temperature vaporization device, i.e. electronic cigarette. Additionally, it has unexpectedly been found that there is a difference between the rate of nicotine uptake in the plasma of users inhaling freebase nicotine formulations using a low temperature vaporization device, i.e. electronic cigarette, as compared to the rate of nicotine uptake in the plasma of users inhaling smoke of a traditional cigarette. Furthermore, it has unexpectedly been found that there is a difference between the rate of nicotine uptake in the plasma of users inhaling freebase nicotine formulations using a low temperature vaporization device, i.e. electronic cigarette, as compared to the rate of nicotine uptake in the plasma of users inhaling nicotine salt formulations using a low temperature vaporization device, i.e. electronic cigarette.

[0053] Thus, looking at freebase nicotine as a source of nicotine in compositions used in e-cigarettes, freebase nicotine compositions' delivery of nicotine to blood when inhaled using is not necessarily comparable in blood plasma levels ($C_{\max}$ and $T_{\max}$) to a traditional cigarette's nicotine delivery to blood when inhaled. Freebase nicotine compositions' delivery of nicotine to blood when inhaled using is not necessarily comparable in blood plasma levels ($C_{\max}$ and $T_{\max}$) to nicotine salt formulations' nicotine delivery to blood when inhaled. Freebase nicotine compositions' delivery of nicotine to blood when inhaled using is not necessarily comparable in blood plasma levels when measuring the rate of nicotine uptake in the blood within the first 0-5 minutes to a traditional cigarette's nicotine delivery to blood when inhaled. Freebase nicotine

compositions' delivery of nicotine to blood when inhaled using necessarily is not comparable in blood plasma levels when measuring the rate of nicotine uptake in the blood within the first 0-5 minutes to nicotine salt formulations' nicotine delivery to blood when inhaled.

[0054] Also consistent with these satisfaction effects, it has unexpectedly been found herein that while there appears to be comparable $C_{\max}$ and $T_{\max}$ values (measuring blood plasma nicotine levels) of nicotine salt formulations inhaled using a low temperature vaporization device, i.e. electronic cigarette, as compared to the $C_{\max}$ and $T_{\max}$ (similarly measuring blood plasma nicotine levels) of a traditional cigarette, there is a demonstrable difference between the rate of nicotine uptake in the plasma of users inhaling certain nicotine salt formulations using a low temperature vaporization device, i.e. electronic cigarette, as compared to the rate of nicotine uptake in the plasma of users inhaling other nicotine salt formulations using a low temperature vaporization device, i.e. electronic cigarette. It is also unexpected that while the $C_{\max}$ and $T_{\max}$ values are comparable to those of a traditional cigarette, (or are approaching that of a traditional cigarette), the rate of nicotine uptake in the plasma of blood of users is higher in certain nicotine salt formulations than that of the traditional cigarette. The nicotine salt formulations which demonstrate the quickest rate of nicotine uptake in the plasma were more preferred in satisfaction evaluations, and were rated more equivalent to cigarette satisfaction than the nicotine salt formulations showing the slowest rates of rise of nicotine in the subjects' blood plasma. In addition, doubling the concentration of the nicotine salt in the formulation may not necessarily impact the rate of absorption of nicotine in the blood (see, for non-limiting example Example 8, nicotine benzoate tested in 4% and 2% concentrations).

[0055] Thus, looking at nicotine salt formulations used in e-cigarettes, nicotine salt formulations delivered using an e-cigarette appear comparable in $C_{\max}$ and $T_{\max}$ values (measuring blood plasma nicotine levels), however, not all nicotine salts perform similarly to each other or to a traditional cigarette with respect to the rate of nicotine uptake in the blood at early time periods (0-1.5 minutes). These results are unexpected. Nicotine salt formulations made using acids having a Vapor Pressure between 20 – 300 mmHg @ 200 °C, or Vapor Pressure > 20 mmHg @ 200 °C, or a Vapor Pressure from 20 to 300 mmHg @ 200 °C, or a Vapor Pressure from 20 to 200 mmHg @ 200 °C, a Vapor Pressure between 20 and 300 mmHg @ 200 °C appear to have a higher rate of nicotine uptake in the blood at early time periods (0-1.5 minutes, 0-3 minutes, 0-2 minutes, 0-4 minutes for non-limiting example) than other nicotine

salt formulations, however, they also provide satisfaction comparable to a traditional cigarette or closer to a traditional cigarette (as compared to other nicotine salt formulations or as compared to nicotine freebase formulations). For non-limiting example, acids that meet one or more criteria of the prior sentence include salicylic acid, sorbic acid, benzoic acid, lauric acid, and levulinic acid. Nicotine salt formulations made using acids that have a difference between boiling point and melting point of at least 50 °C, and a boiling point greater than 160 °C, and a melting point less than 160 °C appear to have a higher rate of nicotine uptake in the blood at early time periods (0-1.5 minutes, 0-3 minutes, 0-2 minutes, 0-4 minutes for non-limiting example) than other nicotine salt formulations, however, they also provide satisfaction comparable to a traditional cigarette or closer to a traditional cigarette (as compared to other nicotine salt formulations or as compared to nicotine freebase formulations). For non-limiting example, acids that meet the criteria of the prior sentence include salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid. Nicotine salt formulations made using acids that have a difference between boiling point and melting point of at least 50 °C, and a boiling point at most 40 °C less than operating temperature, and a melting point at least 40 °C lower than operating temperature appear to have a higher rate of nicotine uptake in the blood at early time periods (0-1.5 minutes, 0-3 minutes, 0-2 minutes, 0-4 minutes for non-limiting example) than other nicotine salt formulations, however, they also provide satisfaction comparable to a traditional cigarette or closer to a traditional cigarette (as compared to other nicotine salt formulations or as compared to nicotine freebase formulations). Operating temperature can be 100 °C to 300°C, or about 200°C, about 150°C to about 250°C, 180°C to 220°C, about 180°C to about 220°C, 185°C to 215°C, about 185°C to about 215°C, about 190°C to about 210°C, 190°C to 210°C, 195°C to 205°C, or about 195°C to about 205°C. For non-limiting example, acids that meet the criteria of the prior sentence include salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid. Combinations of these criteria for preference of certain nicotine salt formulations are contemplated herein.

[0056] Other reasons for excluding certain acids from formulations may be unrelated to the rate of nicotine uptake, however. For example, an acid may be inappropriate for use with the device materials (corrosive or otherwise incompatible). Sulfuric acid is an example of this, which may be inappropriate for the e-cigarette device. An acid may be inappropriate for use in inhalation or for toxicity reasons – thus not be compatible for human consumption, ingestion, or

inhalation. Sulfuric acid again is an example of this, which may be inappropriate for a user of an e-cigarette device, depending on the embodiment of the composition. An acid that is bitter or otherwise bad-tasting may also provide a reason for exclusion, such as acetic acid in some embodiments. Acids that oxidize at room temperature or at operating temperature may be inappropriate for certain embodiments, for example, sorbic acid, as this indicates a decomposition or reaction or instability that may be undesirable in the formulation.

Decomposition of acids at room or operating temperatures may also indicate that the acid is inappropriate for use in the embodiment formulations. For example, citric acid decomposes at 175°C, and malic acid decomposes at 140°C, thus for a device operating at 200°C, these acids may not be appropriate. Acids that have poor solubility in the composition constituents may be inappropriate for use in certain embodiments of the compositions herein. For example, nicotine bitartrate with a composition of nicotine and tartaric acid as 1:2 molar ratio will not produce a solution at a concentration of 0.5%(w/w) nicotine or higher and 0.9%(w/w) tartaric acid or higher in propylene glycol (PG) or vegetable glycerin (VG) or any mixture of PG and VG at ambient conditions. As used herein, weight percentage (w/w) refers to the weight of the individual component over the weight of the total formulation.

[0057] As used in this specification and the claims, the singular forms “a,” “an,” and “the” include plural referents unless the context clearly dictates otherwise.

[0058] The term “organic acid” as used herein, refers to an organic compound with acidic properties (e.g., by Brønsted-Lowry definition, or Lewis definition). A common organic acid is the carboxylic acids, whose acidity is associated with their carboxyl group –COOH. A dicarboxylic acid possesses two carboxylic acid groups. The relative acidity of an organic is measured by its pK_a value and one of skill in the art knows how to determine the acidity of an organic acid based on its given pK_a value. The term “keto acid” as used herein, refers to organic compounds that contain a carboxylic acid group and a ketone group. Common types of keto acids include alpha-keto acids, or 2-oxoacids, such as pyruvic acid or oxaloacetic acid, having the keto group adjacent to the carboxylic acid; beta-keto acids, or 3-oxoacids, such as acetoacetic acid, having the ketone group at the second carbon from the carboxylic acid; gamma-keto acids, or 4-oxoacids, such as levulinic acid, having the ketone group at the third carbon from the carboxylic acid.

[0059] The term “electronic cigarette” or “e-cigarette” or “low temperature vaporization device” as used herein, refers to an electronic inhaler that vaporizes a liquid solution into an aerosol mist, simulating the act of tobacco smoking. The liquid solution comprises a formulation comprising nicotine. There are many electronic cigarettes which do not resemble conventional cigarettes at all. The amount of nicotine contained can be chosen by the user via the inhalation. In general, an electronic cigarette contains three essential components: a plastic cartridge that serves as a mouthpiece and a reservoir for liquid, an "atomizer" that vaporizes the liquid, and a battery. Other embodiment electronic cigarettes include a combined atomizer and reservoir, called a “cartomizer” that may or may not be disposable, a mouthpiece that may be integrated with the cartomizer or not, and a battery.

[0060] As used in this specification and the claims, unless otherwise stated, the term “about” refers to variations of 1%, 2%, 3%, 4%, 5%, 10%, 15%, or 25%, depending on the embodiment.

[0061] Suitable carriers (e.g., a liquid solvent) for the nicotine salts described herein include a medium in which a nicotine salt is soluble at ambient conditions, such that the nicotine salt does not form a solid precipitate. Examples include, but are not limited to, glycerol, propylene glycol, trimethylene glycol, water, ethanol and the like, as well as combinations thereof. In some embodiments, the liquid carrier comprises 0% to 100% of propylene glycol and 100% to 0% of vegetable glycerin. In some embodiments, the liquid carrier comprises 10% to 70% of propylene glycol and 90% to 30% of vegetable glycerin. In some embodiments, the liquid carrier comprises 20% to 50% of propylene glycol and 80% to 50% of vegetable glycerin. In some embodiments, the liquid carrier comprises 30% propylene glycol and 70% vegetable glycerin.

[0062] The formulations described herein vary in concentration. In some formulations, a dilute concentration of the nicotine salt in the carrier is utilized. In some formulations, a less dilute concentration of the nicotine salt in the carrier is utilized. In some formulations the concentration of nicotine in the nicotine salt formulation is about 1% (w/w) to about 25% (w/w). In some formulations the concentration of nicotine in the nicotine salt formulation is about 1% (w/w) to about 20% (w/w). In some formulations the concentration of nicotine in the nicotine salt formulation is about 1% (w/w) to about 18% (w/w). In some embodiments the concentration of nicotine in the nicotine salt formulation is about 1% (w/w) to about 15% (w/w). In some formulations the concentration of nicotine in the nicotine salt formulation is about 4% (w/w) to about 12% (w/w). In some formulations the concentration of nicotine in the nicotine salt

formulation is about 4% (w/w). In some embodiments the concentration of nicotine in the nicotine salt formulation is about 2% (w/w). In some formulations the concentration of nicotine in the nicotine salt formulation is 1% (w/w) to 25% (w/w). In some formulations the concentration of nicotine in the nicotine salt formulation is 1% (w/w) to 20% (w/w). In some formulations the concentration of nicotine in the nicotine salt formulation is 1% (w/w) to 18% (w/w). In some formulations the concentration of nicotine in the nicotine salt formulation is 1% (w/w) to 15% (w/w). In some formulations the concentration of nicotine in the nicotine salt formulation is 4% (w/w) to 12% (w/w). In some formulations the concentration of nicotine in the nicotine salt formulation is 4% (w/w). In some formulations the concentration of nicotine in the nicotine salt formulation is 2% (w/w). In some formulations, a less dilute concentration of one nicotine salt is used in conjunction with a more dilute concentration of a second nicotine salt. In some formulations, the concentration of nicotine in the first nicotine salt formulation is about 1% to about 20%, and is combined with a second nicotine salt formulation having a concentration of nicotine therein from about 1% to about 20% or any range or concentration therein. In some formulations, the concentration of nicotine in the first nicotine salt formulation is 1% to 20%, and is combined with a second nicotine salt formulation having a concentration of nicotine therein from 1% to 20% or any range or concentration therein. As used with respect to concentrations of nicotine in the nicotine salt formulations, the term “about” refers to ranges of 0.05% (i.e. if the concentration is about 2%, the range is 1.95%-2.05%), 0.1 (i.e. if the concentration is about 2%, the range is 1.9%-2.1%), 0.25 (i.e. if the concentration is about 2%, the range is 1.75%-2.25%), 0.5 (i.e. if the concentration is about 2%, the range is 1.5%-2.5%), or 1 (i.e. if the concentration is about 4%, the range is 3%-5%), depending on the embodiment.

[0063] Nicotine salts are formed by the addition of a suitable acid, including organic or inorganic acids. In some formulations provided herein, suitable organic acids are carboxylic acids. Examples of organic carboxylic acids disclosed herein are monocarboxylic acids, dicarboxylic acids (organic acid containing two carboxylic acid groups), carboxylic acids containing an aromatic group such as benzoic acids, hydroxycarboxylic acids, heterocyclic carboxylic acids, terpenoid acids, sugar acids; such as the pectic acids, amino acids, cycloaliphatic acids, aliphatic carboxylic acids, keto carboxylic acids, and the like. In some formulations provided herein, the organic acids used herein are monocarboxylic acids. Nicotine salts are formed from the addition of a suitable acid to nicotine. In some formulations provided

herein, the stoichiometric ratios of the nicotine to acid (nicotine:acid) are 1:1, 1:2, 1:3, 1:4, 2:3, 2:5, 2:7, 3:4, 3:5, 3:7, 3:8, 3:10, 3:11, 4:5, 4:7, 4:9, 4:10, 4:11, 4:13, 4:14, 4:15, 5:6, 5:7, 5:8, 5:9, 5:11, 5:12, 5:13, 5:14, 5:16, 5:17, 5:18, or 5:19. In some formulations provided herein, the stoichiometric ratios of the nicotine to acid are 1:1, 1:2, 1:3, or 1:4 (nicotine:acid).

[0064] Nicotine is an alkaloid molecule that comprises two basic nitrogens. It may occur in different states of protonation. For example, if no protonation exists, nicotine is referred to as the “free base.” If one nitrogen is protonated, then the nicotine would be “mono-protonated.”

[0065] Nicotine salt formulations may be formed by adding a suitable acid to nicotine, stirring the neat mixture at ambient temperature or at elevated temperature, and then diluting the neat mixture with a carrier mixture, such as a mixture of propylene glycol and glycerin. In some embodiments, the suitable acid is completely dissolved by the nicotine prior to dilution. The suitable acid may not completely dissolved by the nicotine prior to dilution. The addition of the suitable acid to the nicotine to form a neat mixture may cause an exothermic reaction. The addition of the suitable acid to the nicotine to form a neat mixture may be conducted at 55 °C. The addition of the suitable acid to the nicotine to form a neat mixture may be conducted at 90 °C. The neat mixture may be cooled to ambient temperature prior to dilution. The dilution may be carried out at elevated temperature.

[0066] Nicotine salt formulations may be prepared by combining nicotine and a suitable acid in a carrier mixture, such as a mixture of propylene glycol and glycerin. The mixture of nicotine and a first carrier mixture is combined with a mixture of a suitable acid in a second carrier mixture. In some embodiments, the first and second carrier mixtures are identical in composition. In some embodiments, the first and second carrier mixtures are not identical in composition. In some embodiments, heating of nicotine/acid/carrier mixture is required to facilitate complete dissolution.

[0067] In some embodiments, nicotine salt formulations may be prepared and added to a solution of 3:7 ratio by weight of propylene glycol (PG)/vegetable glycerin (VG), and mixed thoroughly. While described herein as producing 10g of each of the formulations, all procedures noted *infra* are scalable. Other manners of formulation may also be employed from the formulations noted *infra*, without departing from the disclosure herein, and as would be known to one of skill in the art upon reading the disclosure herein.

[0068] The optimal nicotine salt formulation may be determined by the vapor pressure of the constituent acid. In some embodiments, the nicotine salt formulations comprise an acid with a vapor pressure that is similar to the vapor pressure of free base nicotine. In some embodiments, the nicotine salt formulations are formed from an acid with a vapor pressure that is similar to the vapor pressure of free base nicotine at the heating temperature of the device. Figure 3 illustrates this trend. Nicotine salts formed from nicotine and benzoic acid; nicotine and salicylic acid; or nicotine and levulinic acid are salts that produce a satisfaction in an individual user consistent with efficient transfer of nicotine and a rapid rise in nicotine plasma levels. This pattern may be due to the mechanism of action during heating of the nicotine salt formulation. The nicotine salt may disassociate at, or just below, the heating temperature of the device, resulting in a mixture of free base nicotine and the individual acid. At that point, if both the nicotine and acid have similar vapor pressures, they may aerosolize at the same time, giving rise to a transfer of both free base nicotine and the constituent acid to the user.

[0069] The nicotine salt liquid formulation for generating an inhalable aerosol upon heating in an electronic cigarette may comprise a nicotine salt in a biologically acceptable liquid carrier; wherein the acid used to form said nicotine salt is characterized by a vapor pressure between 20 – 4000 mmHg at 200 °C. In some embodiments, the acid used to form the nicotine salt is characterized by vapor pressure between 20 – 2000 mmHg at 200 °C. In some embodiments, the acid used to form the nicotine salt is characterized by vapor pressure between 100 – 300 mmHg at 200 °C.

[0070] Unexpectedly, different nicotine salt formulations produced varying degrees of satisfaction in an individual. In some embodiments, the extent of protonation of the nicotine salt affected satisfaction, such that more protonation was less satisfying as compared to less protonation. The nicotine salt formed may be monoprotonated. The nicotine salt formed may be diprotonated. The nicotine salt may exist in more than one protonation state, e.g., an equilibrium of mono-protonated and di-protonated nicotine salts. The extent of protonation of the nicotine molecule may be dependent upon the stoichiometric ratio of nicotine:acid used in the salt formation reaction. The extent of protonation of the nicotine molecule may be dependent upon the solvent. The extent of protonation of the nicotine molecule may be unknown. In some embodiments, monoprotonated nicotine salts produced a high degree of satisfaction in the user. For example, nicotine benzoate and nicotine salicylate are mono-protonated nicotine salts and all

produce a high degree of satisfaction in the user. The reason for this trend may be explained by a mechanism of action wherein the nicotine is first deprotonated prior to transfer to the vapor with the constituent acid and then retained and stabilized after re-protonated by the acid going down stream to the lungs of the user. It may be easier to remove one proton versus two protons, thus resulting in better transfer efficiency. In addition, the lack of satisfaction of free base nicotine indicates that a second factor may be important. A nicotine salt may be best performing when it is at its optimal extent of protonation, depending on the salt. For example, nicotine pyruvate is a nicotine salt with 1:2 nicotine:acid ratio. The formulation containing nicotine pyruvate (1:2) may deliver more satisfaction to the user than the one containing same amount of nicotine but only half amount of pyruvic acid, i.e. nicotine pyruvate (1:1). This may be explained as 1 mole of nicotine produces a salt with 2 moles of pyruvic acid. When there is not enough pyruvic acid to associate with all nicotine molecules, the free base nicotine left unprotonated in the formulation may reduce the satisfaction the formulation provides.

[0071] The flavor of the constituent acid used in the salt formation may be a consideration in choosing the acid. A suitable acid may have minimal or no toxicity to humans in the concentrations used. A suitable acid may be compatible with the electronic cigarette components it contacts or could contact at the concentrations used. That is, such acid does not degrade or otherwise react with the electronic cigarette components it contacts or could contact. The odor of the constituent acid used in the salt formation may be a consideration in choosing a suitable acid. The concentration of the nicotine salt in the carrier may affect the satisfaction in the individual user. In some embodiments, the flavor of the formulation is adjusted by changing the acid. In some embodiments, the flavor of the formulation is adjusted by adding exogenous flavorants. In some embodiments, an unpleasant tasting or smelling acid is used in minimal quantities to mitigate such characteristics. In some embodiments, exogenous pleasant smelling or tasting acid is added to the formulation. Examples of salts which can provide flavor and aroma to the mainstream aerosol at certain levels include nicotine acetate, nicotine oxalate, nicotine malate, nicotine isovalerate, nicotine lactate, nicotine citrate, nicotine phenylacetate and nicotine myristate.

[0072] Nicotine salt formulations may generate an inhalable aerosol upon heating in an electronic cigarette. The amount of nicotine or nicotine salt aerosol inhaled may be user-

determined. The user may, for example, modify the amount of nicotine or nicotine salt inhaled by adjusting his inhalation strength.

[0073] Formulations are described herein comprising two or more nicotine salts. In some embodiments, wherein a formulation comprises two or more nicotine salts, each individual nicotine salt is formed as described herein.

[0074] Nicotine salt formulations, as used herein, refer to a single or mixture of nicotine salts with other suitable chemical components used for e-cigarette, such as carriers, stabilizers, diluents, dispersing agents, suspending agents, thickening agents, and/or excipients. In certain embodiments, the nicotine salt formulation is stirred at ambient conditions for 20 minutes. In certain embodiments, the nicotine salt formulation is heated and stirred at 55C for 20 minutes. In certain embodiments, the nicotine salt formulation is heated and stirred at 90C for 60 minutes. In certain embodiments, the formulation facilitates administration of nicotine to an organism (e.g., lung).

[0075] The nicotine of nicotine salt formulations provided herein is either naturally occurring nicotine (e.g., from extract of nicotineous species such as tobacco), or synthetic nicotine. In some embodiments, the nicotine is (-)-nicotine, (+)-nicotine, or a mixture thereof. In some embodiments, the nicotine is employed in relatively pure form (e.g., greater than about 80% pure, 85% pure, 90% pure, 95% pure, or 99 % pure). In some embodiments, the nicotine for nicotine salt formulation provided herein is "water clear" in appearance in order to avoid or minimize the formation of tarry residues during the subsequent salt formation steps.

[0076] Nicotine salt formulations used for e-cigarettes described herein, in some embodiments, have a nicotine concentration of about 0.5% (w/w) to about 20% (w/w), wherein the concentration is of nicotine weight to total solution weight, i.e. (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 1% (w/w) to about 20% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 1% (w/w) to about 18% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 1% (w/w) to about 15% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 4% (w/w) to about 12% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 1% (w/w) to about 18% (w/w), about 3% (w/w) to about 15% (w/w), or about 4% (w/w) to about

12% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 0.5% (w/w) to about 10% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 0.5% (w/w) to about 5% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 0.5% (w/w) to about 4% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 0.5% (w/w) to about 3% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 0.5% (w/w) to about 2% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 0.5% (w/w) to about 1% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 1% (w/w) to about 10% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 1% (w/w) to about 5% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 1% (w/w) to about 4% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 1% (w/w) to about 3% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 1% (w/w) to about 2% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 2% (w/w) to about 10% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 2% (w/w) to about 5% (w/w). In certain embodiments, nicotine salt formulations provided herein have a nicotine concentration of about 2% (w/w) to about 4% (w/w). Certain embodiments provide a nicotine salt formulation having a nicotine concentration of about 0.5%, 0.6%, 0.7%, 0.8%, 0.9%, 1.0%, 1.1%, 1.2%, 1.3%, 1.4%, 1.5%, 1.6%, 1.7%, 1.8%, 1.9%, 2.0%, 2.1%, 2.2%, 2.3%, 2.4%, 2.5%, 2.6%, 2.7%, 2.8%, 2.9%, 3.0%, 3.1%, 3.2%, 3.3%, 3.4%, 3.5%, 3.6%, 3.7%, 3.8%, 3.9%, 4.0%, 4.5%, 5.0%, 5.5%, 6.0%, 6.5%, 7.0%, 7.5%, 8.0%, 8.5%, 9.0%, 9.5%, 10%, 11%, 12%, 13%, 14%, 15%, 16%, 17%, 18%, 19%, or 20% (w/w), or more, including any increments therein. Certain embodiments provide a nicotine salt formulation having a nicotine concentration of about 5% (w/w). Certain embodiments provide a nicotine salt formulation having a nicotine concentration of about 4% (w/w). Certain embodiments provide a nicotine salt formulation having a nicotine concentration of about 3% (w/w). Certain embodiments provide a nicotine salt formulation having a nicotine concentration

of about 2% (w/w). Certain embodiments provide a nicotine salt formulation having a nicotine concentration of about 1% (w/w). Certain embodiments provide a nicotine salt formulation having a nicotine concentration of about 0.5% (w/w).

[0077] The formulation further may comprise one or more flavorants.

[0078] The suitable acid for the nicotine salt formulation may have a vapor pressure >20 mmHg at 200 °C and is non-corrosive to the electronic cigarette or is non-toxic to humans. In some embodiments, the suitable acid for nicotine salt formation is selected from the group consisting of salicylic acid, formic acid, sorbic acid, acetic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid.

[0079] The suitable acid for the nicotine salt formulation may have a vapor pressure of about 20 to 200 mmHg at 200 °C and is non-corrosive to the electronic cigarette or is non-toxic to humans. In some embodiments, the suitable acid for nicotine salt formation is selected from the group consisting of salicylic acid, benzoic acid, lauric acid, and levulinic acid.

[0080] The suitable acid for the nicotine salt formulation may have a melting point <160 °C, a boiling point >160 °C, at least a 50-degree difference between the melting point and the boiling point, and is non-corrosive to the electronic cigarette or is non-toxic to humans. In some embodiments, the suitable acid for nicotine salt formation has a melting point at least 40 degrees lower than the operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, at least a 50-degree difference between the melting point and the boiling point, and is non-corrosive to the electronic cigarette or is non-toxic to humans; wherein the operating temperature is 200 °C. In some embodiments, the suitable acid for nicotine salt formation is selected from the group consisting of salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid.

[0081] The suitable acid for the nicotine salt formulation does not decompose at the operating temperature of the electronic cigarette. In some embodiments, the suitable acid for nicotine salt formation does not oxidize at the operating temperature of the electronic cigarette. In some embodiments, the suitable acid for nicotine salt formation does not oxidize at room temperature. In some embodiments, the suitable acid for nicotine salt formation does not provide an unpleasant taste. In some embodiments, the suitable acid for nicotine salt formation has good solubility in a liquid formulation for use in an electronic cigarette.

[0082] Provided herein is an electronic cigarette 2 having a fluid storage compartment 4 comprising an embodiment nicotine salt formulation of any embodiment described herein within the fluid storage compartment described herein. An embodiment is shown in FIG. 7. The electronic cigarette 2 of FIG. 7 includes a mouth end 6, and a charging end 8. The mouth-end 6 includes a mouthpiece 10. The charging end 8 may connect to a battery or a charger or both, wherein the battery is within a body of the electronic cigarette, and the charger is separate from the battery and couples to the body or the battery to charge the battery. In some embodiments the electronic cigarette comprises a rechargeable battery within a body 14 of the electronic cigarette and the charge end 8 comprises a connection 12 for charging the rechargeable battery. In some embodiments, the electronic cigarette comprises a cartomizer that comprises the fluid storage compartment and an atomizer. In some embodiments, the atomizer comprises a heater. In some embodiments the fluid storage compartment 4 is separable from an atomizer. In some embodiments the fluid storage compartment 4 is replaceable as part of a replaceable cartridge. In some embodiments the fluid storage compartment 4 is refillable. In some embodiments, the mouthpiece 10 is replaceable.

[0083] Provided herein is a cartomizer 18 for an electronic cigarette 2 having a fluid storage compartment 4 comprising an embodiment nicotine salt formulation of any embodiment described herein within the fluid storage compartment described herein. The cartomizer 18 embodiment of FIG. 8 includes a mouth end 6, and a connection end 16. The connection end 16 in the embodiment of FIG. 8 couples the cartomizer 14 to a body of an electronic cigarette, or to a battery of the electronic cigarette, or both. The mouth end 6 includes a mouthpiece 10. In some embodiments, the cartomizer does not include a mouthpiece, and in such embodiments, the cartomizer can be coupled to a mouthpiece of an electronic cigarette, or the cartomizer can be coupled to a battery or body of an electronic cigarette, while the mouthpiece is also coupled to the battery or the body of the electronic cigarette. In some embodiments, the mouthpiece is integral with the body of the electronic cigarette. In some embodiments, including the embodiment of FIG. 8, the cartomizer 18 comprises the fluid storage compartment 4 and an atomizer (not shown). In some embodiments, the atomizer comprises a heater (not shown).

Examples

Example 1: Preparation of Nicotine salt Formulations

[0084] Various nicotine formulations were prepared and added to a solution of 3:7 ratio by weight of propylene glycol (PG)/vegetable glycerin (VG), and mixed thoroughly. The examples shown below were used to make 10g of each of the formulations. All procedures are scalable.

[0085] For example, in order to make nicotine formulations with a final nicotine free base equivalent concentration of 2% (w/w), the following procedures were applied to each individual formulation.

- Nicotine benzoate salt formulation: 0.15g benzoic acid was added to a beaker followed by adding 0.2g nicotine to the same beaker. The mixture was stirred at 55 °C for 20 minutes until benzoic acid was completely dissolved and an orange oily mixture was formed. The mixture was cooled down to ambient conditions. 9.65g PG/VG (3:7) solution was added to the orange nicotine benzoate salt and the mixture was stirred until a visually homogenous formulation solution was achieved.

- Nicotine benzoate salt formulation can also be made by adding 0.15g benzoic acid to a beaker followed by adding 0.2g nicotine and 9.65g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 55 °C for 20 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine citrate salt formulation was made by adding 0.47g citric acid to a beaker followed by adding 0.2g nicotine and 9.33g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 90 °C for 60 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine malate salt formulation was made by adding 0.33g L-malic acid to a beaker followed by adding 0.2g nicotine and 9.47g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 90 °C for 60 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine succinate salt formulation was made by adding 0.29g succinic acid to a beaker followed by adding 0.2g nicotine and 9.51g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 90 °C for 60 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine salicylate salt formulation was made by adding 0.17g salicylic acid to a beaker followed by adding 0.2g nicotine and 9.63g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 90 °C for 60 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine salicylate salt formulation can also be made by adding 0.17g salicylic acid to a beaker followed by adding 0.2g nicotine to the same beaker. The mixture was stirred at 90 °C for 60 minutes until salicylic acid was completely dissolved and an orange oily mixture was formed. The mixture was either cooled to ambient conditions or kept at 90 °C when 9.63g PG/VG (3:7) solution was added. The mixture was then stirred at 90 °C until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine free base formulation was made by adding 0.2g nicotine to a beaker followed by adding 9.8g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at ambient conditions for 10 minutes until a visually homogenous formulation solution was achieved.

[0086] For example, in order to make nicotine salt formulations with a final nicotine free base equivalent concentration of 3% (w/w), the following procedures were applied to each individual formulation.

- Nicotine benzoate salt formulation: 0.23g benzoic acid was added to a beaker followed by adding 0.3g nicotine to the same beaker. The mixture was stirred at 55 °C for 20 minutes until benzoic acid was completely dissolved and an orange oily mixture was formed. The mixture was cooled down to ambient conditions. 9.47g PG/VG (3:7) solution was added to the orange nicotine benzoate salt and the blend was stirred until a visually homogenous formulation solution was achieved.

- Nicotine benzoate salt formulation can also be made by adding 0.23g benzoic acid to a beaker followed by adding 0.3g nicotine and 9.47g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 55 °C for 20 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine citrate salt formulation was made by adding 0.71g citric acid to a beaker followed by adding 0.3g nicotine and 8.99g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 90 °C for 60 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine malate salt formulation was made by adding 0.5g L-malic acid to a beaker followed by adding 0.3g nicotine and 9.2g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 90 °C for 60 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.
- Nicotine levulinate salt formulation was made by adding melted 0.64g levulinic acid to a beaker followed by adding 0.3g nicotine to the same beaker. The mixture was stirred at ambient conditions for 10 minutes. Exothermic reaction took place and oily product was produced. The mixture was allowed to cool down to ambient temperature and 9.06g PG/VG (3:7) solution was added to the same beaker. The mixture was then stirred at ambient conditions for 20 minutes until a visually homogenous formulation solution was achieved.
- Nicotine pyruvate salt formulation was made by adding 0.33g pyruvic acid to a beaker followed by adding 0.3g nicotine to the same beaker. The mixture was stirred at ambient conditions for 10 minutes. Exothermic reaction took place and oily product was produced. The mixture was allowed to cool down to ambient temperature and 9.37g PG/VG (3:7) solution was added to the same beaker. The mixture was then stirred at ambient conditions for 20 minutes until a visually homogenous formulation solution was achieved.
- Nicotine succinate salt formulation was made by adding 0.44g succinic acid to a beaker followed by adding 0.3g nicotine and 9.26g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 90 °C for 60 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.
- Nicotine salicylate salt formulation was made by adding 0.26g salicylic acid to a beaker followed by adding 0.3g nicotine and 9.44g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 90 °C for 60 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.
- Nicotine salicylate salt formulation can also be made by adding 0.26g salicylic acid to a beaker followed by adding 0.3g nicotine to the same beaker. The mixture was stirred at 90 °C for 60 minutes until salicylic acid was completely dissolved and an orange oily mixture was formed. The mixture was either cooled to ambient conditions or kept at 90 °C when 9.44g PG/VG (3:7) solution was added. The blend was then stirred at 90C until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine free base formulation was made by adding 0.3g nicotine to a beaker followed by adding 9.7g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at ambient conditions for 10 minutes until a visually homogenous formulation solution was achieved.

[0087] For example, in order to make nicotine salt formulations with a final nicotine free base equivalent concentration of 4% (w/w), the following procedures were applied to each individual formulation.

- Nicotine benzoate salt formulation: 0.3g benzoic acid was added to a beaker followed by adding 0.4g nicotine to the same beaker. The mixture was stirred at 55 °C for 20 minutes until benzoic acid was completely dissolved and an orange oily mixture was formed. The mixture was cooled down to ambient conditions. 9.7g PG/VG (3:7) solution was added to the orange nicotine benzoate salt and the blend was stirred until a visually homogenous formulation solution was achieved.

- Nicotine benzoate salt formulation can also be made by adding 0.3g benzoic acid to a beaker followed by adding 0.4g nicotine and 9.7g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 55 °C for 20 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.

For example, in order to make nicotine salt formulations with a final nicotine free base equivalent concentration of 5% (w/w), the following procedures were applied to each individual formulation.

- Nicotine benzoate salt formulation: 0.38g benzoic acid was added to a beaker followed by adding 0.5g nicotine to the same beaker. The mixture was stirred at 55 °C for 20 minutes until benzoic acid was completely dissolved and an orange oily mixture was formed. The mixture was cooled down to ambient conditions. 9.12g PG/VG (3:7) solution was added to the orange nicotine benzoate salt and the blend was stirred until a visually homogenous formulation solution was achieved.

- Nicotine benzoate salt formulation can also be made by adding 0.38g benzoic acid to a beaker followed by adding 0.5g nicotine and 9.12g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 55 °C for 20 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine malate salt formulation was made by adding 0.83g L-malic acid to a beaker followed by adding 0.5g nicotine and 8.67g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 90 °C for 60 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine levulinate salt formulation was made by adding melted 1.07g levulinic acid to a beaker followed by adding 0.5g nicotine to the same beaker. The mixture was stirred at ambient conditions for 10 minutes. Exothermic reaction took place and oily product was produced. The mixture was allowed to cool down to ambient temperature and 8.43g PG/VG (3:7) solution was added to the same beaker. The mixture was then stirred at ambient conditions for 20 minutes until a visually homogenous formulation solution was achieved.

- Nicotine pyruvate salt formulation was made by adding 0.54g pyruvic acid to a beaker followed by adding 0.5g nicotine to the same beaker. The mixture was stirred at ambient conditions for 10 minutes. Exothermic reaction took place and oily product was produced. The mixture was allowed to cool down to ambient temperature and 8.96g PG/VG (3:7) solution was added to the same beaker. The mixture was then stirred at ambient conditions for 20 minutes until a visually homogenous formulation solution was achieved.

- Nicotine succinate salt formulation was made by adding 0.73g succinic acid to a beaker followed by adding 0.5g nicotine and 8.77g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 90 °C for 60 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine salicylate salt formulation was made by adding 0.43g salicylic acid to a beaker followed by adding 0.5g nicotine and 9.07g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at 90 °C for 60 minutes until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine salicylate salt formulation can also be made by adding 0.43g salicylic acid to a beaker followed by adding 0.5g nicotine to the same beaker. The mixture was stirred at 90 °C for 60 minutes until salicylic acid was completely dissolved and an orange oily mixture was formed. The mixture was either cooled to ambient conditions or kept at 90C when 9.07g PG/VG (3:7) solution was added. The blend was then stirred at 90 °C until a visually homogenous formulation solution was achieved with no undissolved chemicals.

- Nicotine free base formulation was made by adding 0.5g nicotine to a beaker followed by adding 9.5g PG/VG (3:7) solution to the same beaker. The mixture was then stirred at ambient conditions for 10 minutes until a visually homogenous formulation solution was achieved.

[0088] Various formulations comprising different nicotine salts can be prepared similarly, or different concentrations of the above-noted nicotine formulations or other nicotine salt

formulations can be prepared as one of skill in the art would know to do upon reading the disclosure herein.

[0089] Various formulations comprising two or more nicotine salts can be prepared similarly in a solution of 3:7 ratio of propylene glycol (PG)/vegetable glycerin (VG). For example, 0.43g (2.5% w/w nicotine) of nicotine levulinate salt and 0.34 g (2.5% w/w nicotine) of nicotine acetate salt are added to 9.23g of PG/VG solution, to achieve a 5% w/w nicotine formulation.

[0090] Also provided is another exemplary formulation. For example, 0.23g (1.33% w/w nicotine) of nicotine benzoate salt (molar ratio 1:1 nicotine/benzoic acid), 0.25g (1.33% w/w nicotine) of nicotine salicylate salt (molar ratio 1:1 nicotine/salicylic acid) and 0.28 g (1.34% w/w nicotine) of nicotine pyruvate salt (molar ratio 1:2 nicotine/pyruvic acid) are added to 9.25g of PG/VG solution, to achieve a 5% w/w nicotine formulation.

Example 2: Heart rate study of nicotine solutions via e-cigarette

[0091] Exemplary formulations of nicotine levulinate, nicotine benzoate, nicotine succinate, nicotine salicylate, nicotine malate, nicotine pyruvate, nicotine citrate, nicotine freebase, and a control of propylene glycol were prepared as noted in Example 1 in 3% w/w solutions and were administered in the same fashion by an electronic cigarette to the same human subject. About 0.5 mL of each solution was loaded into an "eRoll" cartridge atomizer (joyetech.com) to be used in the study. The atomizer was then attached to an "eRoll" e-cigarette (same manufacturer). The operating temperature was from about 150°C to about 250 °C, or from about 180°C to about 220 °C.

[0092] Heart rate measurements were taken for 6 minutes; from 1 minute before start of puffing, for 3 minutes during puffing, and continuing until 2 minutes after end of puffing. The test participant took 10 puffs over 3 minutes in each case. The base heart rate was the average heart rate over the first 1 minute before start of puffing. Heart rate after puffing started was averaged over 20-second intervals. Puffing (inhalation) occurred every 20 seconds for a total of 3 minutes. Normalized heart rate was defined as the ratio between individual heart rate data point and the base heart rate. Final results were presented as normalized heart rate, shown for the first 4 minutes in FIG. 1.

[0093] FIG. 1 summarizes results from heart rate measurements taken for a variety of nicotine salt formulations. For ease of reference in reviewing FIG. 1, at the 180-second

timepoint, from top to bottom (highest normalized heart rate to lowest normalized heart rate), the nicotine formulations are as follows: nicotine salicylate formulation, nicotine malate formulation, nicotine levulinate formulation (nearly identical to nicotine malate formulation at 180 seconds, thus, as a second reference point: the nicotine malate formulation curve is lower than the nicotine levulinate formulation curve at the 160-second time point), nicotine pyruvate formulation, nicotine benzoate formulation, nicotine citrate formulation, nicotine succinate formulation, and nicotine free base formulation. The bottom curve (lowest normalized heart rate) at the 180-second timepoint is associated with the placebo (100% propylene glycol). The test formulations comprising a nicotine salt cause a faster and more significant rise in heart rate than the placebo. The test formulations comprising a nicotine salt also cause faster and more significant rise when compared with a nicotine freebase formulation with the same amount of nicotine by weight. In addition, the nicotine salts (e.g., nicotine benzoate and nicotine pyruvate) prepared from the acids having calculated vapor pressures between 20 - 200 mmHg at 200 °C (benzoic acid (171.66 mmHg), with the exception of pyruvic acid (having a boiling point of 165C), respectively) cause a faster rise in heart rate than the rest. The nicotine salts (e.g., nicotine levulinate, nicotine benzoate, and nicotine salicylate) prepared from the acids (benzoic acid, levulinic acid and salicylic acid, respectively) also cause a more significant heart rate increase. Thus, other suitable nicotine salts formed by the acids with the similar vapor pressure and/or similar boiling point may be used in accordance with the practice of the present invention. This experience of increased heart rate theoretically approaching or theoretically comparable to that of a traditional burned cigarette has not been demonstrated or identified in other electronic cigarette devices. Nor has it been demonstrated or identified in low temperature tobacco vaporization devices (electronic cigarettes) that do not burn the tobacco, even when a nicotine salt was used (a solution of 20% (w/w) or more of nicotine salt) as an additive to the tobacco. Thus the results from this experiment are surprising and unexpected.

Example 3: Satisfaction Study of Nicotine salt Solution via e-cigarette

[0094] In addition to the heart rate study shown in Example 2, nicotine formulations (using 3% w/w nicotine formulations as described in Example 1) were used to conduct a satisfaction study in a single test participant. The test participant, an e-cigarette and/or traditional cigarette user, was required to have no nicotine intake for at least 12 hours before the test. The participant

took 10 puffs using an e-cigarette (same as used in Example 2) over 3 minutes in each case, and then was asked to rate the level of physical and emotional satisfaction he or she felt on a scale of 0 - 10, with 0 being no physical or emotional satisfaction. The results indicated that the least satisfying compound was the nicotine free base. Nicotine benzoate, nicotine salicylate, and nicotine succinate all performed well, followed by nicotine pyruvate, nicotine citrate, and nicotine pyruvate.

[0095] Based on the Satisfaction Study, the nicotine salts formulations with acids having vapor pressure ranges between >20 mmHg @ 200 °C, or 20-200 mmHg @ 200 °C, or 100 – 300 mmHg @ 200 °C provide more satisfaction than the rest (except the pyruvic acid which has boiling point of 165 °C). For reference, it has been determined that salicylic acid has a vapor pressure of about 135.7 mmHg @ 200 °C, benzoic acid has a vapor pressure of about 171.7 mmHg @ 200 °C, lauric acid has a vapor pressure of about 38 mmHg @ 200 °C, and levulinic acid has a vapor pressure of about 149 mmHg @ 200 °C.

Example 4: Test formulation 1 (TF1):

[0096] A solution of nicotine levulinate in glycerol comprising nicotine salt used: 1.26g (12.6% w/w) of 1:3 nicotine levulinate 8.74g (87.4% w/w) of glycerol - Total weight 10.0g.

[0097] Neat nicotine levulinate was added to the glycerol, and mixed thoroughly. L-Nicotine has a molar mass of 162.2g, and levulinic acid molar mass is 116.1g. In a 1:3 molar ratio, the percentage of nicotine in nicotine levulinate by weight is given by: $162.2g / (162.2g + (3 \times 116.1g)) = 31.8\% \text{ (w/w)}$.

Example 5: Test formulation 2 (TF2):

[0098] A solution of free base nicotine in glycerol comprising 0.40g (4.00% w/w) of L-nicotine was dissolved in 9.60g (96.0% w/w) of glycerol and mixed thoroughly.

Example 6: Heart rate study of nicotine solutions via e-cigarette:

[0099] Both formulations (TF1 and TF2) were administered in the same fashion by an electronic cigarette to the same human subject: about 0.6 mL of each solution was loaded into "eGo-C" cartridge atomizer (joyetech.com). The atomizer was then attached to an "eVic" e-cigarette (same manufacturer). This model of e-cigarette allows for adjustable voltage, and

therefore wattage, through the atomizer. The operating temperature of the e-cigarette is from about 150°C to about 250 °C, or from about 180°C to about 220 °C.

[00100] The atomizer in both cases has resistance 2.4ohms, and the e-cigarette was set to 4.24V, resulting in 7.49W of power. ($P = V^2 / R$)

[00101] Heart rate was measured in a 30-second interval for ten minutes from start of puffing. Test participants took 10 puffs over 3 minutes in each case (solid line (2nd highest peak): cigarette, dark dotted line (highest peak): test formulation 1 (TF1-nicotine salt formulation), light dotted line: test formulation 2 (TF2 — nicotine formulation). Comparison between cigarette, TF1, and TF2 is shown in FIG. 2.

[00102] It is clearly shown in FIG. 2 that the test formulation with nicotine levulinate (TF1) causes a faster rise in heart rate than just nicotine (TF2). Also, TF1 more closely resembles the rate of increase for a cigarette. Other salts were tried and also found to increase heart rate relative to a pure nicotine solution. Thus, other suitable nicotine salts that cause the similar effect may be used in accordance with the practice of the present invention. For example, other keto acids (alpha-keto acids, beta-keto acids, gamma-keto acids, and the like) such as pyruvic acid, oxaloacetic acid, acetoacetic acid, and the like. This experience of increased heart rate comparable to that of a traditional burned cigarette has not been demonstrated or identified in other electronic cigarette devices, nor has it been demonstrated or identified in low temperature tobacco vaporization devices that do not burn the tobacco, even when a nicotine salt was used (a solution of 20% (W/W) or more of nicotine salt) as an additive to the tobacco. Thus the results from this experiment are surprising and unexpected.

[00103] In addition, the data appears to correlate well with the previous findings shown in FIG. 2.

[00104] As previously noted in the Satisfaction Study, the nicotine salts formulations with acids having vapor pressures between 20 – 300 mmHg @ 200 °C provide more satisfaction than the rest, with the exception of the nicotine salt formulation made with pyruvic acid, which has a boiling point of 165 °C, as noted in FIG. 3. Based on the findings herein, it was anticipated that these nicotine salt formulations having either:

- a Vapor Pressure between 20 – 300 mmHg @ 200 °C,
- a Vapor Pressure > 20 mmHg @ 200 °C,

- a difference between boiling point and melting point of at least 50 °C, and a boiling point greater than 160 °C, and a melting point less than 160 °C,
- a difference between boiling point and melting point of at least 50 °C, and a boiling point greater than 160 °C, and a melting point less than 160 °C,
- a difference between boiling point and melting point of at least 50 °C, and a boiling point at most 40 °C less than operating temperature, and a melting point at least 40 °C lower than operating temperature, or
- a combination thereof produce one or more of the following effects:

[00105] $T_{\max}$ – Time to maximum blood concentration: Based on the results established herein, a user of an e-cigarette comprising the nicotine salt formulation will experience a comparable rate of physical and emotional satisfaction from using a formulation comprising a mixture of nicotine salts prepared with an appropriate acid at least 1.2X to 3X faster than using a formulation comprising a freebase nicotine. As illustrated in FIG. 1: Nicotine from a nicotine salts formulation appears to generate a heartbeat that is nearly 1.2 times that of a normal heart rate for an individual approximately 40 seconds after the commencement of puffing; whereas the nicotine from a nicotine freebase formulation appears to generate a heartbeat that is nearly 1.2 times that of a normal heart rate for an individual approximately 110 seconds after the commencement of puffing; a 2.75 X difference in time to achieve a comparable initial satisfaction level.

[00106] Again this would not be inconsistent with the data from FIG. 2, where the data illustrated that at approximately 120 seconds (2 minutes), the heart rate of test participants reached a maximum of 105 – 110 bpm with either a regular cigarette or a nicotine salt formulation (TF1); whereas those same participants heart rates only reached a maximum of approximately 86 bpm at approximately 7 minutes with a nicotine freebase formulation (TF2); also a difference in effect of 1.2 times greater with nicotine salts (and regular cigarettes) versus freebase nicotine.

[00107] Further, when considering peak satisfaction levels (achieved at approximately 120 seconds from the initiation of puffing (time =0) and looking at the slope of the line for a normalized heart rate, the approximate slope of those nicotine salt formulations that exceeded the freebase nicotine formulation range between 0.0054 hr_n/sec and 0.0025 hr_n/sec. By comparison, the slope of the line for the freebase nicotine formulation is about 0.002. This would suggest that

the concentration of available nicotine will be delivered to the user at a rate that is between 1.25 and 2.7 times faster than a freebase formulation.

[00108] In another measure of performance; $C_{\max}$ – Maximum blood nicotine concentration; it is anticipated that similar rates of increase will be measured in blood nicotine concentration, as those illustrated above. That is, it was anticipated based on the findings herein, and unexpected based on the art known to date, that there would be comparable $C_{\max}$ between the common cigarette and certain nicotine salt formulations, but with a lower $C_{\max}$ in a freebase nicotine solution.

[00109] Similarly, anticipated based on the findings herein, and unexpected based on the art known to date, that certain nicotine salt formulations would have higher rate of nicotine uptake levels in the blood at early time periods. Indeed, Example 8 presents data for multiple salt formulations consistent with these predictions which were made based on the findings and tests noted herein, and unexpected compared to the art available to date.

Example 7: Heart rate study of nicotine solutions via e-cigarette

[00110] Exemplary formulations of nicotine levulinate, nicotine benzoate, nicotine succinate, nicotine salicylate, nicotine malate, nicotine pyruvate, nicotine citrate, nicotine sorbate, nicotine laurate, nicotine freebase, and a control of propylene glycol are prepared as noted in Example 1 and are administered in the same fashion by an electronic cigarette to the same human subject. About 0.5 mL of each solution is loaded into an "eRoll" cartridge atomizer (joyetech.com) to be used in the study. The atomizer is then attached to an "eRoll" e-cigarette (same manufacturer). The operating temperature of the e-cigarette is from about 150°C to about 250 °C, or from about 180°C to about 220 °C.

[00111] Heart rate measurements are taken for 6 minutes; from 1 minute before start of puffing, for 3 minutes during puffing, and continuing until 2 minutes after end of puffing. The test participant takes 10 puffs over 3 minutes in each case. The base heart rate is the average heart rate over the first 1 minute before start of puffing. Heart rate after puffing started is averaged over 20-second intervals. Normalized heart rate is defined as the ratio between individual heart rate data point and the base heart rate. Final results are presented as normalized heart rate.

Example 8: Blood Plasma testing

[00112] Blood plasma testing was conducted on three subjects (n = 3). Eight test articles were used in this study: one reference cigarette and seven blends used in an e-cigarette device having an operating temperature of the e-cigarette from about 150°C to about 250 °C, or from about 180°C to about 220 °C. The reference cigarette was Pall Mall (New Zealand). Seven blends were tested in the e-cigarette: 2% free base, 2% benzoate, 4% benzoate, 2% citrate, 2% malate, 2% salicylate, and 2% succinate. Except for 2% succinate (n = 1), all other blends have n = 3. The seven blends were liquid formulations prepared as described in Example 1.

[00113] The concentration of nicotine in each of the formulations was confirmed using UV spectrophotometer (Cary 60, manufactured by Agilent). The sample solutions for UV analysis were made by dissolving 20mg of each of the formulations in 20mL 0.3% HCl in water. The sample solutions were then scanned in UV spectrophotometer and the characteristic nicotine peak at 259nm was used to quantify nicotine in the sample against a standard solution of 19.8 µg/mL nicotine in the same diluent. The standard solution was prepared by first dissolving 19.8mg nicotine in 10mL 0.3% HCl in water followed by a 1:100 dilution with 0.3% HCl in water. Nicotine concentrations reported for all formulations were within the range of 95%-105% of the claimed concentrations

[00114] All subjects were able to consume 30-55 mg of the liquid formulation of each tested blend using the e-cigarette.

[00115] Literature results: C. Bullen et al, Tobacco Control 2010, 19:98-103

Cigarette (5min adlib, n=9): $T_{max} = 14.3$ (8.8-19.9), $C_{max} = 13.4$ (6.5-20.3)

1.4% E-cig (5min adlib, n=8): $T_{max} = 19.6$ (4.9-34.2), $C_{max} = 1.3$ (0.0-2.6)

Nicorette Inhalator (20mg/20min, n=10): $T_{max} = 32.0$ (18.7-45.3), $C_{max} = 2.1$ (1.0-3.1)

[00116] Estimated C_{max} of 2% nicotine blends:

$C_{max} = \text{Mass consumed} * \text{Strength} * \text{Bioavailability} / (\text{Vol of Distribution} * \text{Body Weight}) =$
 $40\text{mg} * 2\% * 80\% / (2.6\text{L/kg} * 75\text{kg}) = 3.3 \text{ ng/mL}$

[00117] Estimated C_{max} of 4% nicotine blends:

$C_{max} = \text{Mass consumed} * \text{Strength} * \text{Bioavailability} / (\text{Vol of Distribution} * \text{Body Weight}) =$
 $40\text{mg} * 4\% * 80\% / (2.6\text{L/kg} * 75\text{kg}) = 6.6 \text{ ng/mL}$

[00118] Pharmacokinetic profiles of the blood plasma testing are shown in FIG. 4; showing blood nicotine concentrations (ng/mL) over time after the first puff (inhalation) of the aerosol

from the e-cigarette or the smoke of the Pall Mall. Ten puffs were taken at 30 sec intervals starting at time =0 and continuing for 4.5 minutes. For ease of reference and review of FIG. 4, at the 5-minute timepoint, the curves on the graph show from top to bottom (highest average blood nicotine concentration to lowest average blood nicotine concentration) are 4% benzoate, 2% succinate, 2% salicylate, 2% citrate, Pall Mall cigarette, 2% benzoate, 2% malate, and 2% free base blend. Although noted as highest to lowest at this time point, this is not to say that there is a statistically significant difference between any of the salt formulations, or between any of the salt formulations and the Pall Mall cigarette. However, it is possible there may be a statistically significant difference between the C_{max} of particular salt formulations, and it is also likely based on the data shown in FIG. 4 and in other studies herein that the freebase formulation is statistically different from salt formulations and/or the Pall Mall with respect to C_{max} , since it appears lower than others tested at several time points. One of skill in the art, upon review of the disclosure herein could properly power a test to determine actual statistically-based differences between one or more formulations and the cigarette, or between the formulations themselves in an e-cigarette. For ease of reference Tables 1 & 2 present the amount of nicotine detected (as an average of all users) for each formulation and the Pall Mall, presented in ng/mL, along with C_{max} and T_{max} and AUC. Data from these tables, along with the raw data therefore, was used to generate FIG. 4, 5, and 6.

Table 1

Time	Pall Mall	2% Freebase	2% Benzoate	4% Benzoate
-2	0.46	0.03	0.09	0.05
0	-0.46	-0.03	-0.09	-0.05
1.5	1.54	0.08	5.67	6.02
3	9.98	1.19	8.60	11.47
5	11.65	1.70	11.44	15.06
7.5	11.34	3.09	6.43	12.12
10	9.24	3.42	5.03	11.08
12.5	8.85	3.35	4.68	10.10
15	8.40	2.81	4.47	8.57
30	5.51	1.74	2.72	5.56

60	3.39	0.79	1.19	3.60
T _{max} (min)	5.17	10.00	6.67	5.83
C _{max} (ng/mL)	11.65	3.42	11.44	15.06
AUC (ng*min/mL)	367.5	106.2	207.8	400.2

Table 2

Time	2% Citrate	2% Malate	2% Salicylate	2% Succinate
-2	0.06	-0.17	-0.19	-0.06
0	-0.06	0.17	0.19	0.06
1.5	4.80	1.09	6.14	2.10
3	8.33	5.30	12.04	10.81
5	12.09	10.02	13.46	13.81
7.5	6.93	5.93	5.21	5.15
10	6.01	4.85	4.60	5.18
12.5	5.34	4.17	3.83	4.17
15	4.72	3.79	3.52	3.41
30	3.40	1.56	2.19	2.01
60	1.70	0.46	0.55	1.00
T _{max} (min)	5.83	5.00	4.33	5.00
C _{max} (ng/mL)	12.09	10.02	13.46	13.81
AUC (ng*min/mL)	238.0	146.1	182.9	179.5

[00119] Comparison of T_{max} and C_{max} of the seven blends and reference cigarette are shown in FIG. 5. Comparison of C_{max} and AUC of the seven blends and reference cigarette are shown in FIG. 6. Due to the time limit of the wash-period, baseline blood nicotine concentration (at t=-2 and t=0 min) was higher for samples consumed at a later time on the test day. The data in FIGS. 4-6 show corrected blood nicotine concentration values (i.e. apparent blood nicotine concentration at each time point minus baseline nicotine concentration of the same sample).

[00120] Rates of nicotine uptake in the blood of the users of each sample within the first 90 seconds are shown in Table 3.

Table 3

Sample	Rate of nicotine uptake (ng/mL/min)
2% Salicylate	4.09
2% Benzoate	3.78
2% Citrate	3.20
2% Succinate	1.40
Pall Mall (reference)	1.03
2% Malate	0.73
2% Freebase	0.05
4% Benzoate	4.01

[00121] Although the $T_{\max}$ and $C_{\max}$ values are comparable between the tested blends and the reference cigarette (with the exception of the 2% free base blend), the rates of nicotine absorption within the first 90 seconds differed among the test articles. In particular, four blends (2% salicylate, 2% benzoate, 4% benzoate, and 2% citrate) showed markedly higher rates of absorption within the first 90 seconds compared to the other blends and with the reference cigarette. These four blends contain salts (salicylate, benzoate, and citrate) which performed well in the Satisfaction Study of Example 3. Moreover, 2% benzoate and 4% benzoate had comparable rates of absorption, suggesting that a lower concentration of nicotinic salt may not adversely impact the rate of absorption.

Example 9: Blood Plasma testing

[00122] Blood plasma testing is conducted on 24 subjects ($n = 24$). Eight test articles are used in this study: one reference cigarette and seven blends delivered to a user in an e-cigarette as an aerosol. The operating temperature of the e-cigarette is from about 150°C to about 250 °C, or from about 180°C to about 220 °C. The reference cigarette is Pall Mall (New Zealand). Seven blends are tested: 2% free base, 2% benzoate, 4% benzoate, 2% citrate, 2% malate, 2% salicylate, and 2% succinate. The seven blends are liquid formulations prepared according to protocols similar to that described *infra* and in Example 1.

[00123] All subjects are to consume 30-55 mg of the liquid formulation of each tested blend. Ten puffs are to be taken at 30 sec intervals starting at time =0 and continuing for 4.5 minutes. Blood plasma testing is to occur for at least 60 minutes from the first puff (t=0) Pharmacokinetic data (e.g., C_{max} , T_{max} , AUC) for nicotine in the plasma of users are obtained at various time periods during those 60 minutes, along with rates of nicotine absorption within the first 90 seconds for each test article.

Example 10: Blood Plasma testing

[00124] Blood plasma testing is conducted on twenty-four subjects (n = 24). Eleven test articles are used in this study: one reference cigarette and ten blends delivered to a user in an e-cigarette as an aerosol. The reference cigarette is Pall Mall (New Zealand). The operating temperature of the e-cigarette is from about 150°C to about 250 °C, or from about 180°C to about 220 °C. Ten blends are tested: 2% free base, 2% benzoate, 2% sorbate, 2% pyruvate, 2% laurate, 2% levulinate, 2% citrate, 2% malate, 2% salicylate, and 2% succinate. The ten blends are liquid formulations prepared according to protocols similar to that described *infra* and in Example 1.

[00125] All subjects are to consume 30-55 mg of the liquid formulation of each tested blend. Ten puffs are to be taken at 30 sec intervals starting at time =0 and continuing for 4.5 minutes. Blood plasma testing is to occur for at least 60 minutes from the first puff (t=0) . Pharmacokinetic data (e.g., C_{max} , T_{max} , AUC) for nicotine in the plasma of users are obtained at various time periods during those 60 minutes, along with rates of nicotine absorption within the first 90 seconds for each test article.

Example 11: Blood Plasma testing

[00126] Blood plasma testing is conducted on twenty-four subjects (n = 24). Twenty-one test articles are used in this study: one reference cigarette and twenty blends delivered to a user in an e-cigarette as an aerosol. The reference cigarette is Pall Mall (New Zealand). The operating temperature of the e-cigarette is from about 150°C to about 250 °C, or from about 180°C to about 220 °C. Twenty blends are tested: 2% free base, 4% free base, 2% benzoate, 4% benzoate, 2% sorbate, 4% sorbate, 2% pyruvate, 4% pyruvate, 2% laurate, 4% laurate, 2% levulinate, 4% levulinate, 2% citrate, 4% citrate, 2% malate, 4% malate, 2% salicylate, 4% salicylate, 2%

succinate, and 4% succinate. The twenty blends are liquid formulations prepared according to protocols similar to that described *infra* and in Example 1.

[00127] All subjects are to consume 30-55 mg of the liquid formulation of each tested blend. Ten puffs are to be taken at 30 sec intervals starting at time =0 and continuing for 4.5 minutes. Blood plasma testing is to occur for at least 60 minutes from the first puff (t=0) . Pharmacokinetic data (e.g., C_{max} , T_{max} , AUC) for nicotine in the plasma of users are obtained at various time periods during those 60 minutes, along with rates of nicotine absorption within the first 90 seconds for each test article.

Example 12: Blood Plasma testing

[00128] Blood plasma testing is conducted on twenty-four subjects (n = 24). Twenty-one test articles are used in this study: one reference cigarette and twenty blends delivered to a user in an e-cigarette as an aerosol. The reference cigarette is Pall Mall (New Zealand). The operating temperature of the e-cigarette is from about 150°C to about 250 °C, or from about 180°C to about 220 °C. Twenty blends are tested: 2% free base, 1% free base, 2% benzoate, 1% benzoate, 2% sorbate, 1% sorbate, 2% pyruvate, 1% pyruvate, 2% laurate, 1% laurate, 2% levulinate, 1% levulinate, 2% citrate, 1% citrate, 2% malate, 1% malate, 2% salicylate, 1% salicylate, 2% succinate, and 1% succinate. The twenty blends are liquid formulations prepared according to protocols similar to that described *infra* and in Example 1.

[00129] All subjects are to consume 30-55 mg of the liquid formulation of each tested blend. Ten puffs are to be taken at 30 sec intervals starting at time =0 and continuing for 4.5 minutes. Blood plasma testing is to occur for at least 60 minutes from the first puff (t=0) . Pharmacokinetic data (e.g., C_{max} , T_{max} , AUC) for nicotine in the plasma of users are obtained at various time periods during those 60 minutes, along with rates of nicotine absorption within the first 90 seconds for each test article.

[00130] Further understanding may be gained through contemplation of the numbered embodiments below.

2. A method of delivering nicotine to a user comprising operating an electronic cigarette to a user wherein the electronic cigarette comprises a nicotine salt formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine

salt is characterized by vapor pressure >20 mmHg at 200 °C, and inhaling an aerosol generated from the nicotine salt formulation heated by the electronic cigarette.

3. A method of delivering nicotine to a user comprising operating an electronic cigarette to a user wherein the electronic cigarette comprises a nicotine salt formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C, and inhaling an aerosol generated from the nicotine salt formulation heated by the electronic cigarette.

4. A method of delivering nicotine to a user comprising operating an electronic cigarette wherein the electronic cigarette comprises a nicotine salt formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point, and inhaling an aerosol generated from the nicotine salt formulation heated by the electronic cigarette.

5. A method of delivering nicotine to a user comprising providing an electronic cigarette to a user wherein the electronic cigarette comprises a nicotine salt formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point, and inhaling an aerosol generated from the nicotine salt formulation heated by the electronic cigarette.

6. The method of any one of embodiments 1-3, wherein an operating temperature is from 150 °C to 250 °C.

7. The method of any one of embodiments 1-3, wherein an operating temperature is from 180 °C to 220 °C.

8. The method any one of embodiments 1-3, wherein an operating temperature is about 200 °C.

9. The method of embodiment 4, wherein the operating temperature is from 150 °C to 250 °C.

10. The method of embodiment 4, wherein the operating temperature is from 180 °C to 220 °C.

11. The method of embodiment 4, wherein the operating temperature is about 200 °C.
12. The method any one of embodiments 1-10, wherein the aerosol comprises condensate of the nicotine salt.
13. The method any one of embodiments 1-10, wherein the aerosol comprises condensate of freebase nicotine.
14. The method any one of embodiments 1-10, wherein the aerosol comprises condensate of freebase nicotine and condensate of the carrier.
15. The method any one of embodiments 1-10, wherein the aerosol comprises condensate of freebase nicotine and condensate of the acid.
16. The method any one of embodiments 1-14, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 5 microns.
17. The method any one of embodiments 1-14, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 1 or 2 microns.
18. The method any one of embodiments 1-14, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 0.7 microns.
19. The method any one of embodiments 1-14, wherein the aerosol comprises condensate in particle sizes from about 0.3 microns to about 0.4 microns.
20. The method any one of embodiments 1-18, wherein the acid is a carboxylic acid.
21. The method of any one of embodiments 1-18, wherein the acid used to form said nicotine salt is an organic acid.
22. The method of embodiment 20, wherein the organic acid is monocarboxylic acid, aromatic acid, or keto acid.
23. The method of embodiment 20, wherein the organic acid is formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, caprylic acid, capric acid, citric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, phenylacetic acid, benzoic acid, pyruvic acid, levulinic acid, tartaric acid, lactic acid, malonic acid, succinic acid, fumaric acid, finnaric acid, gluconic acid, saccharic acid, salicylic acid, sorbic acid, malonic acid, or malic acid.
24. The method of any one of embodiments 1-18, wherein the acid used to form the nicotine salt is salicylic acid.

25. The method of any one of embodiments 1-18, wherein the acid used to form the nicotine salt is benzoic acid.

26. The method of any one of embodiments 1-18, wherein the acid used to form the nicotine salt is pyruvic acid.

27. The method of any one of embodiments 1-18, wherein the acid used to form the nicotine salt is sorbic acid.

28. The method of any one of embodiments 1-18, wherein the acid used to form the nicotine salt is lauric acid.

29. The method of any one of embodiments 1-18, wherein the acid used to form the nicotine salt is levulinic acid.

30. The method of any one of embodiments 1-18, wherein said nicotine salt comprises nicotine pyruvate.

31. The method of any one of embodiments 1-18, wherein said nicotine salt comprises nicotine salicylate.

32. The method of any one of embodiments 1-18, wherein said nicotine salt comprises nicotine sorbate.

33. The method of any one of embodiments 1-18, wherein said nicotine salt comprises nicotine laurate.

34. The method of any one of embodiments 1-18, wherein said nicotine salt comprises nicotine levulinate.

35. The method of any one of embodiments 1-18, wherein said nicotine salt comprises nicotine benzoate.

36. The method of any one of embodiments 1-34, wherein the liquid carrier comprises glycerol, propylene glycol, trimethylene glycol, water, ethanol or combinations thereof.

37. The method of any one of embodiments 1-34, wherein the liquid carrier comprises propylene glycol and vegetable glycerin.

38. The method of any one of embodiments 1-34, wherein the liquid carrier comprises 20% to 50% of propylene glycol and 80% to 50% of vegetable glycerin.

39. The method of any one of embodiments 1-34, wherein the liquid carrier comprises 30% propylene glycol and 70% vegetable glycerin.

40. The method of any one of embodiments 1-38, wherein the nicotine salt is in an amount that forms about 0.5% to about 20% nicotine in the inhalable aerosol.
41. The method of any one of embodiments 1-38, wherein the nicotine salt is in an amount that forms about 1% to about 20% nicotine in the inhalable aerosol.
42. The method of any one of embodiments 1-40, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 25% (w/w).
43. The method of any one of embodiments 1-40, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 20% (w/w).
44. The method of any one of embodiments 1-40, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 18% (w/w).
45. The method of any one of embodiments 1-40, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 15% (w/w).
46. The method of any one of embodiments 1-40, wherein the liquid formulation has a nicotine concentration of about 4% (w/w) to about 12% (w/w).
47. The method of any one of embodiments 1-40, wherein the liquid formulation has a nicotine concentration of about 4% (w/w).
48. The method of any one of embodiments 1-40, wherein the liquid formulation has a nicotine concentration of about 2% (w/w).
49. The method of any one of embodiments 1-47, wherein the formulation further comprises a flavorant.
50. The method of any one of embodiments 1-48, wherein the formulation is non-corrosive to an electronic cigarette.
51. The method of any one of embodiments 1-49, wherein the acid is stable at and below operating temperature or about 200 °C.
52. The method of any one of embodiments 1-50, wherein the acid does not decompose at and below operating temperature or about 200 °C.
53. The method of any one of embodiments 1-51, wherein the acid does not oxidize at and below operating temperature or about 200 °C.
54. The method of any one of embodiments 1-52, wherein the formulation is non-corrosive to the electronic cigarette.

55. The method of any one of embodiments 1-53, wherein the formulation is non-toxic to a user of the electronic cigarette.

56. The method of any one of embodiments 1-54, wherein the formulation further comprises one or more additional nicotine salts in a biologically acceptable liquid carrier suitable for generating the inhalable aerosol upon heating.

57. The method of embodiment 55, wherein a second acid used to form the additional nicotine salt is selected from the group consisting of salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid.

58. A method of delivering nicotine to the blood of a user, said method comprising providing an aerosol that is inhaled by the user from an electronic cigarette that comprises a nicotine salt formulation wherein providing the aerosol comprises the electronic cigarette heating the formulation thereby generating the aerosol, wherein the aerosol is effective in delivering a level of nicotine in the blood of the user that is at least 5ng/mL at about 1.5 minutes after a first puff of ten puffs of the aerosol, each puff taken at 30 second intervals.

59. The method of embodiment 54, wherein the nicotine salt formulation comprises a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C.

60. The method of embodiment 54, wherein the nicotine salt formulation comprises a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C.

61. The method of embodiment 54, wherein the nicotine salt formulation comprises a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point.

62. The method of any one of embodiments 57-60, wherein the heating of the formulation is at a temperature from 150 °C to 250 °C.

63. The method of any one of embodiments 57-60, wherein the heating of the formulation is at a temperature from 180 °C to 220 °C.

64. The method of any one of embodiments 57-60, wherein the heating of the formulation is at a temperature of about 200 °C.

65. The method of embodiment 54, wherein the nicotine salt formulation comprises a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than the operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point; and the operating temperature is 200 °C.

66. The method of any one of embodiments 57-64, wherein the Cmax is over 10 ng/mL on average.

67. The method of any one of embodiments 57-64, wherein the Cmax is over 11 ng/mL on average.

68. The method of any one of embodiments 57-64, wherein the Cmax is between 10 ng/mL and 16 ng/mL on average.

69. The method of any one of embodiments 57-64, wherein the Cmax is between 11 ng/mL and 15 ng/mL on average.

70. The method of any one of embodiments 57-64, wherein the Cmax is between 11 ng/mL and 14 ng/mL on average.

71. The method of any one of embodiments 57-69, wherein the Tmax under 10 minutes on average.

72. The method of any one of embodiments 57-69, wherein the Tmax is under 9 minutes on average.

73. The method of any one of embodiments 57-69, wherein the Tmax is under 8 minutes on average.

74. The method of any one of embodiments 57-69, wherein the Tmax is under 7 minutes on average.

75. The method of any one of embodiments 54-63, wherein the Tmax is from 3 minutes to 10 minutes on average.

76. The method of any one of embodiments 57-69, wherein the Tmax is from 3 minutes to 7.5 minutes on average.

77. The method of any one of embodiments 57-75, wherein the aerosol comprises condensate of the nicotine salt.

78. The method of any one of embodiments 57-75, wherein the aerosol comprises condensate of freebase nicotine.

79. The method of any one of embodiments 57-75, wherein the aerosol comprises condensate of freebase nicotine and condensate of the carrier.

80. The method of any one of embodiments 57-75, wherein the aerosol comprises condensate of freebase nicotine and condensate of the acid.

81. The method of any one of embodiments 57-79, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 5 microns.

82. The method of any one of embodiments 57-79, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 1 or 2 microns.

83. The method of any one of embodiments 57-79, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 0.7 microns.

84. The method of any one of embodiments 57-79, wherein the aerosol comprises condensate in particle sizes from about 0.3 microns to about 0.4 microns.

85. The method of any one of embodiments 57-83, wherein the acid is a carboxylic acid.

86. The method of any one of embodiments 57-83, wherein the acid used to form said nicotine salt is an organic acid.

87. The method of embodiment 85, wherein the organic acid is monocarboxylic acid, aromatic acid, or keto acid.

88. The method of embodiment 85, wherein the organic acid is formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, caprylic acid, capric acid, citric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, phenylacetic acid, benzoic acid, pyruvic acid, levulinic acid, tartaric acid, lactic acid, malonic acid, succinic acid, fumaric acid, finnaric acid, gluconic acid, saccharic acid, salicylic acid, sorbic acid, malonic acid, or malic acid.

89. The method of any one of embodiments 57-83, wherein the acid used to form the nicotine salt is salicylic acid.

90. The method of any one of embodiments 57-83, wherein the acid used to form the nicotine salt is benzoic acid.

91. The method of any one of embodiments 57-83, wherein the acid used to form the nicotine salt is pyruvic acid.

92. The method of any one of embodiments 57-83, wherein the acid used to form the nicotine salt is sorbic acid.

93. The method of any one of embodiments 57-83, wherein the acid used to form the nicotine salt is lauric acid.

94. The method of any one of embodiments 57-83, wherein the acid used to form the nicotine salt is levulinic acid.

95. The method of any one of embodiments 57-83, wherein said nicotine salt comprises nicotine pyruvate.

96. The method of any one of embodiments 57-83, wherein said nicotine salt comprises nicotine salicylate.

97. The method of any one of embodiments 57-83, wherein said nicotine salt comprises nicotine sorbate.

98. The method of any one of embodiments 57-83, wherein said nicotine salt comprises nicotine laurate.

99. The method of any one of embodiments 57-83, wherein said nicotine salt comprises nicotine levulinate.

100. The method of any one of embodiments 57-83, wherein said nicotine salt comprises nicotine benzoate.

101. The method of any one of embodiments 57-99, wherein the liquid carrier comprises glycerol, propylene glycol, trimethylene glycol, water, ethanol or combinations thereof.

102. The method of any one of embodiments 57-99, wherein the liquid carrier comprises propylene glycol and vegetable glycerin.

103. The method of any one of embodiments 57-99, wherein the liquid carrier comprises 20% to 50% of propylene glycol and 80% to 50% of vegetable glycerin.

104. The method of any one of embodiments 57-99, wherein the liquid carrier comprises 30% propylene glycol and 70% vegetable glycerin.

105. The method of any one of embodiments 57-103, wherein the nicotine salt is in an amount that forms about 0.5% to about 20% nicotine in the inhalable aerosol.

106. The method of any one of embodiments 57-103, wherein the nicotine salt is in an amount that forms about 1% to about 20% nicotine in the inhalable aerosol.

107. The method of any one of embodiments 57-105, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 25% (w/w).

108. The method of any one of embodiments 57-105, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 20% (w/w).

109. The method of any one of embodiments 57-105, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 18% (w/w).

110. The method of any one of embodiments 57-105, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 15% (w/w).

111. The method of any one of embodiments 57-105, wherein the liquid formulation has a nicotine concentration of about 4% (w/w) to about 12% (w/w).

112. The method of any one of embodiments 57-105, wherein the liquid formulation has a nicotine concentration of about 4% (w/w).

113. The method of any one of embodiments 57-105, wherein the liquid formulation has a nicotine concentration of about 2% (w/w).

114. The method of any one of embodiments 57-112, wherein the formulation further comprises a flavorant.

115. The method of any one of embodiments 57-113, wherein the formulation is non-corrosive to an electronic cigarette.

116. The method of any one of embodiments 57-114, wherein the acid is stable at and below operating temperature or about 200 °C.

117. The method of any one of embodiments 57-115, wherein the acid does not decompose at and below operating temperature or about 200 °C.

118. The method of any one of embodiments 57-116, wherein the acid does not oxidize at and below operating temperature or about 200 °C.

119. The method of any one of embodiments 57-117, wherein the formulation is non-corrosive to the electronic cigarette.

120. The method of any one of embodiments 57-118, wherein the formulation is non-toxic to a user of the electronic cigarette.

121. The method of any one of embodiments 57-119, wherein the formulation further comprises one or more additional nicotine salts in a biologically acceptable liquid carrier suitable for generating the inhalable aerosol upon heating.

122. The method of embodiment 120, wherein a second acid used to form the additional nicotine salt is selected from the group consisting of salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid.

123. A nicotine salt liquid formulation in an electronic cigarette for generating an inhalable aerosol upon heating in the electronic cigarette, the formulation in the cigarette comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C.

124. A nicotine salt liquid formulation in an electronic cigarette for generating an inhalable aerosol upon heating in the electronic cigarette, the formulation in the cigarette comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C.

125. A nicotine salt liquid formulation in an electronic cigarette for generating an inhalable aerosol upon heating in the electronic cigarette, the formulation in the cigarette comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point.

126. A nicotine salt liquid formulation in an electronic cigarette for generating an inhalable aerosol upon heating in the electronic cigarette, the formulation in the cigarette comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point.

127. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-124, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature from 150 °C to 250 °C.

128. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-124, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature from 180 °C to 220 °C.

129. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-124, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature of about 200 °C.

130. The nicotine salt liquid formulation in the electronic cigarette of embodiment 125, wherein the operating temperature is from 150 °C to 250 °C.

131. The nicotine salt liquid formulation in the electronic cigarette of embodiment 125, wherein the operating temperature is from 180 °C to 220 °C.

132. The nicotine salt liquid formulation in the electronic cigarette of embodiment 125, wherein the operating temperature is about 200 °C.

133. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein the acid is a carboxylic acid.

134. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein the acid used to form said nicotine salt is an organic acid.

135. The nicotine salt liquid formulation in the electronic cigarette of embodiment 133, wherein the organic acid is monocarboxylic acid, aromatic acid, or keto acid.

136. The nicotine salt liquid formulation in the electronic cigarette of embodiment 133, wherein the organic acid is formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, caprylic acid, capric acid, citric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, phenylacetic acid, benzoic acid, pyruvic acid, levulinic acid, tartaric acid, lactic acid, malonic acid, succinic acid, fumaric acid, fennaric acid, gluconic acid, saccharic acid, salicylic acid, sorbic acid, malonic acid, or malic acid.

137. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein the acid used to form the nicotine salt is salicylic acid.

138. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein the acid used to form the nicotine salt is benzoic acid.

139. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein the acid used to form the nicotine salt is pyruvic acid.

140. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein the acid used to form the nicotine salt is sorbic acid.

141. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein the acid used to form the nicotine salt is lauric acid.

142. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein the acid used to form the nicotine salt is levulinic acid.

143. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein said nicotine salt comprises nicotine pyruvate.

144. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein said nicotine salt comprises nicotine salicylate.

145. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein said nicotine salt comprises nicotine sorbate.

146. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein said nicotine salt comprises nicotine laurate.

147. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein said nicotine salt comprises nicotine levulinate.

148. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-131, wherein said nicotine salt comprises nicotine benzoate.

149. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-147, wherein the liquid carrier comprises glycerol, propylene glycol, trimethylene glycol, water, ethanol or combinations thereof.

150. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-147, wherein the liquid carrier comprises propylene glycol and vegetable glycerin.

151. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-147, wherein the liquid carrier comprises 20% to 50% of propylene glycol and 80% to 50% of vegetable glycerin.

152. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-147, wherein the liquid carrier comprises 30% propylene glycol and 70% vegetable glycerin.

153. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-151, wherein the nicotine salt is in an amount that forms about 0.5% to about 20% nicotine in the inhalable aerosol.

154. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-151, wherein the nicotine salt is in an amount that forms about 1% to about 20% nicotine in the inhalable aerosol.

155. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-153, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 25% (w/w).

156. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-153, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 20% (w/w).

157. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-153, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 18% (w/w).

158. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-153, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 15% (w/w).

159. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-153, wherein the liquid formulation has a nicotine concentration of about 4% (w/w) to about 12% (w/w).

160. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-153, wherein the liquid formulation has a nicotine concentration of about 4% (w/w).

161. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-153, wherein the liquid formulation has a nicotine concentration of about 2% (w/w).

162. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-160, wherein the formulation further comprises a flavorant.

163. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-161, wherein the formulation is non-corrosive to an electronic cigarette.

164. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-162, wherein the acid is stable at and below operating temperature or about 200 °C.

165. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-163, wherein the acid does not decompose at and below operating temperature or about 200 °C.

166. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-164, wherein the acid does not oxidize at and below operating temperature or about 200 °C.

167. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-165, wherein the formulation is non-corrosive to the electronic cigarette.

168. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-166, wherein the formulation is non-toxic to a user of the electronic cigarette.

169. The nicotine salt liquid formulation in the electronic cigarette of any one of embodiments 122-167 further comprising one or more additional nicotine salts in a biologically acceptable liquid carrier suitable for generating the inhalable aerosol upon heating.

170. The nicotine salt liquid formulation in the electronic cigarette of embodiment 168, wherein a second acid used to form the additional nicotine salt is selected from the group consisting of salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid.

171. A nicotine salt liquid formulation for generating an inhalable aerosol upon heating in the electronic cigarette, the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C.

172. A nicotine salt liquid formulation for generating an inhalable aerosol upon heating in the electronic cigarette, the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C.

173. A nicotine salt liquid formulation for generating an inhalable aerosol upon heating in the electronic cigarette, the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point.

174. A nicotine salt liquid formulation for generating an inhalable aerosol upon heating in the electronic cigarette, the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point.

175. The nicotine salt liquid formulation of any one of embodiments 170-172, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature from 150 °C to 250 °C.

176. The nicotine salt liquid formulation of any one of embodiments 170-172, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature from 180 °C to 220 °C.

177. The nicotine salt liquid formulation of any one of embodiments 170-172, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature of about 200 °C.

178. The nicotine salt liquid formulation of embodiment 173, wherein the operating temperature is from 150 °C to 250 °C.

179. The nicotine salt liquid formulation of embodiment 173, wherein the operating temperature is from 180 °C to 220 °C.

180. The nicotine salt liquid formulation of embodiment 173, wherein the operating temperature is about 200 °C.

181. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein the acid is a carboxylic acid.

182. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein the acid used to form said nicotine salt is an organic acid.

183. The nicotine salt liquid formulation of embodiment 181, wherein the organic acid is monocarboxylic acid, aromatic acid, or keto acid.

184. The nicotine salt liquid formulation of embodiment 181, wherein the organic acid is formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, caprylic acid, capric acid, citric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic

acid, linolenic acid, phenylacetic acid, benzoic acid, pyruvic acid, levulinic acid, tartaric acid, lactic acid, malonic acid, succinic acid, fumaric acid, finnaric acid, gluconic acid, saccharic acid, salicylic acid, sorbic acid, malonic acid, or malic acid.

185. The liquid formulation of any one of embodiments 170-179, wherein the acid used to form the nicotine salt is salicylic acid.

186. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein the acid used to form the nicotine salt is benzoic acid.

187. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein the acid used to form the nicotine salt is pyruvic acid.

188. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein the acid used to form the nicotine salt is sorbic acid.

189. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein the acid used to form the nicotine salt is lauric acid.

190. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein the acid used to form the nicotine salt is levulinic acid.

191. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein said nicotine salt comprises nicotine pyruvate.

192. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein said nicotine salt comprises nicotine salicylate.

193. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein said nicotine salt comprises nicotine sorbate.

194. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein said nicotine salt comprises nicotine laurate.

195. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein said nicotine salt comprises nicotine levulinate.

196. The nicotine salt liquid formulation of any one of embodiments 170-179, wherein said nicotine salt comprises nicotine benzoate.

197. The nicotine salt liquid formulation of any one of embodiments 170-195, wherein the liquid carrier comprises glycerol, propylene glycol, trimethylene glycol, water, ethanol or combinations thereof.

198. The nicotine salt liquid formulation of any one of embodiments 170-195, wherein the liquid carrier comprises propylene glycol and vegetable glycerin.

199. The nicotine salt liquid formulation of any one of embodiments 170-195, wherein the liquid carrier comprises 20% to 50% of propylene glycol and 80% to 50% of vegetable glycerin.

200. The nicotine salt liquid formulation of any one of embodiments 170-195, wherein the liquid carrier comprises 30% propylene glycol and 70% vegetable glycerin.

201. The nicotine salt liquid formulation of any one of embodiments 170-199, wherein the nicotine salt is in an amount that forms about 0.5% to about 20% nicotine in the inhalable aerosol.

202. The nicotine salt liquid formulation of any one of embodiments 170-199, wherein the nicotine salt is in an amount that forms about 1% to about 20% nicotine in the inhalable aerosol.

203. The nicotine salt liquid formulation of any one of embodiments 170-201, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 25% (w/w).

204. The nicotine salt liquid formulation of any one of embodiments 170-201, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 20% (w/w).

205. The nicotine salt liquid formulation of any one of embodiments 170-201, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 18% (w/w).

206. The nicotine salt liquid formulation of any one of embodiments 170-201, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 15% (w/w).

207. The nicotine salt liquid formulation of any one of embodiments 170-201, wherein the liquid formulation has a nicotine concentration of about 4% (w/w) to about 12% (w/w).

208. The nicotine salt liquid formulation of any one of embodiments 170-201, wherein the liquid formulation has a nicotine concentration of about 4% (w/w).

209. The nicotine salt liquid formulation of any one of embodiments 170-201, wherein the liquid formulation has a nicotine concentration of about 2% (w/w).

210. The nicotine salt liquid formulation of any one of embodiments 170-208, wherein the formulation further comprises a flavorant.

211. The nicotine salt liquid formulation of any one of embodiments 170-209, wherein the formulation is non-corrosive to an electronic cigarette.

212. The nicotine salt liquid formulation of any one of embodiments 170-210, wherein the acid is stable at and below operating temperature or about 200 °C.

213. The nicotine salt liquid formulation of any one of embodiments 170-211, wherein the acid does not decompose at and below operating temperature or about 200 °C.

214. The nicotine salt liquid formulation of any one of embodiments 170-212, wherein the acid does not oxidize at and below operating temperature or about 200 °C.

215. The nicotine salt liquid formulation of any one of embodiments 170-213, wherein the formulation is non-corrosive to the electronic cigarette.

216. The nicotine salt liquid formulation of any one of embodiments 170-214, wherein the formulation is non-toxic to a user of the electronic cigarette.

217. The nicotine salt liquid formulation of any one of embodiments 170-215, further comprising one or more additional nicotine salts in a biologically acceptable liquid carrier suitable for generating the inhalable aerosol upon heating.

218. The nicotine salt liquid formulation of embodiment 216, wherein a second acid used to form the additional nicotine salt is selected from the group consisting of salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid.

219. A nicotine salt liquid formulation for use in an electronic cigarette the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C.

220. A nicotine salt liquid formulation for use in an electronic cigarette the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C.

221. A nicotine salt liquid formulation for use in an electronic cigarette the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point.

222. A nicotine salt liquid formulation for use in an electronic cigarette the nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more

than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point.

223. The nicotine salt liquid formulation of any one of embodiments 218-220, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature from 150 °C to 250 °C.

224. The nicotine salt liquid formulation of any one of embodiments 218-220, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature from 180 °C to 220 °C.

225. The nicotine salt liquid formulation of any one of embodiments 218-220, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature of about 200 °C.

226. The nicotine salt liquid formulation of embodiment 221, wherein the operating temperature is from 150 °C to 250 °C.

227. The nicotine salt liquid formulation of embodiment 221, wherein the operating temperature is from 180 °C to 220 °C.

228. The nicotine salt liquid formulation of embodiment 221, wherein the operating temperature is about 200 °C.

229. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein the acid is a carboxylic acid.

230. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein the acid used to form said nicotine salt is an organic acid.

231. The nicotine salt liquid formulation of embodiment 229, wherein the organic acid is monocarboxylic acid, aromatic acid, or keto acid.

232. The nicotine salt liquid formulation of embodiment 229, wherein the organic acid is formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, caprylic acid, capric acid, citric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, phenylacetic acid, benzoic acid, pyruvic acid, levulinic acid, tartaric acid, lactic acid, malonic acid, succinic acid, fumaric acid, fumaric acid, gluconic acid, saccharic acid, salicylic acid, sorbic acid, malonic acid, or malic acid.

233. The liquid formulation of any one of embodiments 218-227, wherein the acid used to form the nicotine salt is salicylic acid.

234. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein the acid used to form the nicotine salt is benzoic acid.

235. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein the acid used to form the nicotine salt is pyruvic acid.

236. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein the acid used to form the nicotine salt is sorbic acid.

237. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein the acid used to form the nicotine salt is lauric acid.

238. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein the acid used to form the nicotine salt is levulinic acid.

239. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein said nicotine salt comprises nicotine pyruvate.

240. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein said nicotine salt comprises nicotine salicylate.

241. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein said nicotine salt comprises nicotine sorbate.

242. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein said nicotine salt comprises nicotine laurate.

243. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein said nicotine salt comprises nicotine levulinate.

244. The nicotine salt liquid formulation of any one of embodiments 218-227, wherein said nicotine salt comprises nicotine benzoate.

245. The nicotine salt liquid formulation of any one of embodiments 218-243, wherein the liquid carrier comprises glycerol, propylene glycol, trimethylene glycol, water, ethanol or combinations thereof.

246. The nicotine salt liquid formulation of any one of embodiments 218-243, wherein the liquid carrier comprises propylene glycol and vegetable glycerin.

247. The nicotine salt liquid formulation of any one of embodiments 218-243, wherein the liquid carrier comprises 20% to 50% of propylene glycol and 80% to 50% of vegetable glycerin.

248. The nicotine salt liquid formulation of any one of embodiments 218-243, wherein the liquid carrier comprises 30% propylene glycol and 70% vegetable glycerin.

249. The nicotine salt liquid formulation of any one of embodiments 218-247, wherein the nicotine salt is in an amount that forms about 0.5% to about 20% nicotine in the inhalable aerosol.

250. The nicotine salt liquid formulation of any one of embodiments 218-247, wherein the nicotine salt is in an amount that forms about 1% to about 20% nicotine in the inhalable aerosol.

251. The nicotine salt liquid formulation of any one of embodiments 218-247, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 25% (w/w).

252. The nicotine salt liquid formulation of any one of embodiments 218-247, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 20% (w/w).

253. The nicotine salt liquid formulation of any one of embodiments 218-247, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 18% (w/w).

254. The nicotine salt liquid formulation of any one of embodiments 218-247, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 15% (w/w).

255. The nicotine salt liquid formulation of any one of embodiments 218-247, wherein the liquid formulation has a nicotine concentration of about 4% (w/w) to about 12% (w/w).

256. The nicotine salt liquid formulation of any one of embodiments 218-247, wherein the liquid formulation has a nicotine concentration of about 4% (w/w).

257. The nicotine salt liquid formulation of any one of embodiments 218-247, wherein the liquid formulation has a nicotine concentration of about 2% (w/w).

258. The nicotine salt liquid formulation of any one of embodiments 218-256, wherein the formulation further comprises a flavorant.

259. The nicotine salt liquid formulation of any one of embodiments 218-257, wherein the formulation is non-corrosive to an electronic cigarette.

260. The nicotine salt liquid formulation of any one of embodiments 218-258, wherein the acid is stable at and below operating temperature or about 200 °C.

261. The nicotine salt liquid formulation of any one of embodiments 218-259, wherein the acid does not decompose at and below operating temperature or about 200 °C.

262. The nicotine salt liquid formulation of any one of embodiments 218-260, wherein the acid does not oxidize at and below operating temperature or about 200 °C.

263. The nicotine salt liquid formulation of any one of embodiments 218-261, wherein the formulation is non-corrosive to the electronic cigarette.

264. The nicotine salt liquid formulation of any one of embodiments 218-262, wherein the formulation is non-toxic to a user of the electronic cigarette.

265. The nicotine salt liquid formulation of any one of embodiments 218-263, further comprising one or more additional nicotine salts in a biologically acceptable liquid carrier suitable for generating the inhalable aerosol upon heating.

266. The nicotine salt liquid formulation of embodiment 264, wherein a second acid used to form the additional nicotine salt is selected from the group consisting of salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid.

267. Use of a nicotine salt formulation for delivery of nicotine to a user from an electronic cigarette wherein the nicotine salt formulation comprises a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200°C , and the nicotine salt formulation is heated by the electronic cigarette to generate an aerosol inhalable by the user.

268. Use of a nicotine salt formulation for delivery of nicotine to a user from an electronic cigarette wherein the nicotine salt formulation comprises a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200°C , and the nicotine salt formulation is heated by the electronic cigarette to generate an aerosol inhalable by the user.

269. Use of a nicotine salt formulation for delivery of nicotine to a user from an electronic cigarette wherein the nicotine salt formulation comprises a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point $<160^{\circ}\text{C}$, a boiling point $>160^{\circ}\text{C}$, and at least a 50-degree difference between the melting point and the boiling point, and the nicotine salt formulation is heated by the electronic cigarette to generate an aerosol inhalable by the user.

270. Use of a nicotine salt formulation for delivery of nicotine to the blood of a user from an electronic cigarette, wherein the nicotine salt formulation in the electronic cigarette is heated to form an aerosol which delivers a level of nicotine in the blood of the user that is at least 5 ng/mL at about 1.5 minutes after a first puff of ten puffs of the aerosol, each puff taken at 30 second intervals.

271. Use of a nicotine salt formulation for delivery of nicotine to a user from an electronic cigarette wherein the nicotine salt formulation comprises a nicotine salt in a biologically

acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point, and the nicotine salt formulation is heated by the electronic cigarette to generate an aerosol inhalable by the user.

272. The use of any one of embodiments 266-269, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature is from 150 °C to 250 °C.

273. The use of any one of embodiments 266-269, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature is from 180 °C to 220 °C.

274. The use of any one of embodiments 266-269, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature is about 200 °C.

275. The use of embodiment 270, wherein the operating temperature is from 150 °C to 250 °C.

276. The use of embodiment 270, wherein the operating temperature is from 180 °C to 220 °C.

277. The use of embodiment 270, wherein the operating temperature is about 200 °C.

278. The use of any one of embodiments 266-276, wherein the aerosol comprises condensate of the nicotine salt.

279. The use of any one of embodiments 266-276, wherein the aerosol comprises condensate of freebase nicotine.

280. The use of any one of embodiments 266-276, wherein the aerosol comprises condensate of freebase nicotine and condensate of the carrier.

281. The use of any one of embodiments 266-276, wherein the aerosol comprises condensate of freebase nicotine and condensate of the acid.

282. The use of any one of embodiments 266-280, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 5 microns.

283. The use of any one of embodiments 266-280, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 1 or 2 microns.

284. The use of any one of embodiments 266-280, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 0.7 microns.

285. The use of any one of embodiments 266-280, wherein the aerosol comprises condensate in particle sizes from about 0.3 microns to about 0.4 microns.

286. The use of any one of embodiments 266-284, wherein the acid is a carboxylic acid.

287. The use of any one of embodiments 266-284, wherein the acid used to form said nicotine salt is an organic acid.

288. The use of embodiment 286, wherein the organic acid is monocarboxylic acid, aromatic acid, or keto acid.

289. The use of embodiment 286, wherein the organic acid is formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, caprylic acid, capric acid, citric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, phenylacetic acid, benzoic acid, pyruvic acid, levulinic acid, tartaric acid, lactic acid, malonic acid, succinic acid, fumaric acid, fennaric acid, gluconic acid, saccharic acid, salicylic acid, sorbic acid, malonic acid, or malic acid.

290. The use of any one of embodiments 266-284, wherein the acid used to form the nicotine salt is salicylic acid.

291. The use of any one of embodiments 266-284, wherein the acid used to form the nicotine salt is benzoic acid.

292. The use of any one of embodiments 266-284, wherein the acid used to form the nicotine salt is pyruvic acid.

293. The use of any one of embodiments 266-284, wherein the acid used to form the nicotine salt is sorbic acid.

294. The use of any one of embodiments 266-284, wherein the acid used to form the nicotine salt is lauric acid.

295. The use of any one of embodiments 266-284, wherein the acid used to form the nicotine salt is levulinic acid.

296. The use of any one of embodiments 266-284, wherein said nicotine salt comprises nicotine pyruvate.

297. The use of any one of embodiments 266-284, wherein said nicotine salt comprises nicotine salicylate.

298. The use of any one of embodiments 266-284, wherein said nicotine salt comprises nicotine sorbate.

299. The use of any one of embodiments 266-284, wherein said nicotine salt comprises nicotine laurate.

300. The use of any one of embodiments 266-284, wherein said nicotine salt comprises nicotine levulinate.

301. The use of any one of embodiments 266-284, wherein said nicotine salt comprises nicotine benzoate.

302. The use of any one of embodiments 266-300, wherein the liquid carrier comprises glycerol, propylene glycol, trimethylene glycol, water, ethanol or combinations thereof.

303. The use of any one of embodiments 266-300, wherein the liquid carrier comprises propylene glycol and vegetable glycerin.

304. The use of any one of embodiments 266-300, wherein the liquid carrier comprises 20% to 50% of propylene glycol and 80% to 50% of vegetable glycerin.

305. The use of any one of embodiments 266-300, wherein the liquid carrier comprises 30% propylene glycol and 70% vegetable glycerin.

306. The use of any one of embodiments 266-304, wherein the nicotine salt is in an amount that forms about 0.5% to about 20% nicotine in the inhalable aerosol.

307. The use of any one of embodiments 266-304, wherein the nicotine salt is in an amount that forms about 1% to about 20% nicotine in the inhalable aerosol.

308. The use of any one of embodiments 266-306, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 25% (w/w).

309. The use of any one of embodiments 266-306, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 20% (w/w).

310. The use of any one of embodiments 266-306, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 18% (w/w).

311. The use of any one of embodiments 266-306, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 15% (w/w).

312. The use of any one of embodiments 266-306, wherein the liquid formulation has a nicotine concentration of about 4% (w/w) to about 12% (w/w).

313. The use of any one of embodiments 266-306, wherein the liquid formulation has a nicotine concentration of about 4% (w/w).

314. The use of any one of embodiments 266-306, wherein the liquid formulation has a nicotine concentration of about 2% (w/w).

315. The use of any one of embodiments 266-313, wherein the formulation further comprises a flavorant.

316. The use of any one of embodiments 266-314, wherein the formulation is non-corrosive to an electronic cigarette.

317. The use of any one of embodiments 266-315, wherein the acid is stable at and below operating temperature or about 200 °C.

318. The use of any one of embodiments 266-316, wherein the acid does not decompose at and below operating temperature or about 200 °C.

319. The use of any one of embodiments 266-317, wherein the acid does not oxidize at and below operating temperature or about 200 °C.

320. The use of any one of embodiments 266-318, wherein the formulation is non-corrosive to the electronic cigarette.

321. The use of any one of embodiments 266-319, wherein the formulation is non-toxic to a user of the electronic cigarette.

322. The use of any one of embodiments 266-320, wherein the formulation further comprises one or more additional nicotine salts in a biologically acceptable liquid carrier suitable for generating the inhalable aerosol upon heating.

323. The use of embodiment 321, wherein a second acid used to form the additional nicotine salt is selected from the group consisting of salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid

324. A cartomizer for an electronic cigarette comprising:

a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C;

an atomizer comprising a heating element in fluid communication with the nicotine salt liquid formulation; and

a fluid storage compartment that stores the nicotine salt liquid formulation.

325. A cartomizer for an electronic cigarette comprising:

a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C;

an atomizer comprising a heating element in fluid communication with the nicotine salt liquid formulation; and

a fluid storage compartment that stores the nicotine salt liquid formulation.

326. A cartomizer for an electronic cigarette comprising:

a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point;

an atomizer comprising a heating element in fluid communication with the nicotine salt liquid formulation; and

a fluid storage compartment that stores the nicotine salt liquid formulation.

327. A cartomizer for an electronic cigarette comprising:

a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point;

an atomizer comprising a heating element in fluid communication with the nicotine salt liquid formulation; and

a fluid storage compartment that stores the nicotine salt liquid formulation.

328. The cartomizer of any one of embodiments 323-325, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature from 150 °C to 250 °C.

329. The cartomizer of any one of embodiments 323-325, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature from 180 °C to 220 °C.

330. The cartomizer of any one of embodiments 323-325, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature of about 200 °C.

331. The cartomizer of embodiment 326, wherein the operating temperature is from 150 °C to 250 °C.

332. The cartomizer of embodiment 326, wherein the operating temperature is from 180 °C to 220 °C.

333. The cartomizer of embodiment 326, wherein the operating temperature is about 200 °C.

334. The cartomizer of any one of embodiments 323-332, wherein the cartomizer further comprises a mouthpiece.

335. The cartomizer of any one of embodiments 323-333, wherein the acid is a carboxylic acid.

336. The cartomizer of any one of embodiments 323-333, wherein the acid used to form said nicotine salt is an organic acid.

337. The cartomizer of embodiment 335, wherein the organic acid is monocarboxylic acid, aromatic acid, or keto acid.

338. The cartomizer of embodiment 335, wherein the organic acid is formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, caprylic acid, capric acid, citric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, phenylacetic acid, benzoic acid, pyruvic acid, levulinic acid, tartaric acid, lactic acid, malonic acid, succinic acid, fumaric acid, finnaric acid, gluconic acid, saccharic acid, salicylic acid, sorbic acid, malonic acid, or malic acid.

339. The cartomizer of any one of embodiments 323-333, wherein the acid used to form the nicotine salt is salicylic acid.

340. The cartomizer of any one of embodiments 323-333, wherein the acid used to form the nicotine salt is benzoic acid.

341. The cartomizer of any one of embodiments 323-333, wherein the acid used to form the nicotine salt is pyruvic acid.

342. The cartomizer of any one of embodiments 323-333, wherein the acid used to form the nicotine salt is sorbic acid.

343. The cartomizer of any one of embodiments 323-333, wherein the acid used to form the nicotine salt is lauric acid.

344. The cartomizer of any one of embodiments 323-333, wherein the acid used to form the nicotine salt is levulinic acid.

345. The cartomizer of any one of embodiments 323-333, wherein said nicotine salt comprises nicotine pyruvate.

346. The cartomizer of any one of embodiments 323-333, wherein said nicotine salt comprises nicotine salicylate.

347. The cartomizer of any one of embodiments 323-333, wherein said nicotine salt comprises nicotine sorbate.

348. The cartomizer of any one of embodiments 323-333, wherein said nicotine salt comprises nicotine laurate.

349. The cartomizer of any one of embodiments 323-333, wherein said nicotine salt comprises nicotine levulinate.

350. The cartomizer of any one of embodiments 323-333, wherein said nicotine salt comprises nicotine benzoate.

351. The cartomizer of any one of embodiments 323-349, wherein the liquid carrier comprises glycerol, propylene glycol, trimethylene glycol, water, ethanol or combinations thereof.

352. The cartomizer of any one of embodiments 323-349, wherein the liquid carrier comprises propylene glycol and vegetable glycerin.

353. The cartomizer of any one of embodiments 323-349, wherein the liquid carrier comprises 20% to 50% of propylene glycol and 80% to 50% of vegetable glycerin.

354. The cartomizer of any one of embodiments 323-349, wherein the liquid carrier comprises 30% propylene glycol and 70% vegetable glycerin.

355. The cartomizer of any one of embodiments 323-353, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 25% (w/w).

356. The cartomizer of any one of embodiments 323-353, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 20% (w/w).

357. The cartomizer of any one of embodiments 323-353, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 18% (w/w).

358. The cartomizer of any one of embodiments 323-353, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 15% (w/w).

359. The cartomizer of any one of embodiments 323-353, wherein the liquid formulation has a nicotine concentration of about 4% (w/w) to about 12% (w/w).

360. The cartomizer of any one of embodiments 323-353, wherein the liquid formulation has a nicotine concentration of about 4% (w/w).

361. The cartomizer of any one of embodiments 323-353, wherein the liquid formulation has a nicotine concentration of about 2% (w/w).

362. The cartomizer of any one of embodiments 323-360, wherein the electronic cigarette is configured to generate an aerosol inhalable by a user.

363. The cartomizer of embodiment 361, wherein the aerosol comprises condensate of the nicotine salt.

364. The cartomizer of embodiment 361, wherein the aerosol comprises condensate of freebase nicotine.

365. The cartomizer of embodiment 361, wherein the aerosol comprises condensate of freebase nicotine and condensate of the carrier.

366. The cartomizer of embodiment 361, wherein the aerosol comprises condensate of freebase nicotine and condensate of the acid.

367. The cartomizer of any one of embodiments 361-365, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 5 microns.

368. The cartomizer of any one of embodiments 361-365, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 1 or 2 microns.

369. The cartomizer of any one of embodiments 361-365, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 0.7 microns.

370. The cartomizer of any one of embodiments 361-365, wherein the aerosol comprises condensate in particle sizes from about 0.3 microns to about 0.4 microns.

371. The cartomizer of any one of embodiments 361-369, wherein the nicotine salt is in an amount that forms about 0.5% to about 20% nicotine in the inhalable aerosol.

372. The cartomizer of any one of embodiments 361-369, wherein the nicotine salt is in an amount that forms about 1% to about 20% nicotine in the inhalable aerosol.

373. The cartomizer of any one of embodiments 323-371, wherein the formulation further comprises a flavorant.

374. The cartomizer of any one of embodiments 323-372, wherein the formulation is non-corrosive to an electronic cigarette.

375. The cartomizer of any one of embodiments 323-373, wherein the acid is stable at and below operating temperature or about 200 °C.

376. The cartomizer of any one of embodiments 323-374, wherein the acid does not decompose at and below operating temperature or about 200 °C.

377. The cartomizer of any one of embodiments 323-375, wherein the acid does not oxidize at and below operating temperature or about 200 °C.

378. The cartomizer of any one of embodiments 323-376, wherein the formulation is non-corrosive to the electronic cigarette.

379. The cartomizer of any one of embodiments 323-377, wherein the formulation is non-toxic to a user of the electronic cigarette.

380. The cartomizer of any one of embodiments 323-378, wherein the formulation further comprises one or more additional nicotine salts in a biologically acceptable liquid carrier suitable for generating the inhalable aerosol upon heating.

381. The cartomizer of embodiment 379, wherein a second acid used to form the additional nicotine salt is selected from the group consisting of salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid.

382. An electronic cigarette for generating an inhalable aerosol comprising

a fluid storage compartment;

a heater; and

a nicotine salt liquid formulation in the fluid storage compartment, the liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C;

a battery; and

a mouthpiece.

383. An electronic cigarette for generating an inhalable aerosol comprising

a fluid storage compartment;

a heater; and

a nicotine salt liquid formulation in the fluid storage compartment, the liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used

to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C;

a battery; and

a mouthpiece.

384. An electronic cigarette for generating an inhalable aerosol comprising

a fluid storage compartment;

a heater; and

a nicotine salt liquid formulation in the fluid storage compartment, the liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point;

a battery; and

a mouthpiece.

385. An electronic cigarette for generating an inhalable aerosol comprising

a fluid storage compartment;

a heater; and

a nicotine salt liquid formulation in the fluid storage compartment, the liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point;

a battery; and

a mouthpiece.

386. The electronic cigarette of any one of embodiments 381-384, wherein the heater comprises a heater chamber, a fluid wick, and a resistive heating element in contact with the fluid wick.

387. The electronic cigarette of any one of embodiments 381-384, wherein the mouthpiece, the heater and the fluid storage compartment form a cartomizer separable from the battery.

388. The electronic cigarette of any one of embodiments 381-384, wherein the heater and the fluid storage compartment form a cartomizer separable from the battery and the mouthpiece.

389. The electronic cigarette of any one of embodiments 381-384, wherein the fluid storage compartment is separable from the heater, the battery and the mouthpiece.

390. The electronic cigarette of any one of embodiments 381-383, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature from 150 °C to 250 °C.

391. The electronic cigarette of any one of embodiments 381-383, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature from 180 °C to 220 °C.

392. The electronic cigarette of any one of embodiments 381-383, wherein the electronic cigarette heats the nicotine salt formulation to an operating temperature of about 200 °C.

393. The electronic cigarette of embodiment 384, wherein the operating temperature is from 150 °C to 250 °C.

394. The electronic cigarette of embodiment 384, wherein the operating temperature is from 180 °C to 220 °C.

395. The electronic cigarette of embodiment 384, wherein the operating temperature is about 200 °C.

396. The electronic cigarette of any one of embodiments 381-394, wherein the aerosol comprises condensate of the nicotine salt.

397. The electronic cigarette of any one of embodiments 381-394, wherein the aerosol comprises condensate of freebase nicotine.

398. The electronic cigarette of any one of embodiments 381-394, wherein the aerosol comprises condensate of freebase nicotine and condensate of the carrier.

399. The electronic cigarette of any one of embodiments 381-394, wherein the aerosol comprises condensate of freebase nicotine and condensate of the acid.

400. The electronic cigarette of any one of embodiments 381-398, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 5 microns.

401. The electronic cigarette of any one of embodiments 381-398, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 1 or 2 microns.

402. The electronic cigarette of any one of embodiments 381-398, wherein the aerosol comprises condensate in particle sizes from about 0.1 microns to about 0.7 microns.

403. The electronic cigarette of any one of embodiments 381-398, wherein the aerosol comprises condensate in particle sizes from about 0.3 microns to about 0.4 microns.

404. The electronic cigarette of any one of embodiments 381-402, wherein the acid is a carboxylic acid.

405. The electronic cigarette of any one of embodiments 381-402, wherein the acid used to form said nicotine salt is an organic acid.

406. The electronic cigarette of embodiment 404, wherein the organic acid is monocarboxylic acid, aromatic acid, or keto acid.

407. The electronic cigarette of embodiment 404, wherein the organic acid is formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, caprylic acid, capric acid, citric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, phenylacetic acid, benzoic acid, pyruvic acid, levulinic acid, tartaric acid, lactic acid, malonic acid, succinic acid, fumaric acid, finnaric acid, gluconic acid, saccharic acid, salicylic acid, sorbic acid, malonic acid, or malic acid.

408. The electronic cigarette of any one of embodiments 381-402, wherein the acid used to form the nicotine salt is salicylic acid.

409. The electronic cigarette of any one of embodiments 381-402, wherein the acid used to form the nicotine salt is benzoic acid.

410. The electronic cigarette of any one of embodiments 381-402, wherein the acid used to form the nicotine salt is pyruvic acid.

411. The electronic cigarette of any one of embodiments 381-402, wherein the acid used to form the nicotine salt is sorbic acid.

412. The electronic cigarette of any one of embodiments 381-402, wherein the acid used to form the nicotine salt is lauric acid.

413. The electronic cigarette of any one of embodiments 381-402, wherein the acid used to form the nicotine salt is levulinic acid.

414. The electronic cigarette of any one of embodiments 381-402, wherein said nicotine salt comprises nicotine pyruvate.

415. The electronic cigarette of any one of embodiments 381-402, wherein said nicotine salt comprises nicotine salicylate.

416. The electronic cigarette of any one of embodiments 381-402, wherein said nicotine salt comprises nicotine sorbate.

417. The electronic cigarette of any one of embodiments 381-402, wherein said nicotine salt comprises nicotine laurate.

418. The electronic cigarette of any one of embodiments 381-402, wherein said nicotine salt comprises nicotine levulinate.

419. The electronic cigarette of any one of embodiments 381-402, wherein said nicotine salt comprises nicotine benzoate.

420. The electronic cigarette of any one of embodiments 381-419, wherein the liquid carrier comprises glycerol, propylene glycol, trimethylene glycol, water, ethanol or combinations thereof.

421. The electronic cigarette of any one of embodiments 381-419, wherein the liquid carrier comprises propylene glycol and vegetable glycerin.

422. The electronic cigarette of any one of embodiments 381-419, wherein the liquid carrier comprises 20% to 50% of propylene glycol and 80% to 50% of vegetable glycerin.

423. The electronic cigarette of any one of embodiments 381-419, wherein the liquid carrier comprises 30% propylene glycol and 70% vegetable glycerin.

424. The electronic cigarette of any one of embodiments 381-422, wherein the nicotine salt is in an amount that forms about 0.5% to about 20% nicotine in the inhalable aerosol.

425. The electronic cigarette of any one of embodiments 381-422, wherein the nicotine salt is in an amount that forms about 1% to about 20% nicotine in the inhalable aerosol.

426. The electronic cigarette of any one of embodiments 381-424, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 25% (w/w).

427. The electronic cigarette of any one of embodiments 381-424, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 20% (w/w).

428. The electronic cigarette of any one of embodiments 381-424, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 18% (w/w).

429. The electronic cigarette of any one of embodiments 381-424, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 15% (w/w).

430. The electronic cigarette of any one of embodiments 381-424, wherein the liquid formulation has a nicotine concentration of about 4% (w/w) to about 12% (w/w).

431. The electronic cigarette of any one of embodiments 381-424, wherein the liquid formulation has a nicotine concentration of about 4% (w/w).

432. The electronic cigarette of any one of embodiments 381-424, wherein the liquid formulation has a nicotine concentration of about 2% (w/w).

433. The electronic cigarette of any one of embodiments 381-431, wherein the formulation further comprises a flavorant.

434. The electronic cigarette of any one of embodiments 381-432, wherein the formulation is non-corrosive to an electronic cigarette.

435. The electronic cigarette of any one of embodiments 381-433, wherein the acid is stable at and below operating temperature or about 200 °C.

436. The electronic cigarette of any one of embodiments 381-434, wherein the acid does not decompose at and below operating temperature or about 200 °C.

437. The electronic cigarette of any one of embodiments 381-435, wherein the acid does not oxidize at and below operating temperature or about 200 °C.

438. The electronic cigarette of any one of embodiments 381-436, wherein the formulation is non-corrosive to the electronic cigarette.

439. The electronic cigarette of any one of embodiments 381-437, wherein the formulation is non-toxic to a user of the electronic cigarette.

440. The electronic cigarette of any one of embodiments 381-438, wherein the formulation further comprises one or more additional nicotine salts in a biologically acceptable liquid carrier suitable for generating the inhalable aerosol upon heating.

441. The electronic cigarette of embodiment 439, wherein a second acid used to form the additional nicotine salt is selected from the group consisting of salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid.

442. A cartridge in an electronic cigarette comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200 °C.

443. A cartridge in an electronic cigarette comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a

nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200 °C.

444. A cartridge in an electronic cigarette comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point <160 °C, a boiling point >160 °C, and at least a 50-degree difference between the melting point and the boiling point.

445. A cartridge in an electronic cigarette comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point.

446. The cartridge of any one of embodiments 441-444, wherein the cartridge is separable from the electronic cigarette.

447. The cartridge of any one of embodiments 441-445, wherein the acid is a carboxylic acid.

448. The cartridge of any one of embodiments 441-445, wherein the acid used to form said nicotine salt is an organic acid.

449. The cartridge of embodiment 447, wherein the organic acid is monocarboxylic acid, aromatic acid, or keto acid.

450. The cartridge of embodiment 447, wherein the organic acid is formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, caprylic acid, capric acid, citric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, phenylacetic acid, benzoic acid, pyruvic acid, levulinic acid, tartaric acid, lactic acid, malonic acid, succinic acid, fumaric acid, finnaric acid, gluconic acid, saccharic acid, salicylic acid, sorbic acid, malonic acid, or malic acid.

451. The cartridge of any one of embodiments 441-445, wherein the acid used to form the nicotine salt is salicylic acid.

452. The cartridge of any one of embodiments 441-445, wherein the acid used to form the nicotine salt is benzoic acid.

453. The cartridge of any one of embodiments 441-445, wherein the acid used to form the nicotine salt is pyruvic acid.

454. The cartridge of any one of embodiments 441-445, wherein the acid used to form the nicotine salt is sorbic acid.

455. The cartridge of any one of embodiments 441-445, wherein the acid used to form the nicotine salt is lauric acid.

456. The cartridge of any one of embodiments 441-445, wherein the acid used to form the nicotine salt is levulinic acid.

457. The cartridge of any one of embodiments 441-445, wherein said nicotine salt comprises nicotine pyruvate.

458. The cartridge of any one of embodiments 441-445, wherein said nicotine salt comprises nicotine salicylate.

459. The cartridge of any one of embodiments 441-445, wherein said nicotine salt comprises nicotine sorbate.

460. The cartridge of any one of embodiments 441-445, wherein said nicotine salt comprises nicotine laurate.

461. The cartridge of any one of embodiments 441-445, wherein said nicotine salt comprises nicotine levulinate.

462. The cartridge of any one of embodiments 441-445, wherein said nicotine salt comprises nicotine benzoate.

463. The cartridge of any one of embodiments 441-461, wherein the liquid carrier comprises glycerol, propylene glycol, trimethylene glycol, water, ethanol or combinations thereof.

464. The cartridge of any one of embodiments 441-461, wherein the liquid carrier comprises propylene glycol and vegetable glycerin.

465. The cartridge of any one of embodiments 441-461, wherein the liquid carrier comprises 20% to 50% of propylene glycol and 80% to 50% of vegetable glycerin.

466. The cartridge of any one of embodiments 441-461, wherein the liquid carrier comprises 30% propylene glycol and 70% vegetable glycerin.

467. The cartridge of any one of embodiments 441-465, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 25% (w/w).

468. The cartridge of any one of embodiments 441-465, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 20% (w/w).

469. The cartridge of any one of embodiments 441-465, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 18% (w/w).

470. The cartridge of any one of embodiments 441-465, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 15% (w/w).

471. The cartridge of any one of embodiments 441-465, wherein the liquid formulation has a nicotine concentration of about 4% (w/w) to about 12% (w/w).

472. The cartridge of any one of embodiments 441-465, wherein the liquid formulation has a nicotine concentration of about 4% (w/w).

473. The cartridge of any one of embodiments 441-465, wherein the liquid formulation has a nicotine concentration of about 2% (w/w).

474. The cartridge of any one of embodiments 441-472, wherein the formulation further comprises a flavorant.

475. The cartridge of any one of embodiments 441-473, wherein the formulation is non-corrosive to an electronic cigarette.

476. The cartridge of any one of embodiments 441-474, wherein the acid is stable at and below operating temperature or about 200 °C.

477. The cartridge of any one of embodiments 441-475, wherein the acid does not decompose at and below operating temperature or about 200 °C.

478. The cartridge of any one of embodiments 441-476, wherein the acid does not oxidize at and below operating temperature or about 200 °C.

479. The cartridge of any one of embodiments 441-477, wherein the formulation is non-corrosive to the electronic cigarette.

480. The cartridge of any one of embodiments 441-478, wherein the formulation is non-toxic to a user of the electronic cigarette.

481. The cartridge of any one of embodiments 441-479, wherein the formulation further comprises one or more additional nicotine salts in a biologically acceptable liquid carrier suitable for generating the inhalable aerosol upon heating.

482. The cartridge of embodiment 480, wherein a second acid used to form the additional nicotine salt is selected from the group consisting of salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid.

483. A kit comprising:

- (a) an electronic cigarette for generating an inhalable aerosol comprising
 - i. a device body comprising a cartridge receptacle;
 - ii. a cartridge comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200°C ;
 - iii. a heater;
 - iv. a battery; and
 - v. a mouthpiece; and
- (b) instructions for using the electronic cigarette to generate an inhalable aerosol.

484. A kit comprising:

- (a) an electronic cigarette for generating an inhalable aerosol comprising
 - i. a device body comprising a cartridge receptacle;
 - ii. a cartridge comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200°C ;
 - iii. a heater;
 - iv. a battery; and
 - v. a mouthpiece; and
- (b) instructions for using the electronic cigarette to generate an inhalable aerosol.

485. A kit comprising:

- (a) an electronic cigarette for generating an inhalable aerosol comprising
 - i. a device body comprising a cartridge receptacle;
 - ii. a cartridge comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is

further characterized by a melting point $<160^{\circ}\text{C}$, a boiling point $>160^{\circ}\text{C}$, and at least a 50-degree difference between the melting point and the boiling point;

iii. a heater;

iv. a battery; and

v. a mouthpiece; and

(b) instructions for using the electronic cigarette to generate an inhalable aerosol.

486. A kit comprising:

(a) an electronic cigarette for generating an inhalable aerosol comprising

i. a device body comprising a cartridge receptacle;

ii. a cartridge comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point;

iii. a heater;

iv. a battery; and

v. a mouthpiece; and

(b) instructions for using the electronic cigarette to generate an inhalable aerosol.

487. The kit of any one of embodiments 482-485, wherein the acid is a carboxylic acid.

488. The kit of any one of embodiments 482-485, wherein the acid used to form said nicotine salt is an organic acid.

489. The kit of embodiment 487, wherein the organic acid is monocarboxylic acid, aromatic acid, or keto acid.

490. The kit of embodiment 487, wherein the organic acid is formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, caprylic acid, capric acid, citric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, phenylacetic acid, benzoic acid, pyruvic acid, levulinic acid, tartaric acid, lactic acid, malonic acid, succinic acid, fumaric acid, fennaric acid, gluconic acid, saccharic acid, salicylic acid, sorbic acid, malonic acid, or malic acid.

491. The kit of any one of embodiments 482-485, wherein the acid used to form the nicotine salt is salicylic acid.

492. The kit of any one of embodiments 482-485, wherein the acid used to form the nicotine salt is benzoic acid.

493. The kit of any one of embodiments 482-485, wherein the acid used to form the nicotine salt is pyruvic acid.

494. The kit of any one of embodiments 482-485, wherein the acid used to form the nicotine salt is sorbic acid.

495. The kit of any one of embodiments 482-485, wherein the acid used to form the nicotine salt is lauric acid.

496. The kit of any one of embodiments 482-485, wherein the acid used to form the nicotine salt is levulinic acid.

497. The kit of any one of embodiments 482-485, wherein said nicotine salt comprises nicotine pyruvate.

498. The kit of any one of embodiments 482-485, wherein said nicotine salt comprises nicotine salicylate.

499. The kit of any one of embodiments 482-485, wherein said nicotine salt comprises nicotine sorbate.

500. The kit of any one of embodiments 482-485, wherein said nicotine salt comprises nicotine laurate.

501. The kit of any one of embodiments 482-485, wherein said nicotine salt comprises nicotine levulinate.

502. The kit of any one of embodiments 482-485, wherein said nicotine salt comprises nicotine benzoate.

503. The kit of any one of embodiments 482-501, wherein the liquid carrier comprises glycerol, propylene glycol, trimethylene glycol, water, ethanol or combinations thereof.

504. The kit of any one of embodiments 482-501, wherein the liquid carrier comprises propylene glycol and vegetable glycerin.

505. The kit of any one of embodiments 482-501, wherein the liquid carrier comprises 20% to 50% of propylene glycol and 80% to 50% of vegetable glycerin.

506. The kit of any one of embodiments 482-501, wherein the liquid carrier comprises 30% propylene glycol and 70% vegetable glycerin.

507. The kit of any one of embodiments 482-505, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 25% (w/w).

508. The kit of any one of embodiments 482-505, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 20% (w/w).

509. The kit of any one of embodiments 482-505, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 18% (w/w).

510. The kit of any one of embodiments 482-505, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 15% (w/w).

511. The kit of any one of embodiments 482-505, wherein the liquid formulation has a nicotine concentration of about 4% (w/w) to about 12% (w/w).

512. The kit of any one of embodiments 482-505, wherein the liquid formulation has a nicotine concentration of about 4% (w/w).

513. The kit of any one of embodiments 482-505, wherein the liquid formulation has a nicotine concentration of about 2% (w/w).

514. The kit of any one of embodiments 482-512, wherein the formulation further comprises a flavorant.

515. The kit of any one of embodiments 482-513, wherein the formulation is non-corrosive to an electronic cigarette.

516. The kit of any one of embodiments 482-514, wherein the acid is stable at and below operating temperature or about 200 °C.

517. The kit of any one of embodiments 482-515, wherein the acid does not decompose at and below operating temperature or about 200 °C.

518. The kit of any one of embodiments 482-516, wherein the acid does not oxidize at and below operating temperature or about 200 °C.

519. The kit of any one of embodiments 482-517, wherein the formulation is non-corrosive to the electronic cigarette.

520. The kit of any one of embodiments 482-518, wherein the formulation is non-toxic to a user of the electronic cigarette.

521. The kit of any one of embodiments 482-519, wherein the formulation further comprises one or more additional nicotine salts in a biologically acceptable liquid carrier suitable for generating the inhalable aerosol upon heating.

522. The kit of embodiment 520, wherein a second acid used to form the additional nicotine salt is selected from the group consisting of salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid.

523. A cartridge comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure >20 mmHg at 200°C .

524. A cartridge comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is characterized by vapor pressure of about 20 to 200 mmHg at 200°C .

525. A cartridge comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point $<160^{\circ}\text{C}$, a boiling point $>160^{\circ}\text{C}$, and at least a 50-degree difference between the melting point and the boiling point.

526. A cartridge comprising a fluid storage compartment, wherein the fluid storage compartment stores a nicotine salt liquid formulation comprising a nicotine salt in a biologically acceptable liquid carrier wherein an acid used to form said nicotine salt is further characterized by a melting point at least 40 degrees lower than an operating temperature of the electronic cigarette, a boiling point no more than 40 degrees lower than the operating temperature of the electronic cigarette, and at least a 50-degree difference between the melting point and the boiling point.

527. The cartridge of any one of embodiments 523-526, wherein the cartridge can be connected to an electronic cigarette.

528. The cartridge of any one of embodiments 523-527, wherein the acid is a carboxylic acid.

529. The cartridge of any one of embodiments 523-527, wherein the acid used to form said nicotine salt is an organic acid.

530. The cartridge of embodiment 529, wherein the organic acid is monocarboxylic acid, aromatic acid, or keto acid.

531. The cartridge of embodiment 529, wherein the organic acid is formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, caprylic acid, capric acid, citric acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, phenylacetic acid, benzoic acid, pyruvic acid, levulinic acid, tartaric acid, lactic acid, malonic acid, succinic acid, fumaric acid, finnaric acid, gluconic acid, saccharic acid, salicylic acid, sorbic acid, malonic acid, or malic acid.

532. The cartridge of any one of embodiments 523-527, wherein the acid used to form the nicotine salt is salicylic acid.

533. The cartridge of any one of embodiments 523-527, wherein the acid used to form the nicotine salt is benzoic acid.

534. The cartridge of any one of embodiments 523-527, wherein the acid used to form the nicotine salt is pyruvic acid.

535. The cartridge of any one of embodiments 523-527, wherein the acid used to form the nicotine salt is sorbic acid.

536. The cartridge of any one of embodiments 523-527, wherein the acid used to form the nicotine salt is lauric acid.

537. The cartridge of any one of embodiments 523-527, wherein the acid used to form the nicotine salt is levulinic acid.

538. The cartridge of any one of embodiments 523-527, wherein said nicotine salt comprises nicotine pyruvate.

539. The cartridge of any one of embodiments 523-527, wherein said nicotine salt comprises nicotine salicylate.

540. The cartridge of any one of embodiments 523-527, wherein said nicotine salt comprises nicotine sorbate.

541. The cartridge of any one of embodiments 523-527, wherein said nicotine salt comprises nicotine laurate.

542. The cartridge of any one of embodiments 523-527, wherein said nicotine salt comprises nicotine levulinate.

543. The cartridge of any one of embodiments 523-527, wherein said nicotine salt comprises nicotine benzoate.

544. The cartridge of any one of embodiments 523-543, wherein the liquid carrier comprises glycerol, propylene glycol, trimethylene glycol, water, ethanol or combinations thereof.

545. The cartridge of any one of embodiments 523-543, wherein the liquid carrier comprises propylene glycol and vegetable glycerin.

546. The cartridge of any one of embodiments 523-543, wherein the liquid carrier comprises 20% to 50% of propylene glycol and 80% to 50% of vegetable glycerin.

547. The cartridge of any one of embodiments 523-543, wherein the liquid carrier comprises 30% propylene glycol and 70% vegetable glycerin.

548. The cartridge of any one of embodiments 523-547, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 25% (w/w).

549. The cartridge of any one of embodiments 523-547, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 20% (w/w).

550. The cartridge of any one of embodiments 523-547, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 18% (w/w).

551. The cartridge of any one of embodiments 523-547, wherein the liquid formulation has a nicotine concentration of about 1% (w/w) to about 15% (w/w).

552. The cartridge of any one of embodiments 523-547, wherein the liquid formulation has a nicotine concentration of about 4% (w/w) to about 12% (w/w).

553. The cartridge of any one of embodiments 523-547, wherein the liquid formulation has a nicotine concentration of about 4% (w/w).

554. The cartridge of any one of embodiments 523-547, wherein the liquid formulation has a nicotine concentration of about 2% (w/w).

555. The cartridge of any one of embodiments 523-553, wherein the formulation further comprises a flavorant.

556. The cartridge of any one of embodiments 523-554, wherein the formulation is non-corrosive to an electronic cigarette.

557. The cartridge of any one of embodiments 523-555, wherein the acid is stable at and below operating temperature or about 200 °C.

558. The cartridge of any one of embodiments 523-556, wherein the acid does not decompose at and below operating temperature or about 200 °C.

559. The cartridge of any one of embodiments 523-557, wherein the acid does not oxidize at and below operating temperature or about 200 °C.

560. The cartridge of any one of embodiments 523-558, wherein the formulation is non-corrosive to the electronic cigarette.

561. The cartridge of any one of embodiments 523-559, wherein the formulation is non-toxic to a user of the electronic cigarette.

562. The cartridge of any one of embodiments 523-560, wherein the formulation further comprises one or more additional nicotine salts in a biologically acceptable liquid carrier suitable for generating the inhalable aerosol upon heating.

563. The cartridge of embodiment 561, wherein a second acid used to form the additional nicotine salt is selected from the group consisting of salicylic acid, sorbic acid, benzoic acid, pyruvic acid, lauric acid, and levulinic acid.

[00131] Although preferred embodiments of the present invention have been shown and described herein, it will be obvious to those skilled in the art that such embodiments are provided by way of example only. Numerous variations, changes, and substitutions will now occur to those skilled in the art without departing from the invention. It should be understood that various alternatives to the embodiments of the invention described herein can be employed in practicing the invention. It is intended that the following embodiments define the scope of the invention and that methods and structures within the scope of these embodiments and their equivalents be covered thereby.

CLAIMS

What is claimed is:

1. A method of delivering nicotine to a user comprising:
deploying an electronic cigarette comprising a nicotine formulation that comprises nicotine, an organic acid, and a biologically acceptable liquid carrier, wherein:
 - a. the nicotine concentration is from about 0.5% (w/w) to about 20% (w/w);
 - b. the nicotine formulation comprises nicotine lactate;
 - c. the biologically acceptable liquid carrier comprises propylene glycol and glycerol;
and
 - d. operation of the electronic cigarette comprises heating at least a portion of the nicotine formulation to generate an inhalable aerosol.
2. The method of claim 1, wherein a molar ratio of nicotine to organic acid is between about 1:1 and 1:3.
3. The method of claim 1, wherein the nicotine formulation further comprises at least one flavorant.
4. The method of claim 1, wherein the nicotine concentration is about 4.5%.
5. The method of claim 1, wherein inhalation of the aerosol into the user's lungs over a period of about 5 minutes at a rate of about one inhalation per 30 seconds results in a nicotine plasma Tmax from about 3 min to about 8 min.
6. The method of claim 1, wherein the inhalable aerosol has a particle size from about 0.1 microns to about 5 microns.
7. A method of delivering nicotine to a user comprising:
deploying an electronic cigarette comprising a nicotine formulation that comprises nicotine, a carboxylic acid, wherein the carboxylic acid comprises lactic acid, and a biologically acceptable liquid carrier, wherein:
 - a. the nicotine concentration is from about 0.5% (w/w) to about 20% (w/w);
 - b. the nicotine formulation comprises protonated nicotine;

- c. the biologically acceptable liquid carrier comprises propylene glycol and glycerol;
 - d. the acid does not decompose at room temperature and does not decompose at the operating temperature of the electronic cigarette; and
 - e. operation of the electronic cigarette comprises heating at least a portion of the nicotine formulation to generate an inhalable aerosol.
8. The method of claim 7, wherein a molar ratio of nicotine to organic acid is between 1:1 and 1:3.
9. The method of claim 7, wherein the nicotine formulation further comprises at least one flavorant.
10. The method of claim 7, wherein the nicotine concentration is about 4.5%.
11. The method of claim 7, wherein inhalation of the aerosol into the user's lungs over a period of about 5 minutes at a rate of about one inhalation per 30 seconds results in a nicotine plasma Tmax from about 3 min to about 8 min.
12. The method of claim 7, wherein the inhalable aerosol has a particle size from about 0.1 microns to about 5 microns.
13. An electronic cigarette, comprising:
a liquid reservoir;
a nicotine formulation within the liquid reservoir, the nicotine formulation comprising:
nicotine lactate;
propylene glycol; and
glycerol;
wherein a concentration of nicotine in the nicotine formulation is from about 0.5% (w/w) to about 20% (w/w);
a vaporizing component configured to produce an aerosol from the nicotine formulation;
and
a mouthpiece configured to connect to the reservoir for inhalation of the aerosol.

14. The electronic cigarette of claim 13, further comprises a battery configured to provide power to the vaporizing component.
15. The electronic cigarette of claim 13, wherein a molar ratio of nicotine to organic acid is between 1:1 and 1:3.
16. The electronic cigarette of claim 13, wherein the nicotine formulation further comprises at least one flavorant.
17. The electronic cigarette of claim 13, wherein the vaporizing component comprises a heating element in fluid communication with the nicotine formulation.
18. The electronic cigarette of claim 13, wherein the nicotine concentration is about 4.5%.
19. The electronic cigarette of claim 13, wherein inhalation of the aerosol into the user's lungs over a period of about 5 minutes at a rate of about one inhalation per 30 seconds results in a nicotine plasma Tmax from about 3 min to about 8 min.
20. The electronic cigarette of claim 13, wherein the inhalable aerosol has a particle size from about 0.1 microns to about 5 microns.

ABSTRACT

A nicotine salt liquid formulation for generating an inhalable aerosol in an electronic cigarette comprising nicotine salt that forms about 0.5% to about 20% nicotine is provided.

FIG. 1

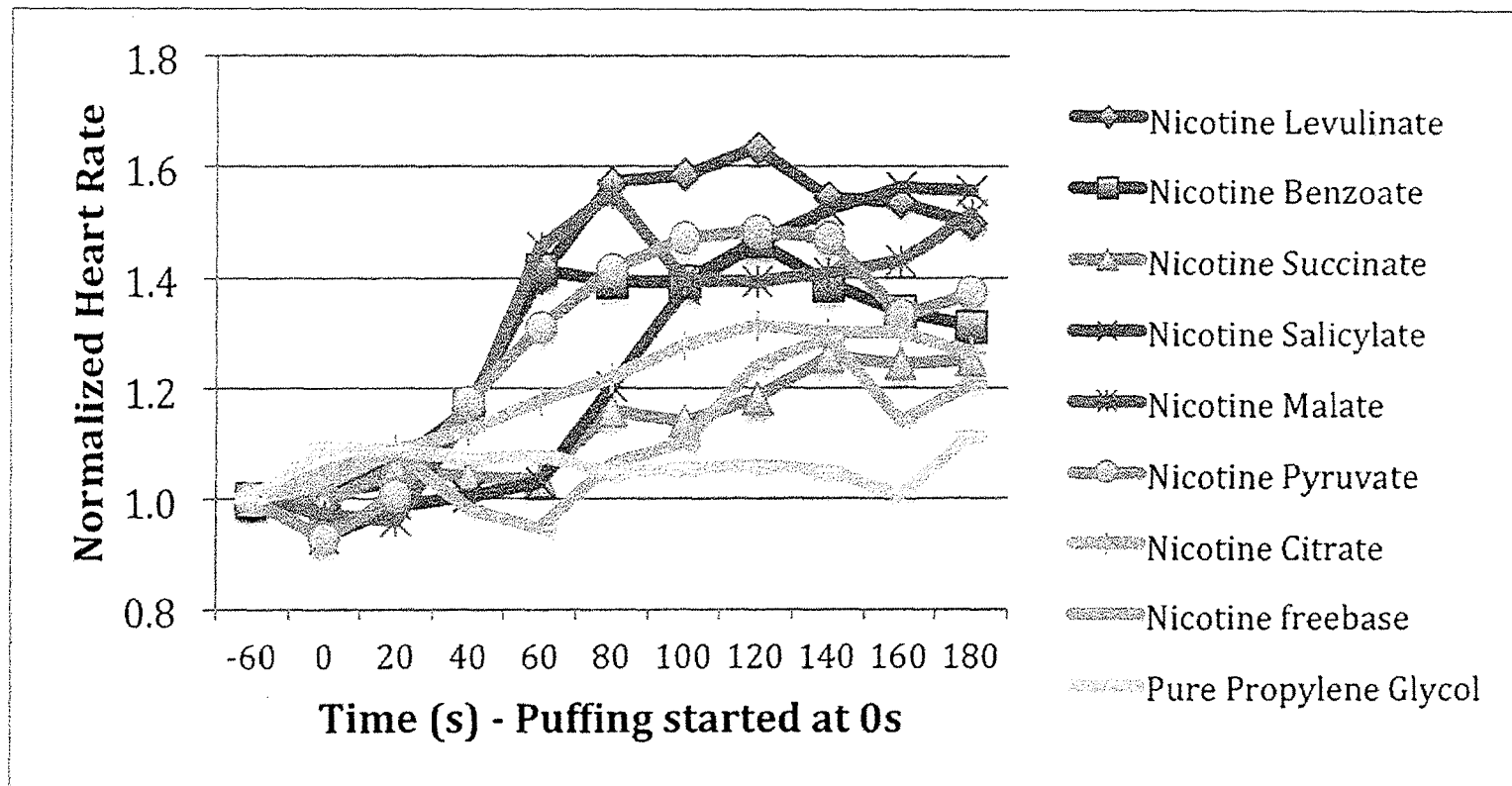


FIG. 2

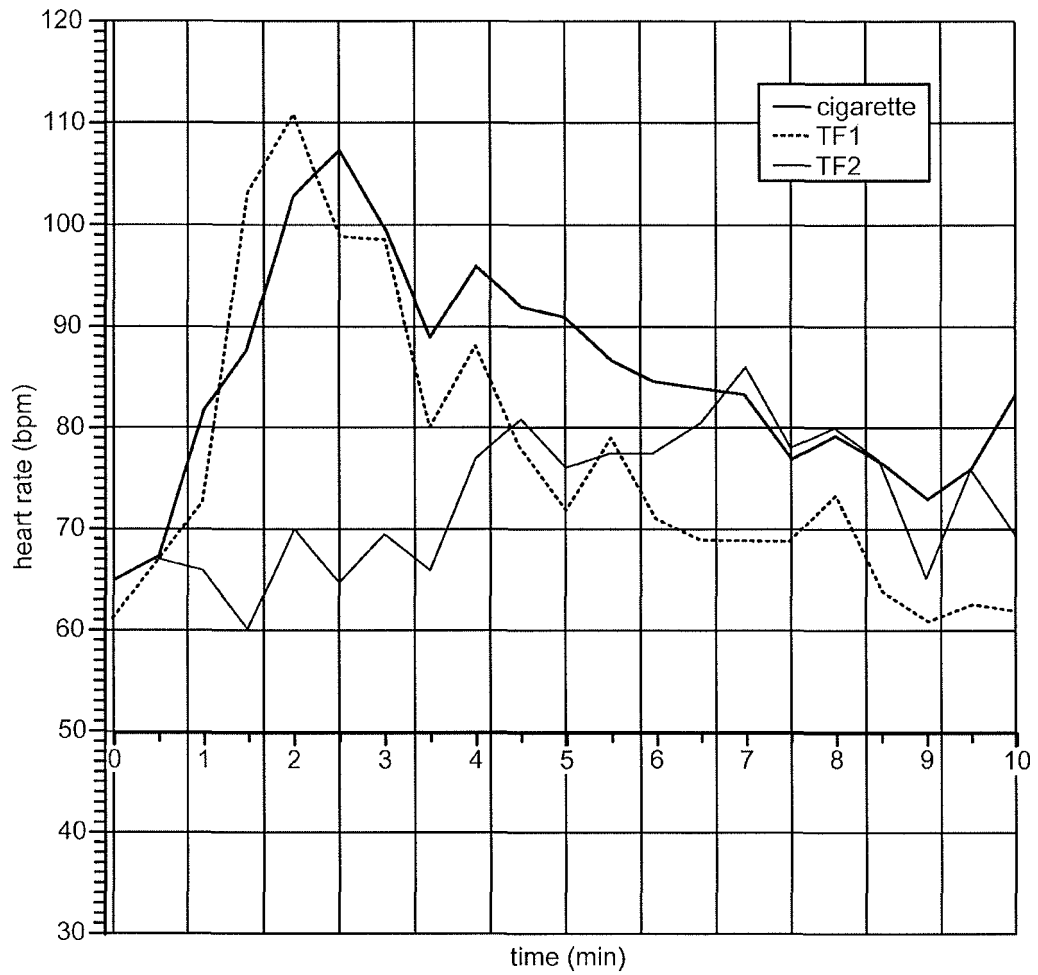


FIG. 3

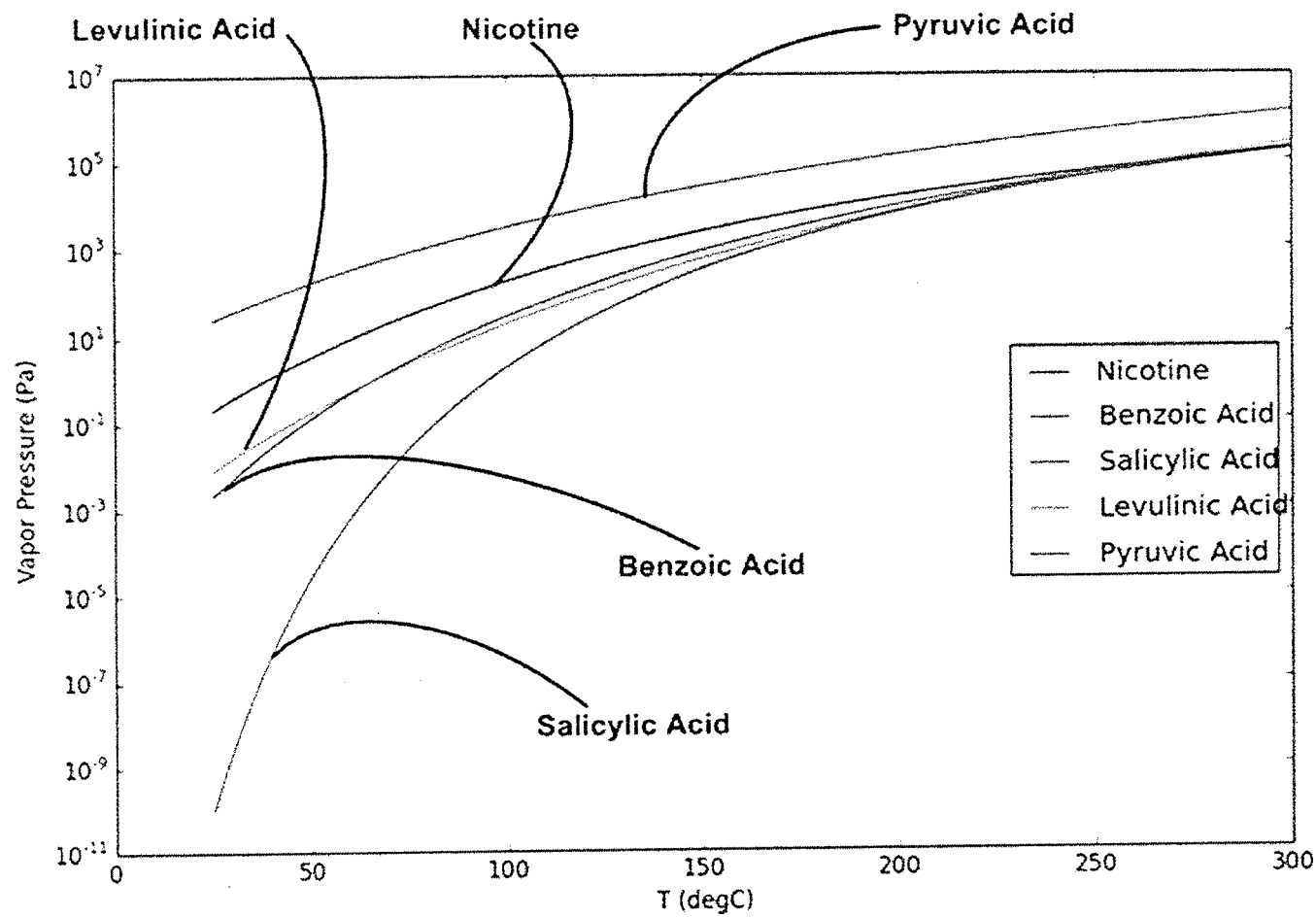


FIG. 4

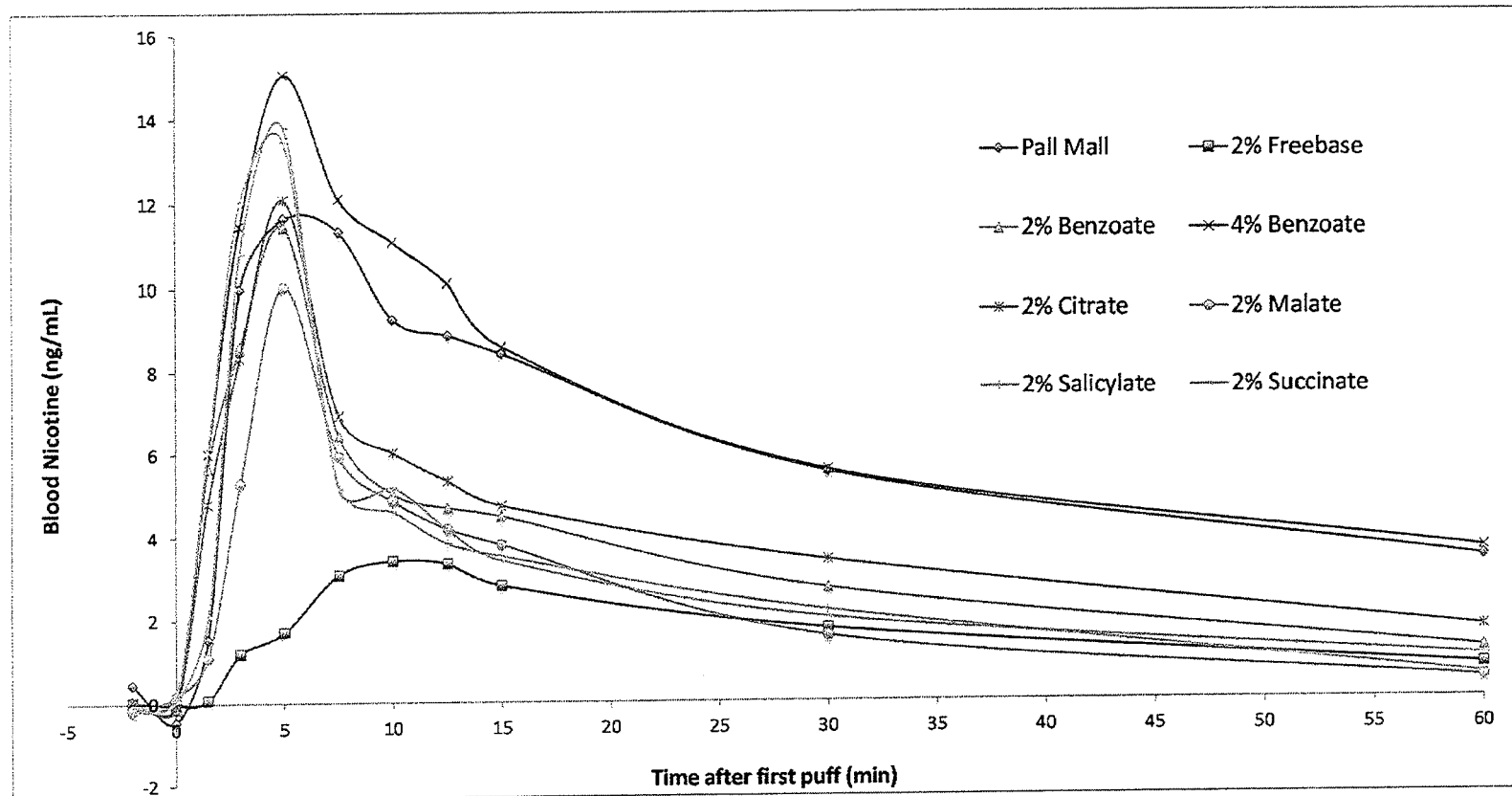


FIG. 5

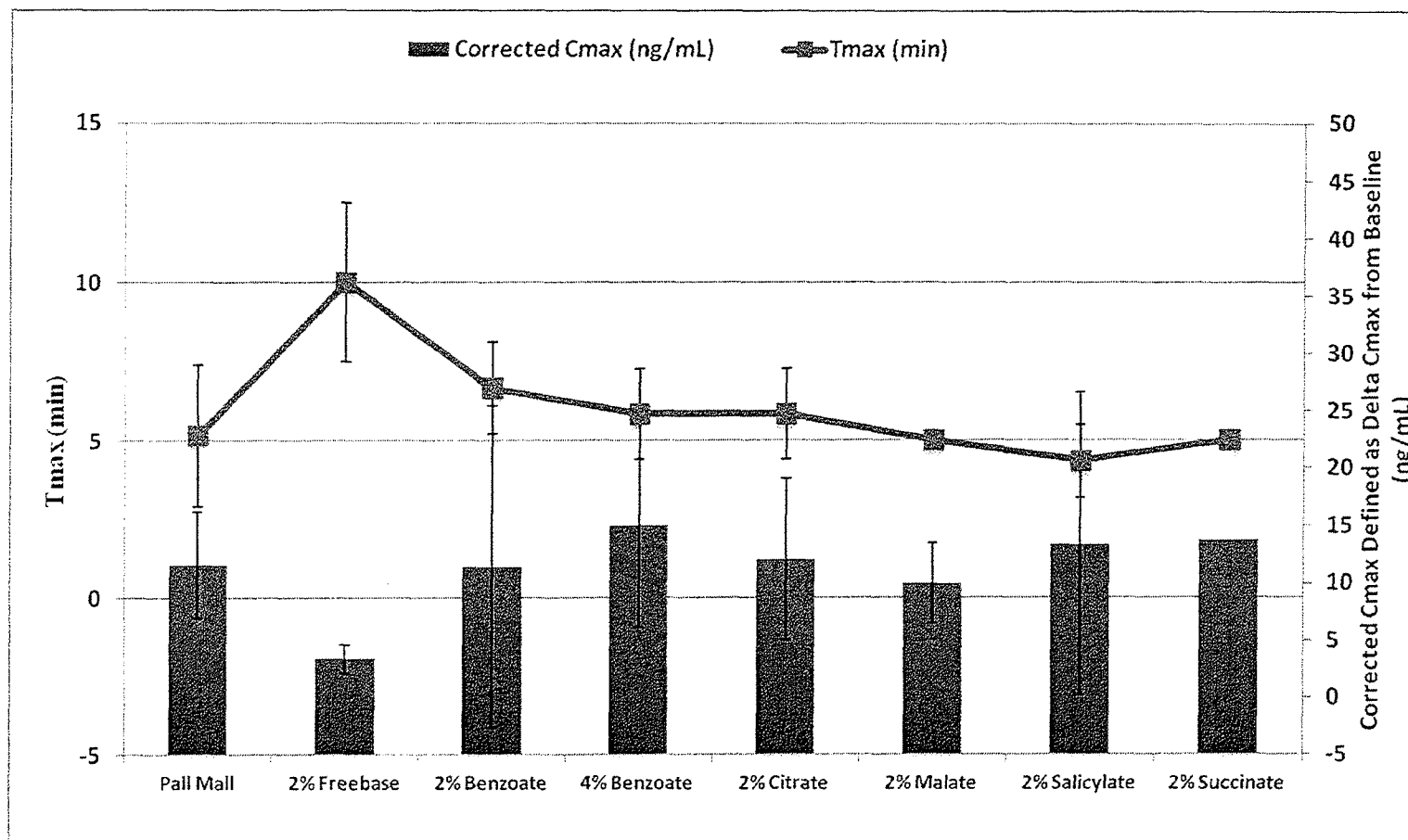


FIG. 6

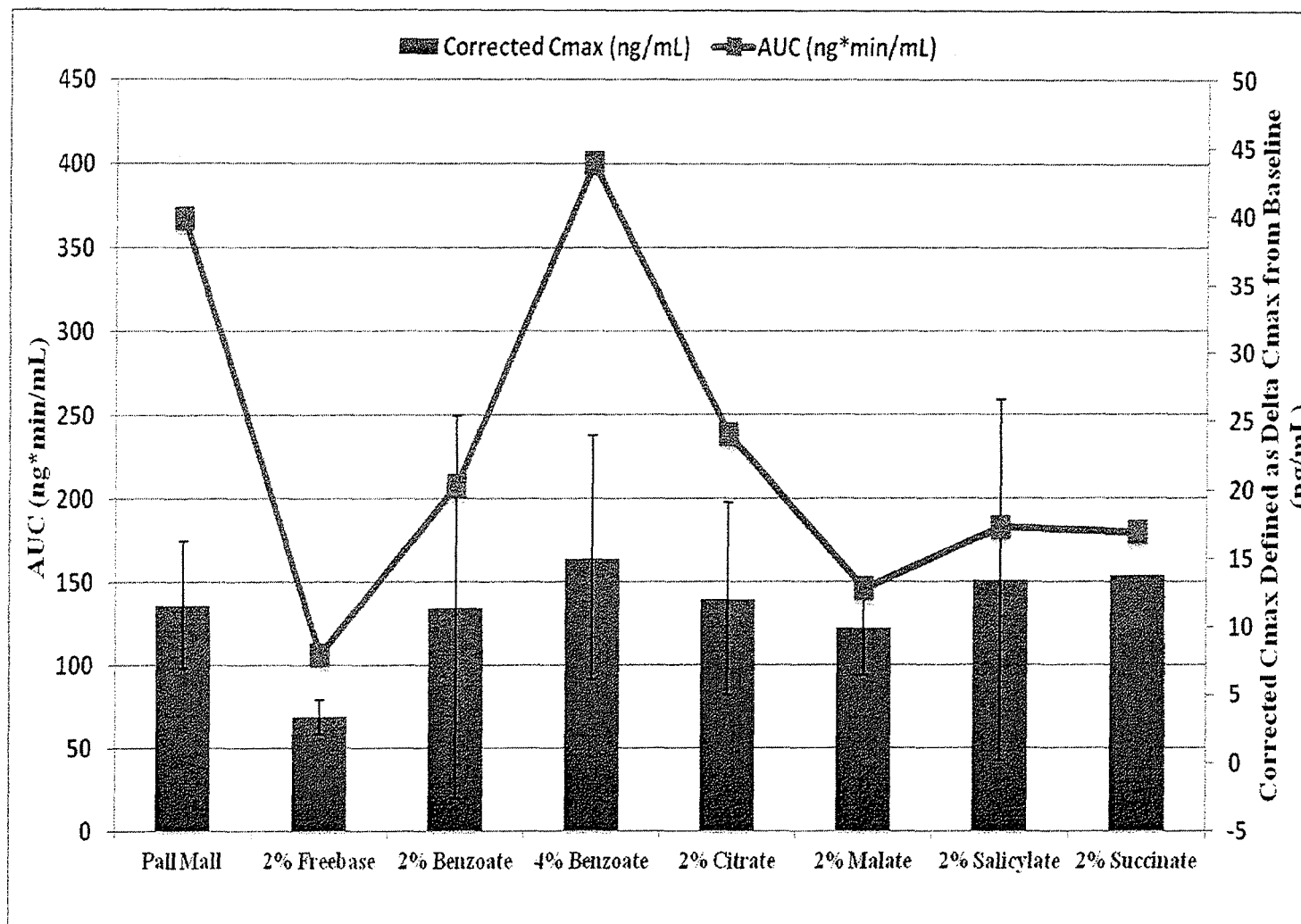


FIG. 7

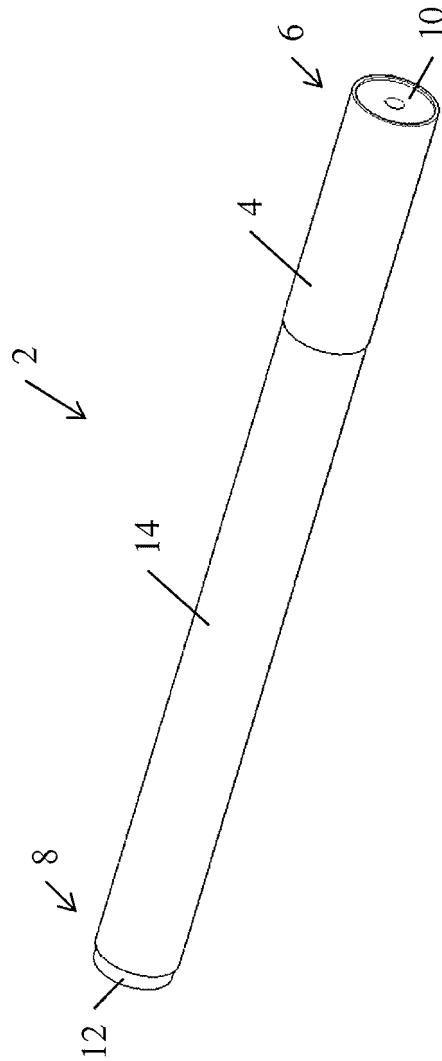
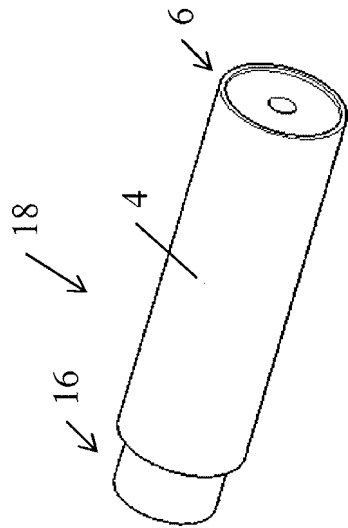


FIG. 8



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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	13211-713.303
		Application Number	
Title of Invention	NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF		
<p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.</p> <p>This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p>			

Secrecy Order 37 CFR 5.2

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
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	Adam		BOWEN			
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☐ An Address is being provided for the correspondence information of this application.

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Title of the Invention	NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF		
Attorney Docket Number	13211-713.303	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	8	Suggested Figure for Publication (if any)	

Filing By Reference :

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

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☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not be** the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	13211-713.303
		Application Number	
Title of Invention	NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF		

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This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the application number blank.

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	14512311	2014-10-10
Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
14512311	Continuation of	14271071	2014-05-06
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
14271071	Claims benefit of provisional	61820128	2013-05-06
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
14271071	Claims benefit of provisional	61912507	2013-12-05
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button. Add			

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Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ^j (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button. Add			

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	13211-713.303
		Application Number	
Title of Invention	NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF		

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

<p>This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.</p> <p>☐ NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.</p>
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Authorization to Permit Access:

<p>☐ Authorization to Permit Access to the Instant Application by the Participating Offices</p> <p>If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.</p> <p>In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.</p> <p>In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.</p>

Applicant Information:

<p>Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.</p>
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	13211-713.303
		Application Number	
Title of Invention	NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF		

Applicant 1	Remove
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Email Address				
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	13211-713.303
		Application Number	
Title of Invention	NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF		

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Address 2			
City		State/Province	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Signature:

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications					
Signature	/Richard D. Shoop/			Date (YYYY-MM-DD)	2015-10-28
First Name	Richard D.	Last Name	Shoop	Registration Number	45763
Additional Signature may be generated within this form by selecting the Add button.					<input type="button" value="Add"/>

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF		
First Named Inventor/Applicant Name:		Adam BOWEN		
Filer:		Richard Douglas Shoop/Jennifer Capizzi		
Attorney Docket Number:		13211-713.303		
Filed as Large Entity				
Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility application filing	1011	1	280	280
Utility Search Fee	1111	1	600	600
Utility Examination Fee	1311	1	720	720
Request for Prioritized Examination	1817	1	4000	4000
Pages:				
Claims:				
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Publ. Fee- Early, Voluntary, or Normal	1504	1	0	0
PROCESSING FEE, EXCEPT PROV. APPLS.	1830	1	140	140
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				5740

Electronic Acknowledgement Receipt

EFS ID:	23924095
Application Number:	14925968
International Application Number:	
Confirmation Number:	2707
Title of Invention:	NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF
First Named Inventor/Applicant Name:	Adam BOWEN
Customer Number:	66854
Filer:	Richard Douglas Shoop/Jennifer Capizzi
Filer Authorized By:	Richard Douglas Shoop
Attorney Docket Number:	13211-713.303
Receipt Date:	28-OCT-2015
Filing Date:	
Time Stamp:	23:21:34
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 5740
RAM confirmation Number	9477
Deposit Account	504050
Authorized User	SHOOP, RICHARD D

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		13211-713-303_Application.pdf	5727373	yes	106
			5b047150dc60f0088d9856d9c3ec17f2ccc779a2		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal of New Application		1	1	
	TrackOne Request		2	2	
	Fee Worksheet (SB06)		3	3	
	Oath or Declaration filed		4	5	
	Specification		6	94	
	Claims		95	97	
	Abstract		98	98	
	Drawings-only black and white line drawings		99	106	
Warnings:					
Information:					
2	Application Data Sheet	13211-713-303_ADS.pdf	1561216	no	7
			e2d175cd560f8aa1dc65469d028c2fd0de44a800		
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	40475	no	2
			9af2f419221b526f61615f13196ac5aad12a1cc7		
Warnings:					
Information:					
Total Files Size (in bytes):			7329064		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 14/925,968			
APPLICATION AS FILED - PART I									
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY			
FOR	NUMBER FILED	NUMBER EXTRA		RATE(\$)	FEE(\$)	RATE(\$)	FEE(\$)		
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A		N/A	280		
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A		N/A	600		
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A		N/A	720		
TOTAL CLAIMS (37 CFR 1.16(i))	20	minus 20 =	*			x 80 =	0.00		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 =	*			x 420 =	0.00		
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00		
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00		
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	1600		
APPLICATION AS AMENDED - PART II									
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)	RATE(\$)	ADDITIONAL FEE(\$)		
	Total (37 CFR 1.16(i))	*	Minus **	=	x =	x =	=		
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =	x =	=		
	Application Size Fee (37 CFR 1.16(s))								
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
				TOTAL ADD'L FEE		TOTAL ADD'L FEE			
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)	RATE(\$)	ADDITIONAL FEE(\$)		
	Total (37 CFR 1.16(i))	*	Minus **	=	x =	x =	=		
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =	x =	=		
	Application Size Fee (37 CFR 1.16(s))								
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
				TOTAL ADD'L FEE		TOTAL ADD'L FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.									



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
14/925,968	10/28/2015	1747	1600	13211-713.303	20	3

CONFIRMATION NO. 2707

FILING RECEIPT



0000000078566042

66854
SHAY GLENN LLP
2755 CAMPUS DRIVE
SUITE 210
SAN MATEO, CA 94403

Date Mailed: 11/12/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Adam BOWEN, San Francisco, CA;
Chenyue XING, San Francisco, CA;

Applicant(s)

Adam BOWEN, San Francisco, CA;
Chenyue XING, San Francisco, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 14/512,311 10/10/2014
which is a CON of 14/271,071 05/06/2014
which claims benefit of 61/820,128 05/06/2013
and claims benefit of 61/912,507 12/05/2013

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 11/09/2015

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/925,968**

Projected Publication Date: 02/18/2016

Non-Publication Request: No

Early Publication Request: No

Title

NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF

Preliminary Class

131

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

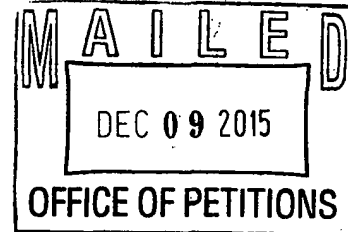
The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.



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SHAY GLENN LLP
2755 CAMPUS DRIVE
SUITE 210
SAN MATEO CA 94403



Doc Code: TRACK1.GRANT

Decision Granting Request for Prioritized Examination (Track I or After RCE)	Application No.: 14/925,968
<p>1. THE REQUEST FILED <u>10/28/15</u> IS GRANTED.</p> <p>The above-identified application has met the requirements for prioritized examination</p> <p>A. ☒ for an original nonprovisional application (Track I).</p> <p>B. ☐ for an application undergoing continued examination (RCE).</p> <p>2. The above-identified application will undergo prioritized examination. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:</p> <p>A. filing a <u>petition for extension of time</u> to extend the time period for filing a reply;</p> <p>B. filing an <u>amendment to amend the application to contain more than four independent claims, more than thirty total claims</u>, or a multiple dependent claim;</p> <p>C. filing a <u>request for continued examination</u>;</p> <p>D. filing a notice of appeal;</p> <p>E. filing a request for suspension of action;</p> <p>F. mailing of a notice of allowance;</p> <p>G. mailing of a final Office action;</p> <p>H. completion of examination as defined in 37 CFR 41.102; or</p> <p>I. abandonment of the application.</p> <p>Telephone inquiries with regard to this decision should be directed to Cheryl Gibson-Baylor at (571)272-3213, Office of Petitions. In his/her absence, calls may be directed to Brian W. Brown, (571)272-5338.</p> <p>Cheryl Gibson-Baylor <u>/Cheryl Gibson-Baylor/</u> [Signature]</p> <p><u>Petitions Paralegal Specialist</u> (Title)</p>	



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/925,968	10/28/2015	Adam BOWEN	13211-713.303	2707
66854	7590	12/16/2015		
SHAY GLENN LLP 2755 CAMPUS DRIVE SUITE 210 SAN MATEO, CA 94403			EXAMINER MAYES, DIONNE WALLS	
			ART UNIT	PAPER NUMBER
			1747	
			NOTIFICATION DATE	DELIVERY MODE
			12/16/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

info@shayglenn.com

Office Action Summary

Application No.
14/925,968

Applicant(s)
BOWEN ET AL.

Examiner
DIONNE WALLS MAYES

Art Unit
1747

AIA (First Inventor to File)
Status
Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 10/28/2015.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☒ Claim(s) 1-20 is/are pending in the application.
5a) Of the above claim(s) ____ is/are withdrawn from consideration.

6) ☐ Claim(s) ____ is/are allowed.

7) ☒ Claim(s) 1-20 is/are rejected.

8) ☐ Claim(s) ____ is/are objected to.

9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10) ☐ The specification is objected to by the Examiner.

11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some** c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. ____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date ____.

3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date ____.

4) ☐ Other: ____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Double Patenting

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of

activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit <http://www.uspto.gov/forms/>. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to <http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp>.

3. Claims 1-12 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-15 of Hon '895 (U.S. Patent No. 9,215,895) in view of Gonda (US. Pat. App. Pub. 2014/0261474).

Regarding the instant independent claims 1 and 7, the Hon '895 patent claims recite nearly all that is recited in the instant claims; but, it fails to recite that the nicotine formulation comprises nicotine lactate and/or a propylene glycol/glycerol liquid carrier. However, the Gonda reference teaches that a nicotine formulation, such as a nicotine lactate salt (based on lactic acid) in solution (i.e., glycerin/glycols), can be prepared so as to be inhaled which results in rapid delivery of nicotine (see abstract and paras.[0052],[0078]). Hence, it would have been obvious to one having ordinary skill in the art to have included the nicotine formulation of Gonda in the device of Hon '895 as such is already known in the art.

Regarding dependent claims 2-6 and 8-12, the limitations of these claims are deemed to have been met by, or an obvious modification of, the claims of Hon '895.

4. Claims 1-4, 6-10 and 12 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 105-122 of copending Application No. 14/271,071.

Regarding claims 1-4, 6-10 and 12, while the claims of copending Application No. 14/271,071 are not identical to those of the instant application, they are not patentably distinct therefrom because, collectively, claims 105-122 of Application No. 14/271,071 generally encompass the above-referenced claims of the instant application.

5. Claims 5 and 11 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 105-122 of copending Application No. 14/271,071 in view of Gonda (US. Pat. No. 2014/0261474) and Bowen et al (US. Pat. App. Pub. 2009/0151717).

Regarding claims 5 and 11, claims 105-122 of Application No. 14/271,071 fail to recite that inhalation of the aerosol into the user's lungs takes place over a period of about 5 minutes at a rate of about one inhalation per 30 seconds and results in a nicotine plasma $T_{\max}$ from about 3 min to about 8 min. However, Gonda states that adjustments in pH, in combination with changing the particle size of the aerosol, can be carried out to create a different experience for the user. By decreasing the pH of the nicotine formulation, the likelihood of airway irritation and cough is reduced. By decreasing the particle size, the aerosolized particles of nicotine will deposit deeper in the lungs, which increases the rate of absorption of the nicotine and leads to an

increase in peak nicotine plasma levels (see para. [0007],[0033]-[0036], [0052], [0064], [0086]). Further, Gonda states that, during inhalation of aerosolized nicotine formulations, a satisfactory dose of nicotine is achieved in a small number of breaths, spaced by short periods, preferably less than 2 minutes (see para. [0017]). (Note: To this point, the Bowen et al reference further discloses that, typically, when smokers “puff” on cigarettes they may take a puff every 30 seconds (i.e., in an intense smoking regime). Bowen et al then shows that aerosol devices used to inhale a nicotine substance can also be “smoked” in such manner (see para. [0107])). This collective disclosure indicates that the parameters of pH, aerosolized nicotine particle size, and even nicotine concentration in the liquid formulation and inhalation rate, are all “result-effective variables”. Note: Once a particular parameter is recognized as a result-effective variable, i.e., a variable which achieves a recognized result, the determination of the optimum or workable ranges of said variable can be characterized by routine experimentation. See *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980) (prior art suggested proportional balancing to achieve desired results in the formation of an alloy). MPEP 2144.05. Hence, it would have been obvious to one having ordinary skill in the art at the time of the invention to have undergone routine experimentation and arrived at the claimed inhalation rate which result in the claimed T_{max} parameters, after determining that these values provided, as close as possible, the same nicotine blood levels achieved by smoking a conventional cigarette - which is the goal of Gonda and Bowen et al.

This is a provisional nonstatutory double patenting rejection.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102 of this title, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. This application currently names joint inventors. In considering patentability of the claims the examiner presumes that the subject matter of the various claims was commonly owned as of the effective filing date of the claimed invention(s) absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and effective filing dates of each claim that was not commonly owned as of the effective filing date of the later invention in order for the examiner to consider the applicability of 35 U.S.C. 102(b)(2)(C) for any potential 35 U.S.C. 102(a)(2) prior art against the later invention.

9. Claims 1-4, 7-10 and 13-18 are rejected under 35 U.S.C. 103 as being unpatentable over Hon (US. Pat. App. Pub. 2006/0196518) in view of Gonda (US. Pat. No. 2014/0261474).

Regarding independent claims 1, 7 and 13, Hon discloses a flameless, battery-operated electronic atomizing cigarette, and a method of using the same, designed to help a smoker wean himself from the tobacco-smoking habit - while still enjoying the nicotine delivery. The cigarette is designed to dispense a liquid nicotine formulation contained in a storage container in aerosolized/vaporized form upon being heated by an electric heater, for inhalation by a user. The nicotine formulation may include anywhere from 0.1-6% nicotine by weight and tobacco essence (see abstract; paras. [0006],[0021],[0028]-[0032])(corresponding to the claimed "a method of delivering nicotine to a user comprising deploying an electronic cigarette comprising a nicotine formulation that comprises nicotine...and a biologically acceptable liquid carrier, wherein...the nicotine concentration is from about 0.5% (w/w) to about 20% (w/w)...operation of the electronic cigarette comprises heating at least a portion of the nicotine formulation to generate an inhalable aerosol"(claims 1,7); and "an electronic cigarette, comprising a liquid reservoir; a nicotine formulation within the liquid reservoir...wherein a concentration of nicotine in the nicotine formulation is from about 0.5% (w/w) to about 20%(w/w); a vaporizing component configured to produce an aerosol form the nicotine formulation; and a mouthpiece configured to connect to the reservoir for inhalation of the aerosol"(claim 13); the "wherein the nicotine formulation further comprises at least one flavorant" recitation of claims 3, 9 and 16; the "wherein

the nicotine concentration is from about 4.5%” recitation of claims 4, 10 and 18; the “further comprises a battery configured to provide power to the vaporizing component” recitation of claim 14; the “wherein the vaporizing component comprises a heating element in fluid communication with the nicotine formulation” recitation of claim 17).

Hon is silent as to whether the nicotine, in its liquid formulation, may be combined with an organic acid (i.e., lactic acid). However, the Gonda reference teaches that administering an aerosolized, liquid nicotine-containing formulation via inhalation (i.e., pulmonary administration) in order to effectuate a peak level of nicotine in the blood plasma after a very short period of time - mimicking that which is typically achieved during actual cigarette smoking - is known. Specifically, Gonda teaches that a nicotine formulation, such as a nicotine lactate salt (based on lactic acid) in solution (i.e., glycerin and glycols), can be prepared so as to be inhaled which results in rapid delivery of nicotine (see abstract and paras.[0052],[0078]). Hence, it would have been obvious to one having ordinary skill in the art to have included the nicotine formulation of Gonda in the device of Hon for the benefits described above (corresponding to the claimed “nicotine, an organic acid/lactic acid, and a biologically acceptable liquid carrier/glycerol”; the “wherein the acid does not decompose at room temperature and does not decompose at the operating temperature of the electronic cigarette”(claim 7)). Hence, the modified Hon/Gonda invention meets all the limitations of the above-referenced claims.

Regarding claims 2, 8 and 15, Gonda doesn’t specifically state the molar ratio of nicotine to lactic acid, for example; however, one of ordinary skill in the art would have

optimized said nicotine/acid amounts in order to provide the optimal stoichiometric amounts for nicotine salt formation and, in doing so, undergone routine experimentation and arrived at the claimed ratios (corresponding to the claimed “wherein the molar ratio of nicotine or organic acid is between about 1:1 and 1:3”).

10. Claims 5-6, 11-12 and 19-20 are rejected under 35 U.S.C. 103 as being unpatentable over Hon (US. Pat. App. Pub. 2006/0196518) in view of Gonda (US. Pat. No. 2014/0261474) and Bowen et al (US. Pat. App. Pub. 2009/0151717).

The modified Hon/Gonda invention fails to disclose anything about nicotine plasma concentrations; the time period at which the maximum concentration is reached after inhaling nicotine from the electronic cigarette; and micron size of the aerosol generated therefrom, to result in the claimed time period for peak nicotine concentration; however, it does disclose that each of these parameters impact nicotine delivery and absorption in the bloodstream (see paras. [0043],[0092]). Specifically, Gonda states that adjustments in pH, in combination with changing the particle size of the aerosol, can be carried out to create a different experience for the user. By decreasing the pH of the nicotine formulation, the likelihood of airway irritation and cough is reduced. By decreasing the particle size, the aerosolized particles of nicotine will deposit deeper in the lungs, which increases the rate of absorption of the nicotine and leads to an increase in peak nicotine plasma levels (see para. [0007],[0033]-[0036], [0052], [0064], [0086]). Further, Gonda states that, during inhalation of aerosolized nicotine formulations, a satisfactory dose of nicotine is achieved in a small number of breaths, spaced by short periods, preferably less than 2 minutes (see para. [0017]).

(Note: To this point, the Bowen et al reference further discloses that, typically, when smokers “puff” on cigarettes they may take a puff every 30 seconds (i.e., in an intense smoking regime). Bowen et al then shows that aerosol devices used to inhale a nicotine substance can also be “smoked” in such manner (see para. [0107])). This collective disclosure indicates that the parameters of pH, aerosolized nicotine particle size, and even nicotine concentration in the liquid formulation and inhalation rate, are all “result-effective variables”. Note: Once a particular parameter is recognized as a result-effective variable, i.e., a variable which achieves a recognized result, the determination of the optimum or workable ranges of said variable can be characterized by routine experimentation. See *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980) (prior art suggested proportional balancing to achieve desired results in the formation of an alloy). MPEP 2144.05. Hence, it would have been obvious to one having ordinary skill in the art at the time of the invention to have undergone routine experimentation and fabricated the nicotine formulation of Hon in the form of a liquid nicotine lactate salt solution and, in so doing, arrived at the claimed particle size, and inhalation rate which result in the claimed $T_{\max}$ parameters, after determining that these values provided, as close as possible, the same nicotine blood levels achieved by smoking a conventional cigarette - which is the goal of Hon, Gonda and Bowen et al (corresponding to the claimed “wherein inhalation of the aerosol into the user’s lungs over a period of about 5 minutes at a rate of about one inhalation per 30 seconds results in a nicotine plasma $T_{\max}$ from about 3 min to about 8 min” recitation of claim 5, 11 and 19; the “wherein the

inhalable aerosol has a particle size from about 0.1 microns to about 5 microns”
recitation of claim 6, 12 and 20).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DIONNE WALLS MAYES whose telephone number is (571)272-5836. The examiner can normally be reached on Tuesday and Thursday, 8:00A - 6:30P EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael H. Wilson can be reached on 571-270-3882. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/DIONNE WALLS MAYES/
Examiner, Art Unit 1747

Notice of References Cited	Application/Control No. 14/925,968		Applicant(s)/Patent Under Reexamination BOWEN ET AL.	
	Examiner DIONNE WALLS MAYES		Art Unit 1747	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2014/0261474 A1	09-2014	GONDA	A61M15/06	131/270
*	B	US-2006/0196518 A1	09-2006	HON	A24F47/002	131/360
*	C	US-2009/0151717 A1	06-2009	BOWEN	A61M11/041	128/200.23
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



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BIB DATA SHEET

CONFIRMATION NO. 2707

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
14/925,968	10/28/2015	131	1747	13211-713.303		
APPLICANTS INVENTORS Adam BOWEN, San Francisco, CA; Chenyue XING, San Francisco, CA; ** CONTINUING DATA ***** This application is a CON of 14/512,311 10/10/2014 PAT 9215895 which is a CON of 14/271,071 05/06/2014 which claims benefit of 61/820,128 05/06/2013 and claims benefit of 61/912,507 12/05/2013 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 11/09/2015						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and /DIONNE WALLS MAYES/ Acknowledged Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY CA	SHEETS DRAWINGS 8	TOTAL CLAIMS 20	INDEPENDENT CLAIMS 3
ADDRESS SHAY GLENN LLP 2755 CAMPUS DRIVE SUITE 210 SAN MATEO, CA 94403 UNITED STATES						
TITLE NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF						
FILING FEE RECEIVED 1600	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	3	((("20060195518") or ("20120256567") or ("20080241255")).PN.	US-PGPUB; USPAT	OR	OFF	2015/01/20 11:41
S2	3	((("20060195518") or ("20120255567") or ("20080241255")).PN.	US-PGPUB; USPAT	OR	OFF	2015/01/20 11:41
S3	2	((("20120255567") or ("20080241255")).PN.	US-PGPUB; USPAT	OR	OFF	2015/01/20 11:42
S4	0	("2006").pn. and (hon).in.	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/20 11:42
S5	42	(hon).in. and cigarette	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/20 11:44
S6	25	("131"/\$ or "128"/\$).ccls. and electronic cigarette and nicotine and plasma	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/20 15:06
S7	6	("131"/\$ or "128"/\$).ccls. and (fuisz).in. and nicotine and plasma	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/20 15:06
S8	91	("131"/\$ or "128"/\$).ccls. and inhal\$5 near15 nicotine and plasma	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/20 15:15
S9	25	("131"/\$ or "128"/\$).ccls. and inhal\$5 near15 nicotine and plasma and ((max or maxim\$3) near25 time)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/20 15:16
S10	23	("131"/\$ or "128"/\$).ccls. and inhal\$5 near15 nicotine and (plasma near25 (peak or max or maxim\$3) near25 time)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/20 15:25
S11	9	("131"/\$ or "128"/\$).ccls. and inhal\$5 same (nicotine same (plasma near25 (peak or max or maxim\$3) near25 time))	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/20 15:25
S12	9	("131"/\$ or "128"/\$).ccls. and inhal\$5 same (nicotine same (plasma near25 (peak or max or maxim\$3) near25 time))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/20 15:26
S13	32	("131"/\$ or "128"/\$).ccls. and inhal\$5 and (nicotine same (plasma near25 (peak or max or maxim\$3) same time))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/20 15:28
S14	2	("131"/\$ or "128"/\$).ccls. and nicotine benzoate	US-PGPUB; USPAT; USOCR; FPRS;	ADJ	ON	2015/01/20 15:51

			EPO; JPO; DERWENT IBM_TDB			
S15	2	(vaporiz\$3 or electronic cigarette) and nicotine benzoate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/20 15:52
S16	346	("131"/\$ or "128"/\$).ccls. and (salt near5 nicotine)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/20 15:53
S17	230	("131"/\$ or "128"/\$).ccls. and (salt near5 nicotine) same (acid)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/20 15:54
S18	210	("131"/\$ or "128"/\$).ccls. and (salt near5 nicotine) near35 (acid)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/20 15:55
S19	17	("131"/\$ or "128"/\$).ccls. and (salt near5 nicotine) near35 (carboxylic or citric)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/20 16:08
S20	1	("2356185").PN.	US-PGPUB; USPAT	OR	OFF	2015/01/20 16:32
S21	1	("2356185").PN.	USOCR	OR	OFF	2015/01/20 16:33
S22	4	nicotine benzoate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT IBM_TDB	ADJ	ON	2015/01/20 16:38
S23	1	("20010029959").PN.	US-PGPUB; USPAT	OR	OFF	2015/01/20 16:43
S24	0	electronic cigarette and inhal\$4 near25 every near15 (seconds or secs)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/20 16:47
S25	1	nicotine and inhal\$4 near25 every near15 (seconds or secs)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/01/20 16:48
S26	1	nicotine and inhal\$4 near25 every near15 (seconds or secs)	US-PGPUB; USPAT; USOCR;	ADJ	ON	2015/01/20 16:59

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S27	53	inhal\$4 near25 every near15 (seconds or secs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/20 17:33
S28	222	puff\$4 near25 every near15 (seconds or secs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/20 17:37
S29	207	("131"/\$ or "128"/\$ or cigarette) and puff\$4 near25 every near15 (seconds or secs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/20 17:40
S30	179	("131"/\$ or "128"/\$) and puff\$4 near25 every near15 (seconds or secs)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2015/01/20 17:40
S31	28	((("20070163610") or ("20090293895") or ("20130186416") or ("7832410") or ("8,156,944") or ("8,511,318") or ("20140345631") or ("20140345635") or ("20040191322") or ("20060018840") or ("20060196518") or ("20080241255") or ("20090004249") or ("20100242976") or ("20110268809") or ("20120255567") or ("4,830,028") or ("4,836,224") or ("6,102,036") or ("6,234,169") or ("6,799,576") or ("6,874,507") or ("7,767,698") or ("8,079,371") or ("8,322,350") or ("8,375,957") or ("8,381,739") or ("8,741,348"))).PN.	US-PGPUB; USPAT	OR	OFF	2015/01/20 20:10
S32	1	(14/512311).APP.	US-PGPUB; USPAT	OR	OFF	2015/03/23 22:03
S33	1	(14/512311).APP.	US-PGPUB; USPAT	OR	OFF	2015/05/14 15:25
S34	1605	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 16:07
S35	237	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and benzoic	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 16:08
S36	221	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and benzoic and (inhal\$5 or mouth or oral\$4)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 16:08

S37	191	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and benzoic and (inhal\$5 or mouth or oral\$4) and (plasma or blood)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 16:08
S38	163	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and benzoic and (inhal\$5 or mouth or oral\$4) and (plasma or blood) and ph	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 16:09
S39	108	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and benzoic and (inhal\$5 or mouth or oral\$4) and (plasma or blood) and ph and ((drop\$4 or vapor\$4 or aerosol\$4 or particle) near25 size)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 16:10
S40	87	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and benzoic and (inhal\$5 or mouth or oral\$4) and (plasma or blood) and ph and ((drop\$4 or vapor\$4 or aerosol\$4 or particle) near25 size) and heat\$4	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 16:11
S41	77	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and benzoic and (inhal\$5) and (plasma or blood) and ph and ((drop\$4 or vapor\$4 or aerosol\$4 or particle) near25 size) and heat\$4	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 16:12
S42	4	("2004076289").PN.	FPRS; EPO; JPO	OR	OFF	2015/05/14 18:13
S43	15	ANDERSSON near3 SVEN-BORJE	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 18:15
S44	13	ANDERSSON near3 SVEN-BORJE and nicotine	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 18:15
S45	71	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and benzoic and (inhal\$5) and (plasma or blood) and ph and ((drop\$4 or vapor\$4 or aerosol\$4 or particle) near25 size) and heat\$4 and lung	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 18:26
S46	21	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and benzoic and (inhal\$5) and (plasma or blood) and (ph near5 "7") and ((drop\$4 or vapor\$4 or aerosol\$4 or particle) near25 size) and heat\$4 and lung	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 18:27
S47	26	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and benzoic and (inhal\$5) and (plasma or blood) and (ph near5 "7") and heat\$4 and lung	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 18:28
S48	38	("128"/\$ or "131"/\$ or "424"/\$ or "514"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and benzoic and (inhal\$5) and	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/14 18:31

		(plasma or blood) and (ph near5 "7") and heat\$4 and lung				
S49	1	("20060196518").PN.	US-PGPUB; USPAT	OR	OFF	2015/05/14 19:32
S50	34	("128"/\$ or "131"/\$ or "424"/\$ or "514"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and (salicylic or sorbic or lauric or levulinic or citric or benzoic or pyruvic) and (inhal\$5) and ((plasma or blood or peek or peak) near10 concentration) and (ph near5 "7") and heat\$4 and lung	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/15 08:30
S51	1	("8831739").PN.	US-PGPUB; USPAT	OR	OFF	2015/05/15 08:43
S52	1	("8381739").PN.	US-PGPUB; USPAT	OR	OFF	2015/05/15 08:43
S53	14	(igor near3 gonda) and nicotine and ng/ml	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/15 10:42
S54	13	(igor near3 gonda) and nicotine near50 concentration near50 ng/ml	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/15 10:42
S55	0	(igor near3 gonda) and nicotine near50 concentration near50 ng/ml near50 salt	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/15 10:43
S56	64	(igor near3 gonda) and ((blood or plasma or nicotine) near50 concentration)	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/15 10:46
S57	13	(igor near3 gonda) and ((blood or plasma or nicotine) near50 concentration) same nicotine	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/05/15 10:46
S58	1	("20030136404").PN.	US-PGPUB; USPAT	OR	OFF	2015/05/17 15:16
S59	1	(14/512311).APP.	US-PGPUB; USPAT	OR	OFF	2015/07/14 09:12
S60	1	("20140261474").PN.	US-PGPUB; USPAT	OR	OFF	2015/07/14 10:27
S61	1	(14/512311).APP.	US-PGPUB; USPAT	OR	OFF	2015/09/17 14:40
S62	934	(A24F47/008).cpc.	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/09/17 14:46
S63	78	("128"/\$ or "131"/\$ or "424"/\$ or "514"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and acid and (inhal\$5) and (plasma or blood) and (ph near5 "7") and heat\$4 and lung	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/09/17 14:46
S64	367	("128"/\$ or "131"/\$ or "424"/\$ or "514"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and acid and (inhal\$5) and (plasma or blood) and heat\$4 and lung	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/09/17 14:47
S65	283	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and (levulinic or pyruvic or salicylic or sorbic or lauric or benzoic) and (inhal\$5 or mouth or oral\$4) and	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/09/17 14:48

		(plasma or blood)				
S69	2	((("20060196518") or ("20140261474")).PN.	US-PGPUB; USPAT	OR	OFF	2015/12/10 16:09

EAST Search History (I nterference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S66	723	(A24F47/008).cpc.	US-PGPUB; *No UPAD	ADJ	ON	2015/09/17 14:46
S67	246	("128"/\$ or "131"/\$ or "424"/\$ or "514"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and acid and (inhal\$5) and (plasma or blood) and heat\$4 and lung	US-PGPUB; *No UPAD	ADJ	ON	2015/09/17 14:47
S68	196	("128"/\$ or "131"/\$ or "424"/\$).ccls. and nicotine near25 (formulation or solution or liquid or solvent) and (levulinic or pyruvic or salicylic or sorbic or lauric or benzoic) and (inhal\$5 or mouth or oral\$4) and (plasma or blood)	US-PGPUB; *No UPAD	ADJ	ON	2015/09/17 14:49

12/ 12/ 2015 9:04:04 PM
C:\ Users\ dmayes\ Documents\ EAST\ Workspaces\ 14925968.wsp

Search Notes 	Application/Control No. 14925968	Applicant(s)/Patent Under Reexamination BOWEN ET AL.
	Examiner DIONNE W MAYES	Art Unit 1747

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Search conducted (see attached search strategy)	12/10/2015	DWM
Inventor search conducted	12/10/2015	DWM

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/925,968	10/28/2015	Adam BOWEN	13211-713.303

CONFIRMATION NO. 2707

PUBLICATION NOTICE



0000000080704214

66854
SHAY GLENN LLP
2755 CAMPUS DRIVE
SUITE 210
SAN MATEO, CA 94403

Title: NICOTINE SALT FORMULATIONS FOR AEROSOL DEVICES AND METHODS THEREOF

Publication No. US-2016-0044968-A1

Publication Date: 02/18/2016

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

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Sheet 1 of 20

Complete if Known

Application Number	14/925,968
Filing Date	October 28, 2015
First Named Inventor	Adam Bowen
Art Unit	1747
Examiner Name	Mayes, Dionne Walls
Attorney Docket Number	13211-713.303

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
	1	US- 374,584	12/13/1887	Cook	
	2	US- 576,653	2/9/1897	Bowlby	
	3	US- 595,070	12/7/1897	Oldenbusch	
	4	US- 720,007	2/10/1903	Dexter	
	5	US- 799,844	9/19/1905	Fuller	
	6	US- 968,160	8/23/1910	Johnson	
	7	US- 969,076	8/30/1910	Pender	
	8	US- 1,067,531	7/15/1913	MacGregor	
	9	US- 1,163,183	12/7/1915	Stoll	
	10	US- 1,299,162	4/1/1919	Fisher	
	11	US- 1,505,748	8/19/1924	Louis	
	12	US- 1,552,877	9/8/1925	Phillipps et al.	
	13	US- 1,632,335	6/14/1927	Hiering	
	14	US- 1,706,244	3/19/1929	Louis	
	15	US- 1,845,340	2/16/1932	Ritz	
	16	US- 1,972,118	9/4/1934	McDill	
	17	US- 1,998,683	4/23/1935	Montgomery	
	18	US- 2,031,363	2/18/1936	Elof	
	19	US- 2,039,559	5/5/1936	Segal	

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Examiner Initials*	Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T ⁶
		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	374	CA2641869A1	5/6/2010	Xia, Hao Ran		
	375	CN101869356A(w/EngTrans)	10/27/2010	Liu Zheqi		
	376	CN102754924A(w/EngTrans)	10/31/2012	Long		
	377	CN1122213A(w/EngAbs)	5/15/1996	Philip Morris Prod Inc		
	378	CN85106876A(w/EngCorres)	9/3/1986	M. J. Luinoziancaogose		
	379	DE19854005A1(w/EngAbs)	5/18/2000	Reemtsma GmbH		

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Application Number	14/925,968
Filing Date	October 28, 2015
First Named Inventor	Adam Bowen
Art Unit	1747
Examiner Name	Mayes, Dionne Walls
Attorney Docket Number	13211-713.303

Sheet 2 of 20**U. S. PATENT DOCUMENTS**

Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
	20	US- 2,104,266	1/4/1938	McCormick	
	21	US- 2,231,909	2/18/1941	Hempel	
	22	US- 2,327,120	8/17/1943	McCoon	
	23	US- 2,460,427	2/1/1949	Musselman et al.	
	24	US- 2,483,304	9/27/1949	Rudolf	
	25	US- 2,502,561	4/4/1950	Ludwig	
	26	US- 2,765,949	10/9/1956	Swan	
	27	US- 2,830,597	4/15/1958	Jakob	
	28	US- 2,860,638	11/18/1958	Frank	
	29	US- 2,897,958	8/4/1959	Tarleton et al.	
	30	US- 2,935,987	5/10/1960	Ackerbauer	
	31	US- 3,146,937	9/1/1964	Joseph	
	32	US- 3,258,015	6/28/1966	Drummond et al.	
	33	US- 3,292,634	12/20/1966	Beucler	
	34	US- 3,373,915	3/19/1968	Anderson et al.	
	35	US- 3,420,360	1/7/1969	Young	
	36	US- 3,479,561	11/18/1969	Janning	
	37	US- 3,567,014	3/2/1971	Feigelman	
	38	US- 3,707,017	12/26/1972	Paquette	

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	380	DE19854012A1(w/EngTrans)	5/18/2000	Reemtsma GmbH		
	381	DE4200639A1(w/EngEquiv)	7/23/1992	Brown & Williamson Tob.		
	382	EP0532194A1	3/17/1993	Philip Morris Prod Inc		
	383	EP0535695A2	4/7/1993	Phillips Petroleum Co		
	384	EP1458388A(asWO03/055486)	9/22/2004	McNeil AB		
	385	EP2325093B1	6/20/2012	Imperial Tobacco Ltd		

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Attorney Docket Number	13211-713.303

Sheet 3 of 20

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		Number-Kind Code ² (if known)			
	39	US- 3,792,704	2/19/1974	Parker	
	40	US- 3,861,523	1/21/1975	Fountain et al.	
	41	US- 3,941,300	3/2/1976	Troth	
	42	US- 4,020,853	5/3/1977	Nuttall	
	43	US- 4,049,005	9/20/1977	Hernandez et al.	
	44	US- 4,066,088	1/3/1978	Ensor	
	45	US- 4,207,976	6/17/1980	Herman	
	46	US- 4,215,708	8/5/1980	Bron	
	47	US- 4,219,032	8/26/1980	Tabatznik et al.	
	48	US- 4,506,683	3/26/1985	Cantrell et al.	
	49	US- 4,519,319	5/28/1985	Howlett	
	50	US- 4,595,024	6/17/1986	Greene et al.	
	51	US- 4,708,151	11/24/1987	Shelar	
	52	US- 4,735,217	4/5/1988	Gerth et al.	
	53	US- 4,771,796	9/20/1988	Myer	
	54	US- 4,793,365	12/27/1988	Sensabaugh Jr. et al.	
	55	US- 4,794,323	12/27/1988	Zhou et al.	
	56	US- 4,798,310	1/17/1989	Kasai et al.	
	57	US- 4,813,536	3/21/1989	Willis	

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		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	386	EP2609821A1	7/3/2013	Philip Morris Prod S.A		
	390	ES2118034A1(w/EngAbs)	9/1/1998	Nugar Bobinajes SI		
	391	GB1025630A	4/14/1966	British American Tobacco		
	392	GB1065678A	4/19/1967	Super Temp Corp		
	393	IE-S2005-0051	2/2/2005	Oglesby & Butler R&D Ltd		
	394	IE-S2005-0563	8/24/2005	Oglesby & Butler R&D Ltd		

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Examiner Name	Mayes, Dionne Walls
Attorney Docket Number	13211-713.303

Sheet 4 of 20

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	58	US- 4,819,665	4/11/1989	Roberts et al.	
	59	US- 4,830,028	5/16/1989	Lawson et al.	
	60	US- 4,836,224	6/6/1989	Lawson et al.	
	61	US- 4,846,199	7/11/1989	Rose	
	62	US- 4,848,374	7/18/1989	Chard et al.	
	63	US- 4,848,563	7/18/1989	Robbins	
	64	US- 4,893,639	1/16/1990	White	
	65	US- 4,907,606	3/13/1990	Lilja et al.	
	66	US- 4,941,483	7/17/1990	Ridings et al.	
	67	US- 4,944,317	7/31/1990	Thal	
	68	US- 4,947,874	8/14/1990	Brooks et al.	
	69	US- 4,947,875	8/14/1990	Brooks et al.	
	70	US- 5,005,759	4/9/1991	Bouche	
	71	US- 5,020,548	6/4/1991	Farrier et al.	
	72	US- 5,027,836	7/2/1991	Shannon et al.	
	73	US- 5,050,621	9/24/1991	Creighton et al.	
	74	US- 5,060,671	10/29/1991	Counts et al.	
	75	US- 5,065,776	11/19/1991	Lawson et al.	
	76	US- 5,076,297	12/31/1991	Farrier et al.	

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		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	395	IE-S2005-0615	9/19/2005	Oglesby & Butler R&D Ltd		
	396	JP02-145179A(w/EngEquiv)	6/4/1990	Hercules Inc		
	397	JP03-049671(w/EngEquiv)	3/4/1991	Brown & Williamson Tob.		
	398	JP03-180166(w/EngEquiv)	8/6/1991	R J Reynolds Tobacco Co		
	399	JP09-075058(w/EngAbs)	3/25/1997	Nagai, Masaya		
	400	JP11-178563(w/EngAbs)	7/6/1999	Japan Tobacco Inc		

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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

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Application Number	14/925,968
Filing Date	October 28, 2015
First Named Inventor	Adam Bowen
Art Unit	1747
Examiner Name	Mayes, Dionne Walls
Attorney Docket Number	13211-713.303

Sheet 5 of 20

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
	77	US- 5,105,831	4/21/1992	Banerjee et al.	
	78	US- 5,105,838	4/21/1992	White et al.	
	79	US- 5,123,530	6/23/1992	Lee	
	80	US- 5,144,962	9/8/1992	Counts et al.	
	81	US- 5,183,062	2/2/1993	Clearman et al.	
	82	US- 5,224,498	7/6/1993	Deevi et al.	
	83	US- 5,249,586	10/5/1993	Morgan et al.	
	84	US- 5,261,424	11/16/1993	Sprinkel Jr.	
	85	US- 5,269,237	12/14/1993	Baker et al.	
	86	US- 5,269,327	12/14/1993	Counts et al.	
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	89	US- 5,372,148	12/13/1994	McCafferty et al.	
	90	US- 5,388,574	2/14/1995	Ingebrethsen	
	91	US- 5,591,368	1/7/1997	Fleischhauer et al.	
	92	US- 5,605,226	2/25/1997	Hernlein	
	93	US- 5,641,064	6/24/1997	Goserud	
	94	US- 5,649,552	7/22/1997	Cho et al.	
	95	US- 5,666,977	9/16/1997	Higgins et al.	

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		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	401	JP2000-203639(w/EngAbs)	7/25/2000	S & B Foods Inc		
	402	JP2000-236865A(w/EngAbs)	9/5/2000	Seiko Kogyo KK		
	403	JP2001-165437A(w/EngAbs)	6/22/2001	Tsubota Pearl Co Ltd		
	404	JP2005-034021A(w/EngCorres)	2/10/2005	Seiko Epson Corp		
	405	JP2006-504430A(w/EngEquiv)	2/9/2006	R J Reynolds Tobacco Co		
	406	JP62-278975(w/EngAbs)	12/3/1987	Watabe, Isamu		

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Filing Date	October 28, 2015
First Named Inventor	Adam Bowen
Art Unit	1747
Examiner Name	Mayes, Dionne Walls
Attorney Docket Number	13211-713.303

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		Number-Kind Code ² (if known)			
	96	US- 5,666,978	9/16/1997	Counts et al.	
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	98	US- 5,730,118	3/24/1998	Hermanson	
	99	US- 5,730,158	3/24/1998	Collins et al.	
	100	US- 5,746,587	5/5/1998	Racine et al.	
	101	US- 5,810,164	9/22/1998	Rennecamp	
	102	US- 5,819,756	10/13/1998	Mielordt	
	103	US- 5,845,649	12/8/1998	Saito et al.	
	104	US- 5,865,185	2/2/1999	Collins et al.	
	105	US- 5,881,884	3/16/1999	Podosek	
	106	US- 5,931,828	8/3/1999	Durkee	
	107	US- 5,934,289	8/10/1999	Watkins et al.	
	108	US- 5,938,018	8/17/1999	Keaveney et al.	
	109	US- 5,944,025	8/31/1999	Cook et al.	
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	112	US- 5,975,415	11/2/1999	Zehnal	
	113	US- 5,979,460	11/9/1999	Matsumura	
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		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	407	JP64-37276A(w/EngEquiv)	2/7/1989	R J Reynolds Tobacco Co		
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	410	WO97/12639A1	4/10/1997	Slutsky, Arthur		
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Sheet 7 of 20

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Application Number	14/925,968
Filing Date	October 28, 2015
First Named Inventor	Adam Bowen
Art Unit	1747
Examiner Name	Mayes, Dionne Walls
Attorney Docket Number	13211-713.303

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	116	US- 6,053,176	4/25/2000	Adams et al.	
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	120	US- 6,125,853	10/3/2000	Susa et al.	
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	122	US- 6,164,287	12/26/2000	White	
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		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	413	WO03/082031A1	10/9/2003	Steinberg, Dan A.		
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	415	WO2004/064548A1	8/5/2004	Netzer, Omry		
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	418	WO2006/015070A1	2/9/2006	Brown & Williamson Tob.		
	419	WO2007/026131A1	3/8/2007	Acetate Products Ltd		

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Sheet 8 of 20

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Application Number	14/925,968
Filing Date	October 28, 2015
First Named Inventor	Adam Bowen
Art Unit	1747
Examiner Name	Mayes, Dionne Walls
Attorney Docket Number	13211-713.303

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	136	US- 6,615,840	9/9/2003	Fournier et al.	
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	138	US- 6,655,379	12/2/2003	Clark et al.	
	139	US- 6,672,762	1/6/2004	Faircloth et al.	
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	144	US- 6,803,545	10/12/2004	Blake et al.	
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	148	US- 6,954,979	10/18/2005	Logan	
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		Country Code ³ Number ⁴ Kind Code ⁵ (if known)			
	421	WO2010/023561A1	3/4/2010	Actavis Group Ptc	
	422	WO2011/033396A2	3/24/2011	Minilogic Device Corp Ltd	
	423	WO2011/117580A2	9/29/2011	Kind Consumer Ltd	
	424	WO2012/021972A1	2/23/2012	Cogestor Inc.	
	425	WO2012/027350A2	3/1/2012	Alelov, Eli	
	426	WO2012/085207A1	6/28/2012	Philip Morris Prod S.A	

Examiner Signature	Date Considered
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First Named Inventor	Adam Bowen
Art Unit	1747
Examiner Name	Mayes, Dionne Walls
Attorney Docket Number	13211-713.303

Sheet 9 of 20

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	167	US- 8,490,629	7/23/2013	Shenassa et al.	
	168	US- 8,539,959	9/24/2013	Scatterday	
	169	US- 8,541,401	9/24/2013	Mishra et al.	
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	171	US- 8,671,952	3/18/2014	Winterson et al.	
	172	US- 8,741,348	6/3/2014	Hansson et al.	
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	428	WO2013/050934A1	4/11/2013	SIS Resources Ltd.		
	429	WO2013/083635A1	6/13/2013	Philip Morris Prod S.A		
	431	WO2013/098398A2	7/4/2013	Philip Morris Prod S.A		
	432	WO2013/142678A1	9/26/2013	Njoy Inc.		
	434	WO2014/093127A2	6/19/2014	Fuisz, Richard C.		
	436	WO2014/118286A2	8/7/2014	Philip Morris Prod S.A		

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	184	US- D644375	8/30/2011	Zhou	
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	195	US- 2003/0005926	1/9/2003	Jones et al.	

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Examiner Initials*	Cite No. ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T ⁶
		Country Code ³ -Number ⁴ -Kind Code ⁵ (if known)				
	437	WO2014/139611A1	9/18/2014	Philip Morris Prod S.A		
	438	WO2014/140087A1	9/18/2014	Philip Morris Prod S.A		
	440	WO2014/187763A1	11/27/2014	Philip Morris Prod S.A		
	441	WO2014/187770A2	11/27/2014	Philip Morris Prod S.A		
	443	WO2015/006652A1	1/15/2015	Alexza Pharm. Inc.		
	445	WO2015/040180A2	3/26/2015	Philip Morris Prod S.A		

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Application Number	14/925,968
Filing Date	October 28, 2015
First Named Inventor	Adam Bowen
Art Unit	1747
Examiner Name	Mayes, Dionne Walls
Attorney Docket Number	13211-713.303

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Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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	196	US- 2003/0089377	5/15/2003	Hajaligol et al.	
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	211	US- 2005/0172976	8/11/2005	Newman et al.	
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	448	WO2015/082652A1	6/11/2015	Philip Morris Prod S.A		
	449	WO2015/084544A1	6/11/2015	Pax Labs, Inc.		
	451	WO2015/101651A1	7/9/2015	Philip Morris Prod S.A		
	453	WO2015/124878A1(EngAbs)	8/27/2015	Smokio		
	454	WO2015/148547A1	10/1/2015	Nicotech LLC		
	455	WO2015/175979A1	11/19/2015	Pax Labs, Inc.		

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Filing Date	October 28, 2015
First Named Inventor	Adam Bowen
Art Unit	1747
Examiner Name	Mayes, Dionne Walls
Attorney Docket Number	13211-713.303

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Examiner Name	Mayes, Dionne Walls
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	280	US- 2011/0226236	9/22/2011	Buchberger	
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	283	US- 2011/0236002	9/29/2011	Oglesby et al.	
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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

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Sheet 17

of 20

Complete if Known

Application Number	14/925,968
Filing Date	October 28, 2015
First Named Inventor	Adam Bowen
Art Unit	1747
Examiner Name	Mayes, Dionne Walls
Attorney Docket Number	13211-713.303

U. S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
	315	US- 2014/0041655	2/13/2014	Barron et al.	
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	325	US- 2014/0190503	7/10/2014	Li et al.	
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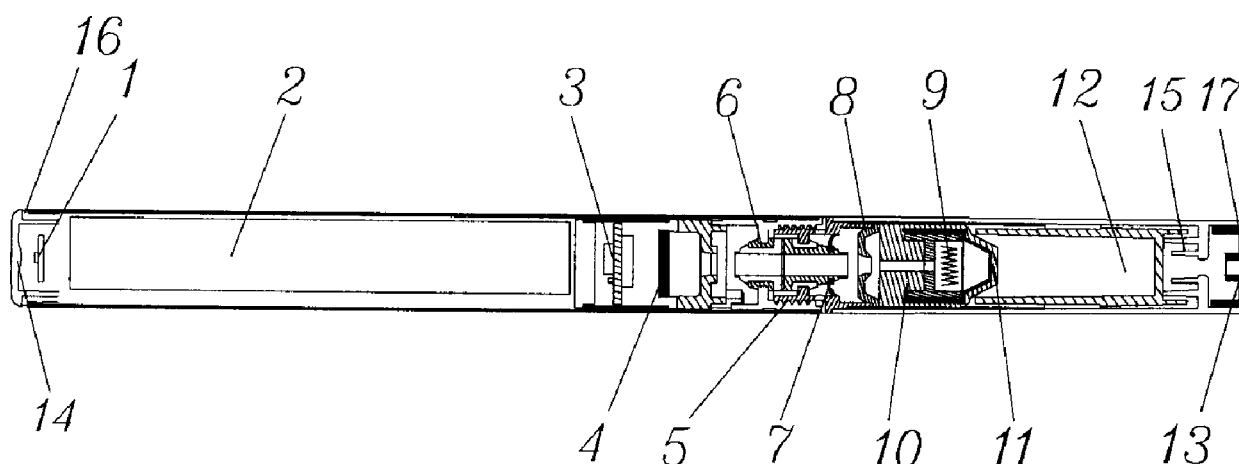
(51) Cl.Int./Int.Cl. *A61M 15/06* (2006.01),
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A61M 11/00 (2006.01), *B05B 17/06* (2006.01)

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(72) Inventeur/Inventor:
XIA, HAO RAN, CN

(54) Titre : CIGARETTE ELECTRONIQUE, ECOLOGIQUE ET NON COMBUSTIBLE A ATOMISEUR SERVANT DE
SUBSTITUT A LA CIGARETTE

(54) Title: ENVIRONMENTAL FRIENDLY, NON-COMBUSTIBLE, ATOMIZING ELECTRONIC CIGARETTE HAVING THE
FUNCTION OF A CIGARETTE SUBSTITUTE



(57) Abrégé/Abstract:

The present invention relates to an environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute, comprising a controller and an actuator removably connected. The interior of the controller has, from left to right, an indicating light cover, a signal indicating light, a rechargeable lithium battery, an integrated circuit board, an electret microphone, a hollow connecting conductor B; the interior of the actuator has, from left to right, a hollow connecting conductor A, a vibrating diaphragm, a liquid blocking film, a second liquid storage chamber, a heater, a liquid transmission mechanism, a liquid storage chamber, a soft mouthpiece; the connecting conductor A has air intake holes; a gap is left between the soft mouthpiece and the liquid storage chamber as an airflow passage; a space is left between the electret microphone and the connecting conductor B to allow the electret microphone's operation. This invention is smoker-, environmentally- friendly.



ABSTRACT

The present invention relates to an environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute, comprising a controller and an actuator removably connected. The interior of the controller has, from left to right, an indicating light cover, a signal indicating light, a rechargeable lithium battery, an integrated circuit board, an electret microphone, a hollow connecting conductor B; the interior of the actuator has, from left to right, a hollow connecting conductor A, a vibrating diaphragm, a liquid blocking film, a second liquid storage chamber, a heater, a liquid transmission mechanism, a liquid storage chamber, a soft mouthpiece; the connecting conductor A has air intake holes; a gap is left between the soft mouthpiece and the liquid storage chamber as an airflow passage; a space is left between the electret microphone and the connecting conductor B to allow the electret microphone's operation. This invention is smoker-, environmentally- friendly.

DESCRIPTION

TITLE OF THE INVENTION

Environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute.

BACKGROUND OF THE INVENTION

The present invention relates to a cigarette substitute and more particularly pertains to an environmental, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute.

Nowadays, though that "smoking is hazardous to health" has been the general knowledge commonly known by people, there are still over one billion smokers worldwide. The Department of Environmental Protection of the United States currently proclaims that tobacco smoke in the air is a Class A carcinogen. According to the data released by the World Health Organization and other departments, about 4.9 million people worldwide are killed each year due to smoking related diseases; however, for various reasons, it is a very difficult task to have a smoker quit smoking completely. The nicotine in tobacco is a chemical substance susceptible of making people addictive to smoking and difficult to quit. The experts of the Medical Society of the United States have pointed out that nicotine is one of the strongest and most forceful substances to make people addictive. Researchers have further determined how nicotine makes smokers addictive through the reactions in human brains. During smoking, alkaloid nicotine generates a large amount of tar droplets in cigarette burning, which enter alveoli and are rapidly absorbed, causing "euphoria", similar to that of stimulants, for example, a smoker experiences a giddy or an ecstatic feeling. Alkaloid nicotine is small molecular alkaloid, a small dosage is essentially harmless to people's body and the half-life in blood is quite short.

Nevertheless, tobacco also contains other harmful substances, namely, tar, carbon monoxide, benzopyrene, polynuclear aromatic hydrocarbons (PAHs), nitrosamine, AZO compounds and so on which are strong carcinogens of great hazards to human life and health.

As to find an instantaneous means to satisfy the tobacco dependency of smokers and to reduce the hazards of tobacco to the lowest, also not to change people's smoking habits, many smoking cessation products have small dosages of alkaloid nicotine incorporated therein, such as, nicotine patches, nicotine mouthwash, nicotine lozenges and so on. Although these products resolve the dependency *problem of smokers to a certain extent*, the usage method of these products are not compatible with the smoking habits of smokers. It is therefore difficult for smokers to accept them. There are also some smoking cessation products which have alkaloid medicated liquid passed through and heated in mechanical devices for smokers to smoke. Though this is more acceptable for smokers in respect of smoking habits, this easily causes losses to smokers due to the unstable properties of the conventional mechanical constructions, being prone to damage and complicated in operating. In order to minimize the change of smoking habits of smokers, some try to add activated carbon filters, liquid filters and other filtering devices on the bases of cigarettes, so as to reduce the hazards of cigarettes on human bodies to a certain extent. Some people try to construct apparatuses similar to the kind of oxygen inhaling apparatuses by means of large size machine apparatuses. Although the smokers' demands are resolved to a certain extent, the apparatuses are gigantic and are of high manufacturing cost. Many also require specific places and are not acceptable to smokers. The effects of smoking cessation are not satisfactory.

BRIEF SUMMARY OF THE INVENTION

In view of the aforesaid disadvantages now present in the prior arts, the object of the present invention is to provide an environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute, the external appearance of which similar to a cigarette, and is compact and easy to carry. It is of simple construction and low cost, compatible with smokers smoking habits, without tar, without carbon monoxide and other harmful substances, *thereby reducing carcinogenic risks, has no need to be lit, thus avoiding the hidden risk of fire calamities, and there is no environmental pollution of the inhaling smoke.*

To attain this, the present invention adopts the following technical proposal:

An environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute, comprising a controller and an actuator which are removably connected, wherein the interior of the controller is disposed with, from left to right, an indicating light cover 14, a signal indicating light 1, a rechargeable lithium battery 2, an integrated circuit board 3, an electret microphone 4 and a hollow connecting conductor B 6; the interior of the actuator is disposed with, from left to right, a hollow connecting conductor A 5, a vibrating diaphragm 7, a liquid blocking film 8, a second liquid storage chamber 10, a heater 9, a liquid transmission mechanism 11, a liquid storage chamber 12 and a soft mouthpiece 13; the connecting conductor A 5 is disposed with air intake holes 702; a gap is left between the soft mouthpiece 13 and the liquid storage chamber 12 as an airflow passage; a space is left between the electret microphone 4 and the connecting conductor B 6 to allow operation of the electret microphone 4.

On the basis of the abovementioned technical proposal, the connecting conductor B 6 and the connecting conductor A 5 are respectively disposed with coupling screw threads or locking grooves.

On the basis of the abovementioned technical proposal, the connecting conductor B 6 and the connecting conductor A 5 are connected by means of hollow contacting copper cap screw threads or by means of locking grooves.

On the basis of the abovementioned technical proposal, the outer surfaces of both the controller and the actuator are disposed with a stainless steel outer casing, the interior of the soft mouthpiece 13 is disposed with a liquid blocking groove 15, the outer end face of the soft mouthpiece 13 is disposed with a liquid blocking cover 17, the base end of the controller or the indicating light cover 14 is disposed with ventilating air holes 16.

On the basis of the abovementioned technical proposal, the interior of the stainless steel outer casing of the actuator is further disposed with an insulation layer.

On the basis of the abovementioned technical proposal, the integrated circuit board 3 comprises a control means IC1, the first pin of the control means IC1 is connected with one end of a capacitor C1, one end of a resistor R7, one end of a resistor R1 and a collector electrode of a transistor Q1 respectively, the other end of the resistor R7 is connected with a VCC (virtual channel connection) terminal, the emitting electrode of the transistor Q1 is connected with one end of a resistor R5 and the fourth pin of the control means IC1 respectively, the other end of the resistor R1 is connected with the base electrode of the transistor Q1 and one end of a resistor R2 respectively, the other end of the resistor R2 is connected with a K terminal and one end of a resistor R4 respectively, the other end of the resistor R4 is connected with the other end of the resistor R5, a GND (ground) terminal and a heater- terminal,

the second pin of the control means IC1 is connected with one end of a resistor R3, the other end of the resistor R3 is connector with a K terminal, the third pin of the control means IC1 is connected with a heater+ terminal and one end of a resistor R6 respectively, the other end of the resistor R6 is connected with a GND (ground) terminal, the fifth pin of the control means IC1 is connected with the cathode of an LED (light emitting diode) light D1 through an LE (light emitter) terminal, the anode of the LED light D1 is connected with one end of a resistor R8, the other end of the resistor R8 is connected with a GND terminal, the sixth pin of the control means IC1 is connected with the gate electrode of the MOS FET (metal-oxide-semiconductor field-effect transistor) Q2, the source electrode of the MOS FET Q2 is connected with a heater+ terminal, a drain electrode is connected with a power source VCC, the seventh pin of the control means IC1 is connected with an S terminal, the eighth pin of the control means IC1 is connected with the other end of the capacitor C1 and a GND terminal respectively, the heater- terminal is connected with the anode of the heater, the heater+ terminals are connected with the cathode of the heater, an on/off switch S1 is connected between the K terminal and the S terminal.

The environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute of the present invention has an external appearance similar to a cigarette, and is compact and easy to carry. It is of simple construction and low cost, compatible with smokers smoking habits, without tar, without carbon monoxide and other harmful substances, thereby reducing carcinogenic risks, has no need to be lit, thus avoiding the hidden risk of fire calamities, and there is no environmental pollution of the inhaling smoke.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a structural view of the environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute.

FIG. 2 is an exploded structural view of the environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute.

FIG. 3 is a structural view of the connecting conductor A, the connecting conductor B and the vibrating diaphragm.

FIG. 4 is a structural view of the liquid blocking film, the second liquid storage chamber, the heater and the liquid transmission mechanism.

FIG. 5 is a structural view showing the airflow circulation in the mouthpiece part and the construction of the soft mouthpiece.

FIG. 6 is a schematic circuit diagram of the integrated circuit board.

The markings on the drawings are: 1 is a signal indicating light, 2 is a rechargeable lithium battery, 3 is an integrated circuit board, 4 is an electret microphone, 5 is a connecting conductor A, 6 is a connecting conductor B, 7 is a vibrating diaphragm, 8 is a liquid blocking film, 9 is a heater, 10 is a second liquid storage chamber, 11 is a liquid transmission mechanism, 12 is a liquid storage chamber, 13 is a soft mouthpiece, 14 is an indicating light cover, 15 is a liquid blocking groove, 16 is a ventilating air hole, 17 is a liquid blocking cover.

DETAILED DESCRIPTION OF THE INVENTION

The preferred embodiment of the present invention is further described in detail with the following embodiment and the accompanying drawings.

FIG. 1 is a structural view of the environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute, FIG. 2 is

an exploded structural view of the environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute, comprising a controller and an actuator which are removably connected, wherein the interior of the controller is disposed with, from left to right, an indicating light cover 14, a signal indicating light 1, a rechargeable lithium battery 2, an integrated circuit board 3, an electret microphone 4 and a hollow connecting conductor B 6; the interior of the actuator is disposed with, from left to right, a hollow connecting conductor A 5, a vibrating diaphragm 7, a liquid blocking film 8, a second liquid storage chamber 10, a heater 9, a liquid transmission mechanism 11, a liquid storage chamber 12 and a soft mouthpiece 13; the connecting conductor A 5 is disposed with air intake holes 702; a gap is left between the soft mouthpiece 13 and the liquid storage chamber 12 as an airflow passage; a space is left between the electret microphone 4 and the connecting conductor B 6 to allow operation of the electret microphone 4. As illustrated in FIG. 1, the electret microphone 4 divides the controller into two independent cavities. The indicating light cover 14, the signal indicating light 1 and the rechargeable lithium battery 2 are inside the left side cavity. The electret microphone 4 and the connecting conductor B 6 are inside the right side cavity. The outcome that "the electret microphone 4 divides the controller into two separate cavities" can be attained by existing prior arts, while the preferred disposition is to tightly seal the gap between the electret microphone 4 and the outer casing of the controller with a soft plastic on the circumference of the electret microphone 4. As illustrated in FIGS. 1 and 2, the rechargeable lithium battery 2 is a built-in component. When the connecting conductor B 6 of the controller is connected with a charger, the rechargeable lithium battery 2 can immediately be recharged by means of the integrated circuit board 3. When the connecting conductor B 6 is connected with the

actuator through the connecting conductor A 5, an environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute is assembled. The signal indicating light 1 can simulate the glowing and dimming effect of a cigarette tip with each inhalation of a smoker. The signal indicating light 1 is electrically powered by the rechargeable lithium battery 2 by means of the integrated circuit board 3. The heater 9 is electrically powered by the rechargeable lithium battery 2 by means of the connecting conductor A 5, the connecting conductor B 6 and the integrated circuit board 3. The present invention operates as follows: when the present invention is used, the medicated liquid flows into the second liquid storage chamber 10 from the liquid storage chamber 12 by means of the liquid transmission mechanism 11. The heater 9 is enclosed in the liquid transmission mechanism 11 (refer to FIG. 4). Under the inhaling action of a smoker, airflow enters the actuator from the air intake holes 702 on the side of the actuator. The vibrating diaphragm 7 vibrates under the airflow action, and consequently, the electret microphone 4 also vibrates. The vibration is then converted into an on/off signal by the control means IC1 (refer to FIG. 6) on the integrated circuit board 3. The heater 9 starts to operate and the medicated liquid in the atomizing chamber of the heater 9 is atomized momentarily. The atomized medicated liquid is inhaled from by the smoker through the soft mouthpiece 13.

On the basis of the abovementioned technical proposal, the connecting conductor B 6 and the connecting conductor A 5 are respectively disposed with coupling screw threads or locking grooves. The controller and the actuator are connected by means of the connection between the connecting conductor B 6 and the connecting conductor A 5. Other than the connection method by screw threads and locking grooves, the connection can be attained by applying other prior arts. On

the basis of the abovementioned technical proposal, the connecting conductor B 6 and the connecting conductor A 5 are connected by means of hollow contacting copper cap screw threads or by means of locking grooves. When the controller and the actuator are connected by means of the connection between the connecting conductor B 6 and the connecting conductor A 5, an integrated body having a shape similar to a cigarette is assembled.

On the basis of the abovementioned technical proposal, for safety, aesthetic and convenient use, the outer surfaces of both the controller and the actuator are disposed with a stainless steel outer casing, the interior of the soft mouthpiece 13 is disposed with a liquid blocking groove 15, the outer end face of the soft mouthpiece 13 is disposed with a liquid blocking cover 17, the base end of the controller or the indicating light cover 14 is disposed with ventilating air holes 16. The application of the liquid blocking groove 15 and the liquid blocking cover 17 is to prevent the medicated liquid from being inhaled into the mouth. The application of ventilating air holes 16 is to ensure good heat radiation of the left side cavity of the controller.

On the basis of the abovementioned technical proposal, the interior of the stainless steel outer casing of the actuator is further disposed with an insulation layer. The purpose is to prevent the hidden safety problem caused by the high temperature of the heater 9.

On the basis of the abovementioned technical proposal, the integrated circuit board 3 comprises the control circuit of the entire system. The electronic time delay function, the electronic clearance reset function are attained by software programs. It also comprises a heater driving circuit and a control means IC1. The integrated circuit board 3 receives a signal of the electret microphone 4, sends it to

the control means IC1 for analysis and processing. Thereafter, the signal is converted to a control signal to control the heater. Simultaneously, the control means IC1 further sends out a glowing and dimming control signal to the signal indicating light 1. The entire circuit is simple and practical and can be attained by applying prior arts accordingly to functional needs.

The biological and physical phenomena of the current chip technology, biology and microelectronics and so on provide the technical bases for the present invention. The advantages of the present invention are: smoking without tar, carbon monoxide and other harmful substances, thereby substantially reducing the carcinogenic risk while smokers still have the smoking feeling; no need to lit and therefore no fire hazard. The inhaling smoke is actually the water vapor of the vaporized medicated liquid, and has no environmental pollution. A low and weak electricity level of 4.2 volts is used to supply electricity and power consumption is low. No combusted substance is generated in its operation. No cigarette ash, no fire, no hidden fire hazards, and is therefore easily acceptable to the general public.

The present invention is further described in detail with the embodiment described in FIGS. 3 to 6.

FIG. 3 is a structural view of the connecting conductor A 5, the connecting conductor B 6 and the vibrating diaphragm 7. As illustrated in the figure, the side of the connecting conductor A 5 is disposed with air intake holes 702. The air intake holes 702 connect the hollow part of the connecting conductor A 5 and the outer part of the actuator. The right side of the connecting conductor A 5 is disposed with a vibrating diaphragm 7 which can cover the air intake holes 702 and strengthen and extend the airflow vibration. When a smoker inhales, airflow enters from the air intake holes 702, driving the vibrating diaphragm to vibrate, which in turn results in

the vibration in the hollow part 606 of the connecting conductor B 6. This causes the electret microphone 4 to send out a low frequency signal. The control means IC1 on the integrated circuit board examines and analyses the low frequency signal and the heater 9 starts to operate in correspondence with the inhalation of the smoker. When the inhaling force of a smoker is reduced, the vibrating diaphragm 7 ceases to vibrate and the airflow passage between the air intake holes 702 and the actuator is cut off by the vibrating diaphragm 7. The electret microphone ceases to operate and the control means IC1 receives no low frequency signal. The heater 9 therefore ceases to operate. Under the action of small airflow, the heater 9 is being connected and cut off, i.e. control of the immediate heating of the heater 9 is attained. The vibrating diaphragm 7 can be made of rubber or silicon. As illustrated in FIG. 3, the connecting conductor A 5 and the connecting conductor B 6 form a connected outer circumference by an interior screw thread 602 and an exterior screw thread 604 respectively. The anode of the input conductive wire which is which is connected to the heater through the screw threads is connected with the rechargeable lithium battery 2 through the integrated circuit board 3. The cathode of the input conductive wire which is connected to the heater through two hollow cylindrical conductors 601, 603 is connected with the rechargeable lithium battery 2 through the integrated circuit board 3. Insulating material rings 605 are used between the cathodes 601, 603 and the anodes 602, 604. In the present embodiment, the insulating material rings 605 can be made of silicon or rubber, and can also be made of other insulating materials. When the connecting conductor B 6 and the connecting conductor A 5 are connected by means of hollow contacting copper cap screw threads or by means of locking grooves, attention has also to be paid to the insulation issue of the cathodes and the anodes and can be attained by existing prior arts.

FIG. 4 is a structural view of the liquid blocking film 8, the second liquid storage chamber 10, the heater 9 and the liquid transmission mechanism 11. As illustrated in the figure, the heater 9 comprises an atomizing chamber disposed with a heating filament 901 and an outer heat insulation base 902. The base part and the side of the heat insulation base 902 are disposed with an ejecting hole 904 and overflow holes 903 respectively. The heating filament 901 can be made of platinum filament, nickel-chrome alloy or iron-chrome-aluminum alloy filament containing rare earth elements. It can also be made into a film-shaped or a ring-shaped body. The heat insulation base 902 can be made of ceramics and so on. The right side of the heater is disposed with the liquid transmission mechanism 11. The liquid transmission mechanism 11 is formed by a mounting frame 1101 and a liquid transmission means 1102. The mounting frame 1101 services a fixation function. The liquid transmission means 1102 is made of a multi-layer nickel foam mesh or other porous metal bodies. The liquid transmission means 1102 can also be made of stainless steel fiber mat, high molecular polymer foam or ceramic foam. The left side of the heater 9 is the second liquid storage chamber 10. The second liquid chamber 10 is constructed by filling multi-layer nickel foam mats into the base part and the periphery of the heat insulation base 902. One end of the liquid transmission mechanism 11 is connected with the second liquid storage chamber 10 by means of the liquid transmission means 1102, while the other end is in contact with the liquid storage chamber 12. The second liquid storage chamber 10 temporarily stores the medicated liquid and the liquid blocking film 8 prevents the medicated liquid in the second liquid storage chamber 10 from flowing out, thereby avoiding the medicated liquid to flow into the controller, thus affecting the circuit. The operating mechanism is as follows: Under the action of the airflow, liquid droplets are drawn into the other

side of the heat insulation base 902 through the ejecting hole 904 on the heat insulation base 902. Under the action of the heating filament 901, the liquid is atomized momentarily and flows out of the heater 9 from the overflow holes 903. It then flows through the airflow passage gap between the soft mouthpiece and the liquid storage chamber 12 to the soft mouthpiece 13 and is finally being inhaled through the soft mouthpiece.13.

FIG. 5 is a structural view showing the airflow circulation in the mouthpiece part and the construction of the soft mouthpiece 13. As illustrated in the figure, the soft mouthpiece 13 is disposed on the outer end face of the actuator. Its soft silicon has a very good mouth feel and allows slight chewing. The interior side of the soft mouthpiece 13 is further disposed with a liquid blocking groove 15 made of soft silicon to prevent liquid from being drawn into the mouth. The exterior side 1301 of the soft mouthpiece 13 extends to the base part of the liquid blocking film 8. It can be made of environmentally friendly material such as polypropylene and effectively prevents the release of internal heat. The soft mouthpiece 13 is further disposed with a liquid blocking cover 17 made of soft silicon to prevent liquid from being drawn into the mouth. The liquid blocking groove 15 is in contact with one end of the liquid storage chamber 12. The liquid storage chamber 12 is a tubular body with an opening on one end. It is first disposed with medicinal cotton fibers and then filled with raw medicated liquid. By means of capillary action of the liquid transmission mechanism 11, the medicated liquid in the liquid storage chamber 12 is induced into the second liquid storage chamber 10. As illustrated in the figure, the atomized medicated liquid flowing out from the overflow holes 903 flows through the airflow passage gap between the soft mouthpiece and the liquid storage chamber 12 to the

liquid blocking groove 15, and then flows to the liquid blocking cover 17, and is finally being inhaled into the mouth of a smoker.

The integrated circuit board 3 comprises the control circuit of the entire system. The electronic time delay function, the electronic clearance reset function are attained by software programs. It also comprises a heater driving circuit and a control means IC1. FIG. 6 is a schematic circuit diagram of the integrated circuit board 3. As illustrated in the figure, the integrated circuit board 3 is controlled by the control means IC1. The control means IC1 is a core intelligent control unit and is mainly responsible for receiving and differentiating input signals, controlling the signal indicating light and the heater 9. The entire device uses a 3.7V lithium battery to supply electricity. VCC represents connecting to the cathode of the battery and GND represents connecting to the anode of the battery. In the figure, the two terminals S, K are connected with the cathode and the anode of the electret microphone. The control signal provided by the electret microphone can be regarded as on/off signal provided by an on/off switch S1. The control means IC1 detects the battery voltage at 10-second intervals. It first determines if the voltage of the power source is higher than 3.3V. If yes, after the signal sent out by the electret microphone is being analyzed, the signal which conforms with specification is converted to an on/off signal. The control signal is output to the heater driving circuit. The transistor amplifies the output signal of the control means IC1. The heating filament is connected with the power supply to generate heat and the heater operates and momentarily heats the liquid alkaloid nicotine. Simultaneously it outputs signals causing the LED emit red or orange light, resembling the lighted tip of a cigarette. It can also output time delay signals to cause the LED light to gradually glow or dim, thereby making the simulated cigarette tip even more similar to a real cigarette. If the

battery voltage is lower than 3.3V, the electret microphone is turned off. The heater 9 does not operate. When the entire device is not active, the control means IC1 enters a sleeping mode and the power consumption of the entire device is less than 15uA. The standby time of the entire device extended, as far as possible, to two and half years' theoretical standby time. When a user continuously uses the present device for 15 times in one minute, the control means IC1 will send out a signal to cut off the output of the heating circuit and simultaneously output a signal to the LED indicating light so that it flashes for 10 seconds. When S1 is continuously connected for more than 6 seconds, the heating circuit is cut off automatically and a signal is simultaneously sent to the LED and so on. The control means IC1 can further be installed with other programmers to attain even more functions and to provide convenience for revisions and improvements of subsequent inventions. The present invention can also be connected with an LCD monitor at a signal output terminal to display more information. The present invention uses the control means IC1 to control the operating processes to ensure the reliability in the operation of an electronic cigarette and to ensure better smoking feeling. The control means IC1 can be attained by applying prior arts, for example, the existing microcontrollers can be selected as the control means IC1. Provided that the basic functions above can be attained, there is no restriction in detail on the selection of the microcontroller. The inhaled "smoke" of the present invention is in fact the "water vapor" of the atomized medicated liquid which does not contain tar, carbon monoxide, benzopyrene, polynuclear aromatic hydrocarbons (PAHs), nitrosamine, AZO compounds and so on which are strong carcinogens. The "water vapor" is liquefied rapidly in the air and does not pollute the environment. The heating part is heated momentarily under low voltage and low current and there is no combustion and

therefore no hidden fire hazard. The outer casing is made of a special type of stainless steel which can effectively shield electromagnetic waves. To further describe in detail, the first pin of the control means IC1 is connected with one end of a capacitor C1, one end of a resistor R7, one end of a resistor R1 and a collector electrode of a transistor Q1 respectively, the other end of the resistor R7 is connected with a VCC (virtual channel connection) terminal, the emitting electrode of the transistor Q1 is connected with one end of a resistor R5 and the fourth pin of the control means IC1 respectively, the other end of the resistor R1 is connected with the base electrode of the transistor Q1 and one end of a resistor R2 respectively, the other end of the resistor R2 is connected with a K terminal and one end of a resistor R4 respectively, the other end of the resistor R4 is connected with the other end of the resistor R5, a GND (ground) terminal and a heater- terminal, the second pin of the control means IC1 is connected with one end of a resistor R3, the other end of the resistor R3 is connected with a K terminal, the third pin of the control means IC1 is connected with a heater+ terminal and one end of a resistor R6 respectively, the other end of the resistor R6 is connected with a GND (ground) terminal, the fifth pin of the control means IC1 is connected with the cathode of an LED (light emitting diode) light D1 through an LE (light emitter) terminal, the anode of the LED light D1 is connected with one end of a resistor R8, the other end of the resistor R8 is connected with a GND terminal, the sixth pin of the control means IC1 is connected with the gate electrode of the MOS FET (metal-oxide-semiconductor field-effect transistor) Q2, the source electrode of the MOS FET Q2 is connected with a heater+ terminal, a drain electrode is connected with a power source VCC, the seventh pin of the control means IC1 is connected with an S terminal, the eighth pin of the control means IC1 is connected with the other end of the capacitor C1 and a GND terminal

respectively, the heater- terminal is connected with the anode of the heater, the heater+ terminals are connected with the cathode of the heater, an on/off switch S1 is connected between the K terminal and the S terminal.

The world's smallest 8-bit microcontroller PIC12C5xx series, manufactured by Microchip, can be selected for the control means IC1.

The present invention operates as follows: after the controller and the actuator are connected by means of the connecting conductors A, B, an environmental friendly, non-combustible, atomizing electronic cigarette is assembled. When a smoker inhales, airflow enters the actuator through the air intake holes on the side of the connecting conductor A 5, through the vibrating diaphragm, the liquid blocking film, the heater, and is finally inhaled from the mouthpiece. A passage hole is disposed on the connecting conductors of the controller and the actuator. When a smoker inhales, the airflow inside the controller flows towards the actuator, thereby activating the control circuit. The side of the indicating light cover on the other side of the controller, is also disposed with ventilating air holes, so part of the battery cavity is in communication with the atmospheric pressure. As such, under the action of the air vibration on the side of the controller, the electret microphone sends out a low frequency signal. IC1 analyzes the vibrating properties, sends out an on/off signal, thereby connecting the electric current. At this time, the indicating light slowly glows under the control of IC1, and simultaneously current flows through the connecting conductors, causing the heater to operate. Due to the airflow action in the heating chamber, the medicated liquid is injected into the atomizing chamber in the form of microscopic droplets. The medicated liquid is momentarily atomized by the action of the heater. After atomization, droplets of large diameter adhere to the wall and are reabsorbed by the liquid transmission mechanism through the overflow holes under

an eddy action, while droplets of small diameter are suspended and floated in the airflow forming water vapor which is inhaled through the atomized steam passage and mouthpiece.

The abovementioned illustration is merely the preferred embodiment of the present invention and the scope of protection of the present invention is not limited thereto. Within the scope of the disclosure of the present invention, other variations may easily be effected by persons skilled in the art and should be covered by the scope of protection of the present invention.

CLAIMS

1. An environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute, comprising a controller and an actuator which are removably connected, wherein the interior of the controller is disposed with, from left to right, an indicating light cover (14), a signal indicating light (1), a rechargeable lithium battery (2), an integrated circuit board (3), an electret microphone (4) and a hollow connecting conductor B (6); the interior of the actuator is disposed with, from left to right, a hollow connecting conductor A (5), a vibrating diaphragm (7), a liquid blocking film (8), a second liquid storage chamber (10), a heater (9), a liquid transmission mechanism (11), a liquid storage chamber (12) and a soft mouthpiece (13); the connecting conductor A (5) is disposed with air intake holes (702); a gap is left between the soft mouthpiece (13) and the liquid storage chamber (12) as an airflow passage; a space is left between the electret microphone (4) and the connecting conductor B (6) to allow operation of the electret microphone (4).

2. An environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute as in Claim 1, wherein the connecting conductor B (6) and the connecting conductor A (5) are respectively disposed with coupling screw threads or locking grooves.

3. An environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute as in Claim 2, wherein the connecting conductor B (6) and the connecting conductor A (5) are connected by means of hollow contacting copper cap screw threads or by means of locking grooves.

4. An environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute as in Claim 1 or 2 or 3, wherein the outer surfaces of both the controller and the actuator are disposed with a stainless steel outer casing, the interior of the soft mouthpiece (13) is disposed with a liquid blocking groove (15), the outer end face of the soft mouthpiece (13) is disposed with a liquid blocking cover (17), the base end of the controller or the indicating light cover (14) is disposed with ventilating air holes (16).

5. An environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute as in Claim 4, wherein the interior of the stainless steel outer casing of the actuator is further disposed with an insulation layer.

6. An environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute as in Claim 1 or 2 or 3, wherein the integrated circuit board (3) comprises a control means IC1, the first pin of the control means IC1 is connected with one end of a capacitor C1, one end of a resistor R7, one end of a resistor R1 and a collector electrode of a transistor Q1 respectively, the other end of the resistor R7 is connected with a VCC (virtual channel connection) terminal, the emitting electrode of the transistor Q1 is connected with one end of a resistor R5 and the fourth pin of the control means IC1 respectively, the other end of the resistor R1 is connected with the base electrode of the transistor Q1 and one end of a resistor R2 respectively, the other end of the resistor R2 is connected with a K terminal and one end of a resistor R4 respectively, the other end of the resistor R4 is connected with the other end of the resistor R5, a GND (ground) terminal and a heater- terminal, the second pin of the control means IC1 is connected with one end of a resistor R3, the other end of the resistor R3 is connector with a K terminal, the

third pin of the control means IC1 is connected with a heater+ terminal and one end of a resistor R6 respectively, the other end of the resistor R6 is connected with a GND (ground) terminal, the fifth pin of the control means IC1 is connected with the cathode of an LED (light emitting diode) light D1 through an LE (light emitter) terminal, the anode of the LED light D1 is connected with one end of a resistor R8, the other end of the resistor R8 is connected with a GND terminal, the sixth pin of the control means IC1 is connected with the gate electrode of the MOS FET (metal-oxide-semiconductor field-effect transistor) Q2, the source electrode of the MOS FET Q2 is connected with a heater+ terminal, a drain electrode is connected with a power source VCC, the seventh pin of the control means IC1 is connected with an S terminal, the eighth pin of the control means IC1 is connected with the other end of the capacitor C1 and a GND terminal respectively, the heater- terminal is connected with the anode of the heater, the heater+ terminals are connected with the cathode of the heater, an on/off switch S1 is connected between the K terminal and the S terminal.

7. An environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute as in Claim 4, wherein the integrated circuit board (3) comprises a control means IC1, the first pin of the control means IC1 is connected with one end of a capacitor C1, one end of a resistor R7, one end of a resistor R1 and a collector electrode of a transistor Q1 respectively, the other end of the resistor R7 is connected with a VCC (virtual channel connection) terminal, the emitting electrode of the transistor Q1 is connected with one end of a resistor R5 and the fourth pin of the control means IC1 respectively, the other end of the resistor R1 is connected with the base electrode of the transistor Q1 and one end of a resistor R2 respectively, the other end of the resistor R2 is connected with a K

terminal and one end of a resistor R4 respectively, the other end of the resistor R4 is connected with the other end of the resistor R5, a GND (ground) terminal and a heater- terminal, the second pin of the control means IC1 is connected with one end of a resistor R3, the other end of the resistor R3 is connected with a K terminal, the third pin of the control means IC1 is connected with a heater+ terminal and one end of a resistor R6 respectively, the other end of the resistor R6 is connected with a GND (ground) terminal, the fifth pin of the control means IC1 is connected with the cathode of an LED (light emitting diode) light D1 through an LE (light emitter) terminal, the anode of the LED light D1 is connected with one end of a resistor R8, the other end of the resistor R8 is connected with a GND terminal, the sixth pin of the control means IC1 is connected with the gate electrode of the MOS FET (metal-oxide-semiconductor field-effect transistor) Q2, the source electrode of the MOS FET Q2 is connected with a heater+ terminal, a drain electrode is connected with a power source VCC, the seventh pin of the control means IC1 is connected with an S terminal, the eighth pin of the control means IC1 is connected with the other end of the capacitor C1 and a GND terminal respectively, the heater- terminal is connected with the anode of the heater, the heater+ terminals are connected with the cathode of the heater, an on/off switch S1 is connected between the K terminal and the S terminal.

8. An environmental friendly, non-combustible, atomizing electronic cigarette having the function of a cigarette substitute as in Claim 5, wherein the integrated circuit board (3) comprises a control means IC1, the first pin of the control means IC1 is connected with one end of a capacitor C1, one end of a resistor R7, one end of a resistor R1 and a collector electrode of a transistor Q1 respectively, the other end of the resistor R7 is connected with a VCC (virtual channel connection)

terminal, the emitting electrode of the transistor Q1 is connected with one end of a resistor R5 and the fourth pin of the control means IC1 respectively, the other end of the resistor R1 is connected with the base electrode of the transistor Q1 and one end of a resistor R2 respectively, the other end of the resistor R2 is connected with a K terminal and one end of a resistor R4 respectively, the other end of the resistor R4 is connected with the other end of the resistor R5, a GND (ground) terminal and a heater- terminal, the second pin of the control means IC1 is connected with one end of a resistor R3, the other end of the resistor R3 is connector with a K terminal, the third pin of the control means IC1 is connected with a heater+ terminal and one end of a resistor R6 respectively, the other end of the resistor R6 is connected with a GND (ground) terminal, the fifth pin of the control means IC1 is connected with the cathode of an LED (light emitting diode) light D1 through an LE (light emitter) terminal, the anode of the LED light D1 is connected with one end of a resistor R8, the other end of the resistor R8 is connected with a GND terminal, the sixth pin of the control means IC1 is connected with the gate electrode of the MOS FET (metal-oxide-semiconductor field-effect transistor) Q2, the source electrode of the MOS FET Q2 is connected with a heater+ terminal, a drain electrode is connected with a power source VCC, the seventh pin of the control means IC1 is connected with an S terminal, the eighth pin of the control means IC1 is connected with the other end of the capacitor C1 and a GND terminal respectively, the heater- terminal is connected with the anode of the heater, the heater+ terminals are connected with the cathode of the heater, an on/off switch S1 is connected between the K terminal and the S terminal.

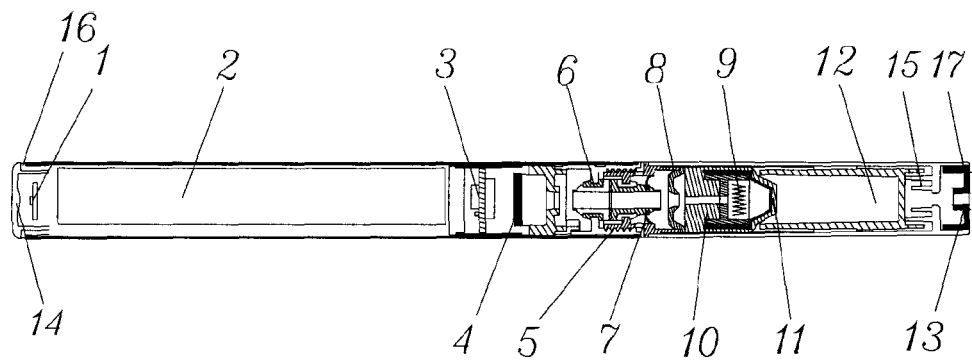


FIG. 1

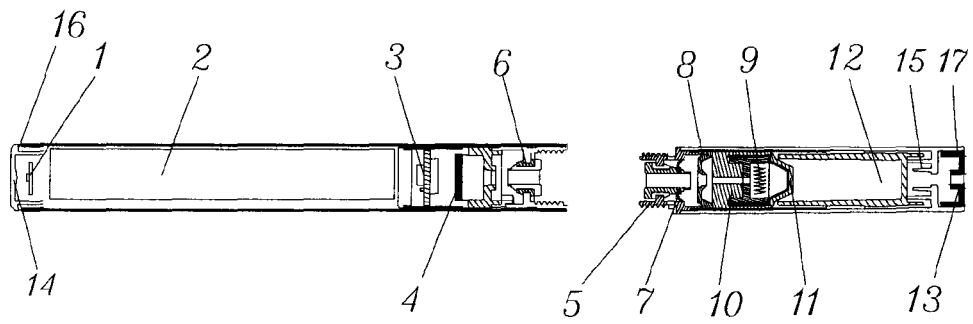


FIG. 2

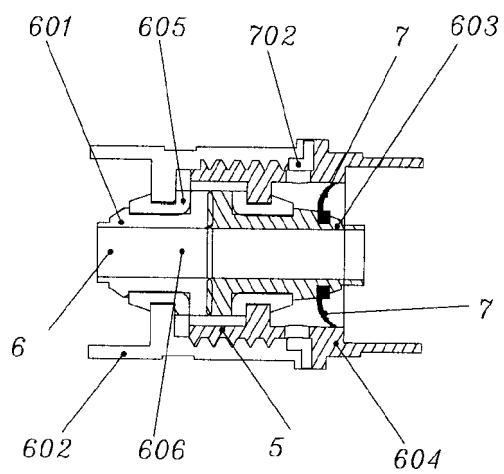


FIG. 3

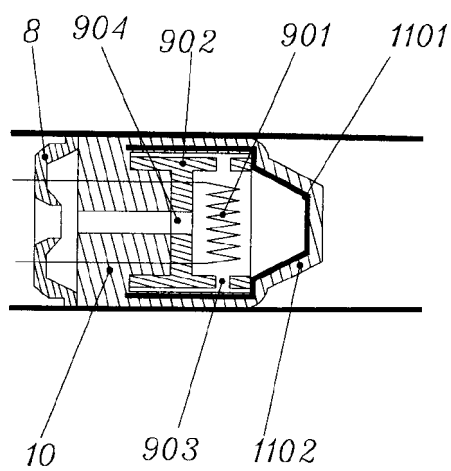


FIG. 4

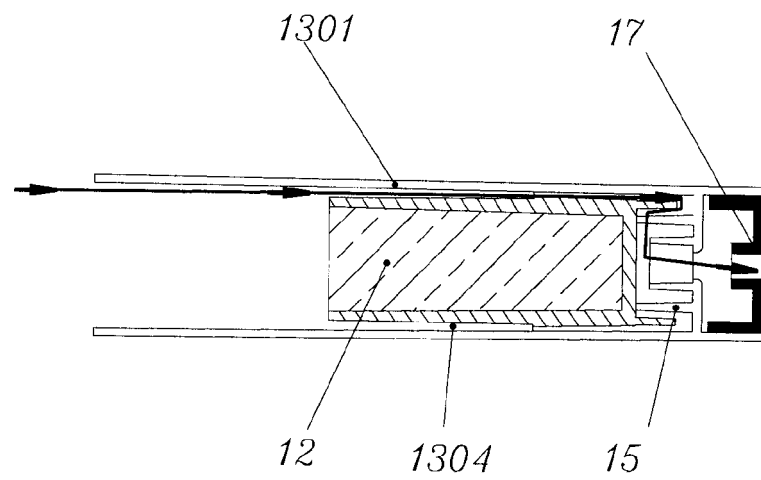


FIG. 5

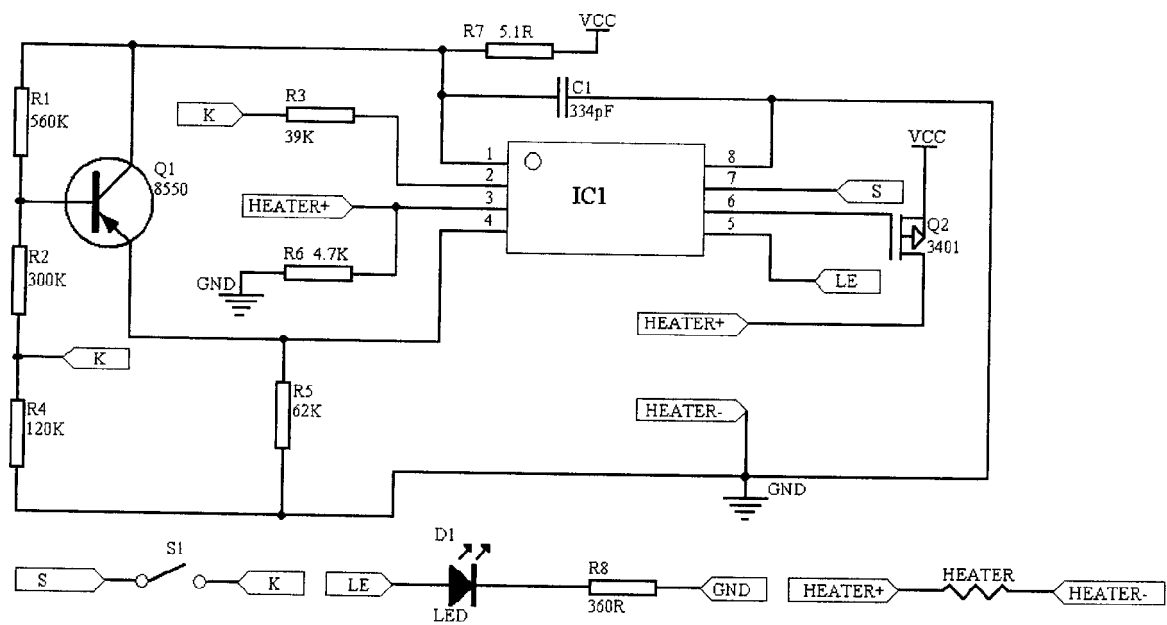


FIG. 6

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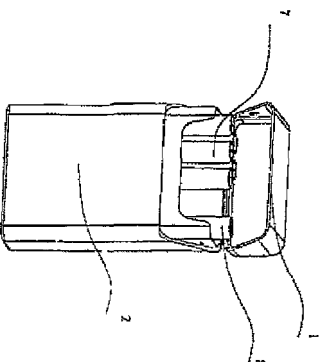
权利要求书 2 页 说明书 8 页 附图 5 页

(54) 发明名称

仿真电子烟及其烟盒

(57) 摘要

本发明提供了一种仿真电子烟及其烟盒,仿真电子烟包括:烟嘴、液体承载器、雾化器以及烟杆,雾化器包括:雾化器套管,具有中空腔体且设置于烟嘴的壳体中;耐高温绝缘体,设置于雾化器套管内且内设置有雾化腔;雾化头,连接于所述耐高温绝缘体的外周面上,与液体承载器相接并导流液体;多孔渗透件,设置于雾化头以及所述耐高温绝缘体的外周面上;电热丝,容置于雾化腔内,电连接于烟杆管内的电池及控制电路;以及吸附体,容置于所述雾化腔内,缠绕于电热丝上且与多孔渗透件连接;雾化器套管、耐高温绝缘体、雾化头及烟杆管均设置有与出烟孔形成气流通路的通气开孔。由此,提高了雾化液使用效率并防止泄露、简化工作控制及充电电池的充电方式。



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1. 一种仿真电子烟,其包括:
烟嘴,包括壳体并设有出烟孔;
液体承载器,设置于所述烟嘴内并承载有液体,且所述液体承载器与所述出烟孔气体连通;
雾化器,可拆装地连接于所述液体承载器;以及
烟杆,包括可拆卸地连接于所述雾化器上的烟杆管以及设置在所述烟杆管内的充电电池及控制电路;
其特征在于,所述雾化器包括:
雾化器套管,具有中空腔体且设置于所述烟嘴的壳体中;
耐高温绝缘体,设置于所述雾化器套管内且内设置有雾化腔;
雾化头,连接于所述耐高温绝缘体的外周面上,并与所述液体承载器相连接并导流所述液体;
多孔渗透件,设置于所述雾化头以及所述耐高温绝缘体的外周面上;
电热丝,容置于所述雾化腔内,且电连接于所述充电电池和所述控制电路;以及
吸附体,容置于所述雾化腔内,缠绕于所述电热丝上且与所述多孔渗透件连接;
其中,所述雾化器套管、所述耐高温绝缘体、所述雾化头以及所述烟杆管均设置有与所述出烟孔形成气体通路的通气开孔。
2. 如权利要求1所述的仿真电子烟,其特征在于,所述烟杆设置有与外界空气连通并与所述雾化器套管的通气开孔连通的开孔,所述控制电路包括有可选择地与所述充电电池电连通的气压电子开关。
3. 如权利要求1所述的仿真电子烟,其特征在于,所述的雾化头形成有可刺穿所述液体承载器以使所述多孔渗透件与所述液体形成液体连通的突出部。
4. 如权利要求1所述的仿真电子烟,其特征在于,所述仿真电子烟还包括有设置于所述烟杆端部的可拆装的透光灯帽,所述烟杆内设置有与所述控制电路以及所述充电电池电连接的灯。
5. 如权利要求2所述的仿真电子烟,其特征在于,所述烟杆还包括与所述控制电路以及所述充电电池的正负极分别电连接的正极顶杆以及负极顶杆,所述正极顶杆以及负极顶杆在所述仿真电子烟工作时电连接于所述加热丝的正负极而在所述仿真电子烟充电时与外部电源的正负极电连接。
6. 如权利要求2所述的仿真电子烟,其特征在于,所述仿真电子烟还包括设置于所述烟杆端部的可拆装的透光灯帽,所述烟杆内设置有与所述控制电路以及所述电池电连接的充电指示灯。
7. 如权利要求5所述的仿真电子烟,其特征在于,所述雾化器还包括与所述电热丝以及所述电池和控制电路形成电连接的且固定于所述雾化器套管内的正极弹簧和负极弹簧。
8. 如权利要求1所述的仿真电子烟,其特征在于,所述多孔渗透件为镍网,所述吸附体为玻纤绳。
9. 如权利要求1所述的仿真电子烟,其特征在于,所述烟杆还包括有与所述充电电池电连接的且在吸烟时与所述电热丝电连接的插头或USB插口。
10. 一种仿真电子烟烟盒,其特征在于,包括:

外壳体,包括烟盒盖和烟盒本体,烟盒盖和烟盒本体形成外壳体容置腔,且烟盒盖和烟盒本体在后表面上连成一体而在前表面以及侧向两侧上分开,烟盒本体前表面外侧设置有与烟盒盖的下边沿相配合的配合部;

内壳体,容置在外壳体的烟盒本体内;

烟弹容置部,设置在内壳体的上部;

电子烟充电容置部,设置在内壳体的上部,容置权利要求 1-8 所述的仿真电子烟;

以及电子烟充电部,设置在内壳体中,且包括彼此电连接的充电控制电路、与电子烟电连接的充电接口、以及与外界电源连接的接口;

其中,烟盒本体前表面的上部内侧或内壳体的上部设置有凹形边,所述凹形边的底边高于配合部的上边沿,烟弹容置部的顶部平齐于或低于所述凹形边的底边,烟充电容置部的顶部平齐于或低于所述凹形边的底边。

11. 如权利要求 10 所述的仿真电子烟烟盒,其特征在于,所述烟弹容置部沿着内壳体的长度方向设置成一排或两排,烟充电容置部沿着内壳体的长度方向与所述烟弹容置部对齐。

12. 如权利要求 11 所述的仿真电子烟烟盒,其特征在于,所述仿真电子烟可拆卸式,所述仿真电子烟烟盒还包括设置在所述内壳体上部的将不带有充电电池的电子烟部分进行容置的烟嘴容置部,所述烟嘴容置部设置成:该烟嘴容置部的顶表面平齐于或低于所述凹形边的底边、所述烟嘴容置部沿着内壳体的长度方向与所述烟弹容置部对齐、且插入烟嘴容置部后的所述不带有充电电池的电子烟部分的顶部与插置的烟弹的顶部平齐。

13. 如权利要求 12 所述的仿真电子烟烟盒,其特征在于,所述充电接口设置成:电子烟的充电部分通过所述电子烟充电容置部插入到所述充电接口之后,使得插置后的所述电子烟的充电部分的顶部与插置后的烟弹的顶部平齐。

14. 如权利要求 13 所述的仿真电子烟烟盒,其特征在于,所述充电接口为螺接或插接接口。

15. 如权利要求 11 所述的仿真电子烟烟盒,其特征在于,所述仿真电子烟烟盒还包括设置在所述内壳体上部的备用电子烟容置部,所述备用电子烟容置部设置成:该备用电子烟容置部的顶表面平齐于或低于所述凹形边的底边、所述备用电子烟容置部沿着内壳体的长度方向与所述烟弹容置部对齐、且该备用电子烟插入备用电子烟容置部后的该备用电子烟的顶部与插置后的烟弹的顶部平齐。

16. 如权利要求 10 所述的仿真电子烟烟盒,其特征在于,所述电子烟充电部与外界电源连接的接口为设置在内壳体下部的可露出到烟盒本体外的 USB 插口或插头。

17. 如权利要求 16 所述的仿真电子烟烟盒,其特征在于,所述 USB 插口或插头设置在内壳体的下部且连接有导出装置,且在内壳体及烟盒本体的底部向下或向侧面设置有供所述 USB 插口或插头移动并从外壳体中露出的槽孔。

18. 如权利要求 10 所述的仿真电子烟烟盒,其特征在于,所述电子烟充电部还包括设置在内壳体的外表面上的充电指示灯,且在所述烟盒本体上的相应位置上设置有通孔。

19. 如权利要求 10 所述的仿真电子烟烟盒,其特征在于,所述烟盒本体在所述电子烟充电部的与外界电源连接的接口部位处设置有撕掉以露出所述接口部位的易撕毁部。

仿真电子烟及其烟盒

技术领域

[0001] 本发明涉及一种仿真电子烟及其烟盒,特别涉及一种提高雾化液的使用效率并有效地防止泄露的仿真电子烟及其具有充电功能的仿真电子烟烟盒。

背景技术

[0002] 吸烟有害健康是一种公知常识,吸烟每年造成数百万人的死亡,并引发多种疾病,戒烟是一种全球化的趋势,各国政府都在积极倡导戒烟,但让吸烟者戒烟是一种非常困难的事情,且烟民的数量在全球呈增长的趋势,首次吸烟烟民的年龄越来越小。另外,随着烟民数量的增加,全球每年需要的烟叶量也在增长,需要使用大量的耕地来种植烟叶,满足烟厂生产卷烟的需求,虽然烟草行业能够为政府带来巨额的税收,但对全民健康会造成巨大的隐患,特别是对于非烟民来说,二手烟造成的危害更大。

[0003] 为了避免吸烟造成的危害,世界各国的研究人员都在努力寻找香烟的替代品,首先制造出了低烟碱含量和低焦油含量的卷烟,但低烟碱含量和低焦油含量的卷烟对于吸烟者来说,口感淡没有味道,烟民不喜欢;其次,研究人员研发了很多卷烟的替代品,如戒烟贴、烟碱口香糖、烟碱饮料等,这些产品虽然不包含焦油,又具有烟的口感,但这些产品改变了吸烟者的习惯,也解决不了烟瘾上来时烟民过瘾的问题,因此,不能够被称为真正的香烟替代品;第三,研究人员推出了电子烟产品,依靠其设计的电路,瞬间将放置于烟嘴中的液体雾化,产生烟雾,而烟嘴中液体的配方可以按照需求和口感的要求进行配制,能够解决烟民的需求。目前电子烟产品存在的主要问题是:1、产品结构复杂,如 CN201197839Y 和 CN201079011Y 的结构;2、采用电池充电或电网的 220v 交流电来进行充电,电池的更换会给使用者带来不便,交流电属于强电,对于电子烟的限压、稳压要求高,并可能造成短路,使电子烟产品不能使用;3、液体的雾化采用的是喷射雾化和超声波雾化,这种雾化方式对烟嘴中液体的流出不易控制,会产生漏液的问题,例如 CN201197839Y 和 CN201079011Y 就可能存在着这个问题;4、在现有的电子烟产品中,采用的是气动膜指南针式点火开关,该开关结构复杂,采用金属片进行接触,使用一段时间后会造接触效果不好,影响使用。

[0004] 尽管上述现有技术提供了电子烟的结构,但是电子烟缺乏与之配套的烟盒,目前使用的烟盒体积较大,携带和使用不便,制约了电子烟市场的发展。尽管 CN201094280Y 在电子烟烟盒方面给出的研究,提出了采用各种内置电池对电子烟进行充电,烟盒的作用仅仅是充电,另外,采用了内置电池,使得烟盒的结构复杂,制造成本增加,该烟盒给电子烟的充电时需要将整支电子烟放入烟盒的特定位置,导致烟盒的外形难与传统烟盒接近。此外,打开烟盒之后,其看到的内部布局与普通香烟完全不同,这样就对消费者的吸引力降低。

发明内容

[0005] 鉴于现有技术存在的上述缺陷,本发明的目的在于提供一种仿真电子烟,其可提高雾化液的使用效率并有效地防止泄露。

[0006] 本发明的另一个目的在于提供一种仿真电子烟,其使得电子烟的使用更简捷,易

于控制,效果更佳。

[0007] 本发明还有的目的在于提供一种仿真电子烟,其改变电子烟的充电模式,以可使用弱电进行充电,从而提高安全可靠。

[0008] 本发明的目的在于提供一种仿真电子烟烟盒,该烟盒可以达到与传统烟盒逼真的程度。

[0009] 本发明的另一个目的在于,提供一种仿真电子烟烟盒,其无需内部设置电池,而可直接利用外部电源进行充电。

[0010] 本发明的再一个目的在于,提供一种仿真电子烟烟盒,其在对一支仿真电子烟充电的同时,消费者可使用另一支配备的仿真电子烟吸烟。

[0011] 为了实现本发明的上述目的,本发明提供了一种仿真电子烟,其包括:烟嘴,包括壳体并设有出烟孔;液体承载器,设置于所述烟嘴内并承载有液体,且所述液体承载器与所述出烟孔气体连通;雾化器,可拆装地连接于所述液体承载器;以及烟杆,包括可拆卸地连接于所述雾化器上的烟杆管以及设置在所述烟杆管内的充电电池及控制电路。其中,所述雾化器包括:雾化器套管,具有中空腔体且设置于所述烟嘴的壳体中;耐高温绝缘体,设置于所述雾化器套管内且内设置有雾化腔;雾化头,连接于所述耐高温绝缘体的外周面上,并与所述液体承载器相连接并导流所述液体;多孔渗透件,设置于所述雾化头以及所述耐高温绝缘体的外周面上;电热丝,容置于所述雾化腔内,且电连接于所述充电电池和所述控制电路;以及吸附体,容置于所述雾化腔内,缠绕于所述电热丝上且与所述多孔渗透件连接。其中,所述雾化器套管、所述耐高温绝缘体、所述雾化头以及所述烟杆管均设置有与所述出烟孔形成气体通路的通气开孔。

[0012] 针对发明的上述目的,优选地,所述烟杆设置有与外界空气连通并与所述雾化器套管的通气开孔连通的开孔,所述控制电路包括有可选择地与所述充电电池电连通的气压电子开关。

[0013] 针对发明的上述目的,优选地,所述烟杆还包括与所述控制电路以及所述充电电池的正负极分别电连接的正极顶杆以及负极顶杆,所述正极顶杆以及负极顶杆在所述仿真电子烟工作时电连接于所述加热丝的正负极而在所述仿真电子烟充电时与外部电源的正负极电连接。

[0014] 在本发明的仿真电子烟中,优选地,所述的雾化头形成有可刺穿所述液体承载器以使所述多孔渗透件与所述液体形成液体连通的突出部。

[0015] 在本发明的仿真电子烟中,优选地,所述仿真电子烟还包括有设置于所述烟杆端部的可拆装的透光灯帽,所述烟杆内设置有与所述控制电路以及所述充电电池电连接的灯。

[0016] 在本发明的仿真电子烟中,优选地,所述仿真电子烟还包括设置于所述烟杆端部的可拆装的透光灯帽,所述烟杆内设置有与所述控制电路以及所述充电电池电连接的充电指示灯。

[0017] 在本发明的仿真电子烟中,优选地,所述雾化器还包括与所述电热丝以及所述充电电池和控制电路形成电连接的且固定于所述雾化器套管内的正极弹簧和负极弹簧。

[0018] 在本发明的仿真电子烟中,优选地,所述多孔渗透件为镍网,所述吸附体为玻纤维绳。

[0019] 在本发明的仿真电子烟中,优选地,所述烟杆还包括有与所述充电电池电连接的且在吸烟时与所述电热丝电连接的插头或USB插口。

[0020] 基于本发明的仿真电子烟,提高了雾化液的使用效率并有效地防止泄露;电子烟的使用更简捷,易于控制,效果更佳;改变电子烟的充电模式,以可使用弱电进行充电,从而提高安全可靠性能。

[0021] 此外,使用本发明的产品具有逼真的仿真效果,该烟既对吸烟者无害,又具有吸烟时吞云吐雾的效果,由于液体是按照需要配制的,对人体和环境无害,该烟无需点燃,安全性很高,能够为消费者所接受。另外,该产品的推广使用,会减少社会对烟叶的需求,能够保护耕地。

[0022] 针对本发明的另一个方面,本发明提供了一种仿真电子烟烟盒,包括:外壳体,包括烟盒盖和烟盒本体,烟盒盖和烟盒本体形成外壳体容置腔,且烟盒盖和烟盒本体在后表面上连成一体而在前表面以及侧向两侧上分开,烟盒本体前表面外侧设置有与烟盒盖的下边沿相配合的配合部;内壳体,容置在外壳体的烟盒本体内;烟弹容置部,设置在内壳体的上部,容置仿真电子烟;电子烟充电容置部,设置在内壳体的上部;以及电子烟充电部,设置在内壳体中,且包括彼此电连接的充电控制电路、与电子烟电连接的充电接口、以及与外界电源连接的接口;其中,烟盒本体前表面的上部内侧或内壳体的上部设置有凹形边,所述凹形边的底边高于配合部的上边沿,烟弹容置部的顶部平齐于或低于所述凹形边的底边,烟充电容置部的顶部平齐于或低于所述凹形边的底边。

[0023] 在所述仿真电子烟烟盒中,优选地,所述烟弹容置部沿着内壳体的长度方向设置成一排或两排,烟充电容置部沿着内壳体的长度方向与所述烟弹容置部对齐。

[0024] 在所述仿真电子烟烟盒中,优选地,所述电子烟可拆卸式,所述仿真电子烟烟盒还包括设置在所述内壳体上部的将不带有充电电池的电子烟部分进行容置的烟嘴容置部,所述烟嘴容置部设置成:该烟嘴容置部的顶表面平齐于或低于所述凹形边的底边、所述烟嘴容置部沿着内壳体的长度方向与所述烟弹容置部对齐、且插入烟嘴容置部后的所述不带有充电电池的电子烟部分的顶部与插置的烟弹的顶部平齐。

[0025] 在所述仿真电子烟烟盒中,优选地,所述充电接口设置成:电子烟的充电部分通过所述电子烟充电容置部插入到所述充电接口之后,使得插置后的所述电子烟的充电部分的顶部与插置后的烟弹的顶部平齐。

[0026] 在所述仿真电子烟烟盒中,优选地,所述充电接口为螺接或插接接口。

[0027] 在所述仿真电子烟烟盒中,优选地,所述仿真电子烟烟盒还包括设置在所述内壳体上部的备用电子烟容置部,所述备用电子烟容置部设置成:该备用电子烟容置部的顶表面平齐于或低于所述凹形边的底边、所述备用电子烟容置部沿着内壳体的长度方向与所述烟弹容置部对齐、且该备用电子烟插入备用电子烟容置部后的该备用电子烟的顶部与插置后的烟弹的顶部平齐。

[0028] 在所述仿真电子烟烟盒中,优选地,所述电子烟充电部与外界电源连接的接口为设置在内壳体下部的可露出到烟盒本体外的USB插口或插头。

[0029] 在所述仿真电子烟烟盒中,优选地,所述USB插口或插头设置在内壳体的下部且连接有导出装置,且在内壳体及烟盒本体的底部向下或向侧面设置有供所述USB插口或插头移动并从外壳体中露出的槽孔。

[0030] 在所述仿真电子烟烟盒中,优选地,所述电子烟充电部还包括设置在内壳体的外表面上的充电指示灯,且在所述烟盒本体上的相应位置上设置有通孔。

[0031] 在所述仿真电子烟烟盒中,优选地,所述烟盒本体在所述电子烟充电部的与外界电源连接的接口部位处设置有撕掉以露出所述接口部位的易撕毁部。

[0032] 基于本发明的仿真电子烟烟盒,其烟盒可以达到逼真普通香烟的程度;此外本发明的仿真电子烟烟盒无需内部设置电池,而可直接利用外部电源进行充电。再有本发明的仿真电子烟烟盒,其在对一支仿真电子烟充电的同时,消费者可同时利用另一支配用仿真电子烟吸烟,从而提高了消费者的使用便利性。

附图说明

[0033] 图 1 为依据本发明的仿真电子烟的整体结构图;

[0034] 图 2 为依据本发明的仿真电子烟的烟嘴和液体承载器的结构示意图;

[0035] 图 3 是依据本发明一实施方式的雾化器的构件的分解图;

[0036] 图 4 是依据本发明一实施方式的烟杆的构件的分解图;

[0037] 图 5 是依据本发明的仿真电子烟的灯帽的结构示意图。

[0038] 图 6 为依据本发明的仿真电子烟烟盒的外壳体拆解后的结构示意图;

[0039] 图 7 是依据本发明的仿真电子烟烟盒的内壳体、烟弹容置部、电子烟充电容置部、电子烟上节容置部、备用电子烟容置部的结构示意图,其中透视地示出电子烟充电接口以及 USB 插口;

[0040] 图 8 是依据本发明的烟弹的结构示意图;

[0041] 图 9 是依据本发明的仿真电子烟烟盒的总装示意图。

具体实施方式

[0042] 下面参照附图来详细说明依据本发明的仿真电子烟及其烟盒。

[0043] 首先参照图 1 至图 5 来说明依据本发明的仿真电子烟。

[0044] 参照图 1 至图 5,依据本发明的仿真电子烟包括:烟嘴 10,包括壳体 101 并设有出烟孔 102;液体承载器 20,设置于烟嘴 10 的壳体 101 内并承载有液体(图未示出),且液体承载器 20 与出烟孔 102 气体连通;雾化器 30,可拆装地连接于液体承载器 20;以及烟杆 40,包括可拆卸地连接于所述雾化器 30 上的烟杆管 470 以及设置在所述烟杆管 470 内的电池 450 及控制电路 460。

[0045] 其中,烟雾化器 30 包括:雾化器套管 310,具有中空腔体且设置于烟嘴 10 的壳体 101 中;耐高温绝缘体 320,设置于雾化器套管 310 内且内设置有雾化腔;雾化头 330,连接于耐高温绝缘体 320 的外周面上,并与液体承载器 20 相连接,以导流液体;多孔渗透件(图未示出),设置于雾化头 330 以及耐高温绝缘体 320 的外周面上;电热丝(图未示出),容置于所述雾化腔内,且电连接于所述电池和所述控制电路;以及吸附体(图未示出),容置于所述雾化腔内,缠绕于所述电热丝上且与所述多孔渗透件连接。其中,雾化器套管 310、耐高温绝缘体 320、雾化头 330、以及所述烟杆管 470 均设置有与出烟孔 102 形成气体通路的通气开孔或开口(例如附图标记 3101、3301、3201 所示)。

[0046] 在上述实施方式中,则当雾化头 330 与液体承载器 20 相连接时,则液体承载器 20

内的液体将被引导并保留在所述多孔渗透件上,而由于在所述雾化腔内设置有缠绕于所述电热丝上且与所述多孔渗透件 330 连接的吸附体,所述液体将通过渗流作用被吸附到所述吸附体上,以在电热丝加热时将所述液体雾化,从而形成烟雾。这样就可以避免直接对保留在所述多孔渗透件上的液体进行加热导致的雾化量过大、液体承载器 20 中的液体使用时间短的缺陷。此外,由于吸附体和所述多孔渗透件之间的连接,通过它们二者之间的渗透所用,可以防止所述多孔渗透件上保留的液体通过雾化器套管 310 和烟嘴 10 的壳体 101 之间的间隙泄露出,从而进一步提高了液体承载器 20 的使用效率。

[0047] 在上述实施方式中,所述耐高温绝缘体 320 可以为陶瓷绝缘材料,以承受所述加热丝工作时所产生的高温。

[0048] 在上述实施方式中,所述多孔渗透件可以为镍网,所述吸附体可以为玻纤绳。

[0049] 在上述实施方式中,液体承载器所含的液体可包含各种符合要求的成分,以满足不同口感和各种治疗的需求,例如加入各种治疗口腔疾病和提神醒脑作用的中医成分。

[0050] 在上述实施方式中,雾化头 330 形成有突出部 3302,其可刺穿液体承载器 20 以使所述多孔渗透件与所述液体形成液体连通,如图 3 所示。此时液体承载器 20 可在相应部位设置有可被突出部 3302 穿破、以使液体流出的铝箔(图未示出)。

[0051] 在上述实施方式中,在雾化器套管 310、耐高温绝缘体 320 以及雾化头 330 设置的与出烟孔 102 形成气体通路的通气开孔或开口,由于其与外界空气连通,使得抽吸本发明的仿真电子烟时更容易,从而与抽吸普通香烟时的抽吸阻力大体相当。

[0052] 针对本发明的仿真电子烟,为了使电子烟的使用更简捷,易于控制,效果更佳,控制电路 460 还可设置有气压电子开关,其通过感测烟杆管内的气流变化来导通电池 450、控制电路 460 以及加热丝之间的电连通。此时烟杆 40 设置有与外界空气连通并与所述套管的通气开孔连通的开孔(图未示出)。在吸仿真电子烟时,通过这些开孔实现了将外部空气导入并引导至出烟孔 102,同时致动气压电子开关以启动雾化操作,所述空气与雾化产生的气体一起被从出烟孔 102 吸出。

[0053] 为了更进一步地逼近抽吸普通香烟时的视觉,所述仿真电子烟还可包括有设置于烟杆 40 端部的可拆装的透光灯帽 50,烟杆 40 内设置有与控制电路 460 以及电池 450 电连接的灯(未示出)。所述灯发出红光,以模拟普通香烟点燃的烟头部分。

[0054] 此外,为了实现将外部空气引入到烟杆管 470 中,灯帽 50 的周边缘可设置通气孔 501。

[0055] 在依据本发明的仿真电子烟中,电池 450 可以为充电电池。优选地,为了能无需将充电电池拆下而直接进行充电,烟杆 40 还包括与控制电路 460 以及充电电池的正负极分别电连接的正极顶杆 410 以及负极顶杆 420,正极顶杆 410 以及负极顶杆 420 在所述仿真电子烟工作时电连接于所述加热丝的正负极、而在所述仿真电子烟充电时与外部电源(图未示出)的正负极电连接。正极顶杆 410 以及负极顶杆 420 之间的绝缘可以采用各种方式,在一个实施方式中,如图 4 所示的形式,具体而言,正极顶杆 410 置于绝缘套管 430 的腔体内,而绝缘套管 430 置于负极顶杆 420 的腔体内,或者采用相反的顺序进行套装。此外,为了降低吸烟时的阻力,可使得安装在最里面的相应顶杆设置有通孔(例如附图标记 4401 所示),以与雾化头 330 的开口及出烟孔 102 气体连通。此时,控制电路中设置有相应的与吸烟操作匹配的工作电路以及与给充电电池进行充电相匹配的充电控制电路。

[0056] 此外,可替代地,可以在电池上设置有一个与其相连接的插头或USB插口(图未示出),所述插头或USB插口可以与外部电源或电热丝实现电连接。

[0057] 此外,为了显示充电状态,还可在烟杆40的烟杆管470的端部设置可拆装的透光灯帽50,所述烟杆内40内设置与控制电路460以及电池450电连接的充电指示灯。此时,吸烟时的模拟点燃烟头的灯和充电时的充电指示灯可以为同一灯,或者为具有不同颜色的灯。当吸烟时的模拟点燃烟头的灯和充电时的充电指示灯为同一灯时,需要对控制电路进行改变,以实现吸烟和充电时不同电路之间的切换,这个属于本领域的公知常识,在此不再赘述。

[0058] 在依据本发明的仿真电子烟中,为了克服公知电子烟在电热丝电连接时由于采用硅胶所带来的老化问题,雾化器30还可包括与所述电热丝以及所述电池和控制电路形成电连接的且固定于雾化器套管310内的正极弹簧340和负极弹簧350,如图3所示。在此所述电连接可以通过正极弹簧340和负极弹簧350锡焊、钎焊、缠结等方式来实现。

[0059] 此外,在依据本发明的仿真电子烟中,雾化器30与烟杆40之间的结合方式可以为插接、螺接等。在一优选实施方式中,如图3和图4所示,可采用螺接方式,通过设置在雾化器套管310内的螺套360以及设置在烟杆管470中并置于烟杆管470一端的螺杆440来实现雾化器30与烟杆40之间的结合。当然,也可以反过来,螺套可以设置在烟杆中而螺杆设置在雾化器套管中。

[0060] 此外,当采用螺杆和螺套连接时,可在螺杆或螺套的边缘设置与外界空气连通的开口,以与雾化头330的开口及出烟孔102气体连通;或者如图4中所示,在螺杆440的本体凸缘上设置与外界空气连通的开口4401,以与安装在烟杆管470中的各相应部件设置的开口或孔形成气体连通。同时,安装在烟杆管470中的螺杆或螺套还可以与外部的充电器的相应部件连接,以实现普通插头式的电连接或USB式的电连接,从而在不同电压进行不同模式的充电。

[0061] 此外,为了增加雾化头的稳定性,还可设置有固定座370,如图3所示。此时前述设置在耐高温绝缘件320的雾化头310卡在固定座370的两个凸部3701上。同时固定座370中间设置有上下贯通孔3702,以与雾化头310的开孔3301气体连通。

[0062] 其次参照图1以及图6至图9来说明依据本发明的仿真电子烟。

[0063] 参照图1以及图6至图9,依据本发明的仿真电子烟烟盒包括:外壳体,包括烟盒盖1和烟盒本体2,烟盒盖1和烟盒本体2形成外壳体容置腔23,且烟盒盖1和烟盒本体2在后表面上连成一体而在前表面及侧向两侧上分开,烟盒本体2前表面的上部内侧设置有凹形边21,在烟盒本体2前表面外侧设置有与烟盒盖1的下边沿11相配合的配合部25,下边沿11与配合部25的上边沿251在烟盒关闭时形成密封,凹形边21的底边210高于配合部25的上边沿251;内壳体3,容置在外壳体的烟盒本体2内;烟弹容置部4,设置在内壳体3的上部,且烟弹容置部4的顶部平齐于或低于凹形边21的底边210;电子烟充电容置部5,设置在内壳体3的上部,且电子烟充电容置部5的顶部平齐于或低于凹形边21的底边210;以及电子烟充电部(图未示出),设置在内壳体3中,且包括彼此电连接的充电控制电路(图未示出)、与电子烟电连接的充电接口6、以及与外界电源连接的接口(图未示出)。此外,烟盒本体2前表面的上部内侧设置的凹形边21可替代地设置于内壳体3上,具体而言,内壳体3的上边31在前表面和两个侧面上延伸,以形成类似烟盒本体2前表面的上部

内侧设置的凹形边,此时形成的凹形边的底边依然高于配合部 25 的上边沿 25f。

[0064] 在依据本发明的仿真电子烟烟盒中,为了逼近普通香烟烟盒打开时的效果,优选地,烟弹容置部 4 沿着内壳体 3 的长度方向设置成一排或两排,以使电子烟的烟弹 7 插入到烟弹容置部 4 之后,就像普通香烟烟盒打开后看到每支烟的过滤嘴一样。

[0065] 在依据本发明的仿真电子烟烟盒中,为了逼近普通香烟烟盒打开时的效果,优选地,电子烟充电容置部 5 沿着内壳体 3 的长度方向与所述成排的烟弹容置部 4 对齐。此时,进一步优选地,充电接口 6 的位置为:在通过电子烟充电容置部 5 将电子烟 8 的下节 81 (内含充电电池) 插入到所述充电接口 6 之后,使得插置后的电子烟 8 的下节 81 的顶部与插置的烟弹 7 的顶部平齐或大致平齐。由此,将电子烟 8 的下节 81 插入到电子烟充电容置部 5 中之后,就像普通香烟烟盒打开后看到整齐排放的带滤嘴的烟一样。

[0066] 此外,为了防止随意放置电子烟上节 82 而造成的丢失且同时为了逼近普通香烟烟盒打开时的效果,在电子烟 8 的下节 81 插入到电子烟充电容置部 5,可将电子烟 8 的上节 82 插入到烟嘴容置部 12 (或者可替代地,烟嘴容置部 12 直接等同于烟弹容置部 4),此时,烟嘴容置部 12 的设置成,烟嘴容置部 12 的顶表面平齐于或低于所述凹形边 21 的底边 210、烟嘴容置部 12 沿着内壳体 3 的长度方向与所述成排的烟弹容置部 4 对齐、且插入烟嘴容置部 12 后的电子烟 8 的上节 82 的顶部与插置的烟弹 7 的顶部平齐或大体平齐。可替代地,由于电子烟的充电接口的设置各部相同,如果电子烟为可拆卸的,可以将电子烟可拆卸部分中带有充电电池的部分装入即可;反之可将整个电子烟直接插入(例如充电接口位于电子烟的端头)。

[0067] 在依据本发明的仿真电子烟烟盒中,为了在避免仅存在一支电子烟时对消费者所造成的不便(即,这支电子烟充电而消费者需要抽吸电子烟,而照成不便),优选地,在内壳体 3 中还设置有备用电子烟容置部 9,可以将另一支电子烟插入,从而消费者可以同时便利地利用另一支电子烟。为了逼近普通香烟烟盒打开时的效果,备用电子烟容置部 9 的设置:该备用电子烟容置部 9 的顶表面平齐于或低于所述凹形边 21 的底边 210、所述备用电子烟容置部 9 沿着内壳体 3 的长度方向与所述烟弹容置部 4 对齐、且该备用电子烟插入备用电子烟容置部 9 后的该备用电子烟的顶部与插置后的烟弹 7 的顶部平齐或大体平齐。

[0068] 在依据本发明的仿真电子烟烟盒中,为了对电子烟 8 进行充电,电子烟充电部与外界电源连接的接口为设置在内壳体 3 下部的可露出到烟盒本体 2 之外的 USB 插口 11 或插头(图未示出)。

[0069] 在依据本发明的仿真电子烟烟盒中,优选地,所述 USB 或插头设置内壳体 3 的下部且连接有导出装置(图未示出),且在内壳体 3 及烟盒本体 2 的底部向下或向侧面设置有供所述 USB 插口或插头移动并从烟盒本体 2 露出的槽孔(例如滑动槽和出入孔)(图未示出)。

[0070] 在依据本发明的仿真电子烟烟盒中,优选地,电子烟充电部还包括设置在内壳体 3 的外表面上的充电指示灯(图未示出),且在烟盒本体 2 上的相应位置上设置有通孔(图未示出),以在对电子烟 8 的充电电池进行充电时,通过充电指示灯来显示充电状态。

[0071] 在依据本发明的仿真电子烟烟盒中,优选地,盒本体 2 的底部上设置有易撕毁部(图未示出),其对应于所述电子烟充电部的与外界电源连接的接口部位设置。在打开烟盒包装塑料膜之后,可以将易撕毁部撕掉,从而露出所述接口部位。

[0072] 在依据本发明的仿真电子烟烟盒中,优选地,所述电子烟充电部的与电子烟 8 的下节 81 电连接的充电接口为螺接或插接接口。

[0073] 在依据本发明的仿真电子烟烟盒中,所述外壳体和内壳体均由绝缘材料(例如塑料)制成。

[0074] 为了简化制造工艺,内壳体可以与烟弹容置部、电子烟充电容置部、电子烟上节容置部、各用电子烟容置部、烟嘴容置部等一体成型。

[0075] 在上述说明中,所述长度方向为图 6 所示的平行于纸面的方向,宽度方向为与纸面垂直的方向,高度方向为与上述长度方向和宽度方向相垂直的方向,该方向的定义与普通香烟烟盒的长、宽、高方向的定义一致。

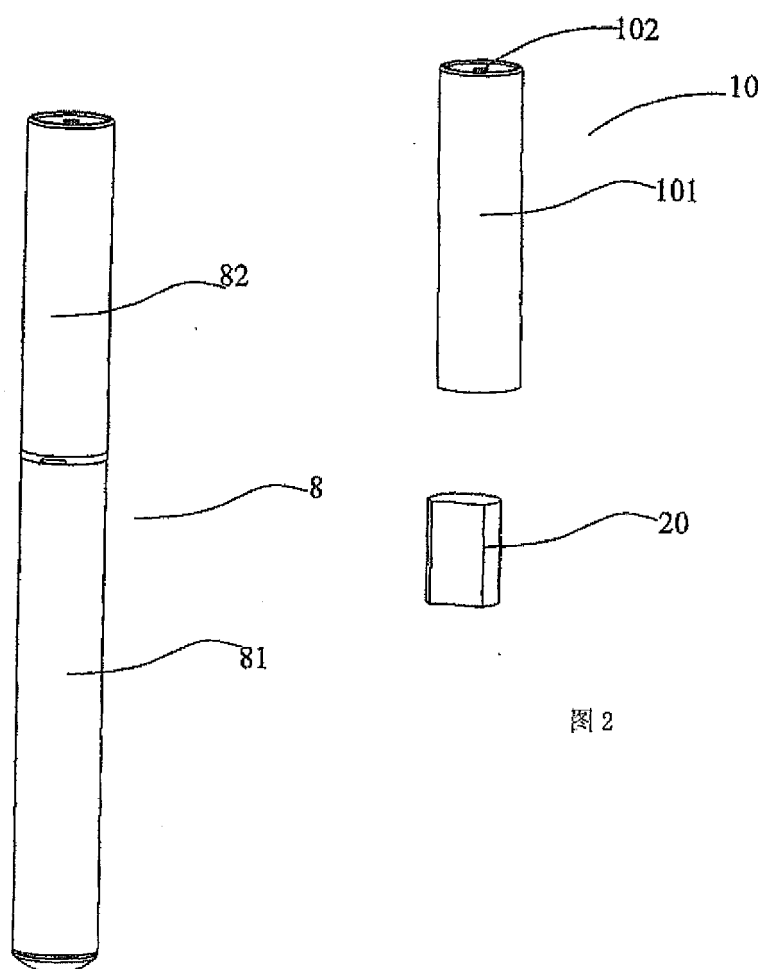


图 1

图 2

30

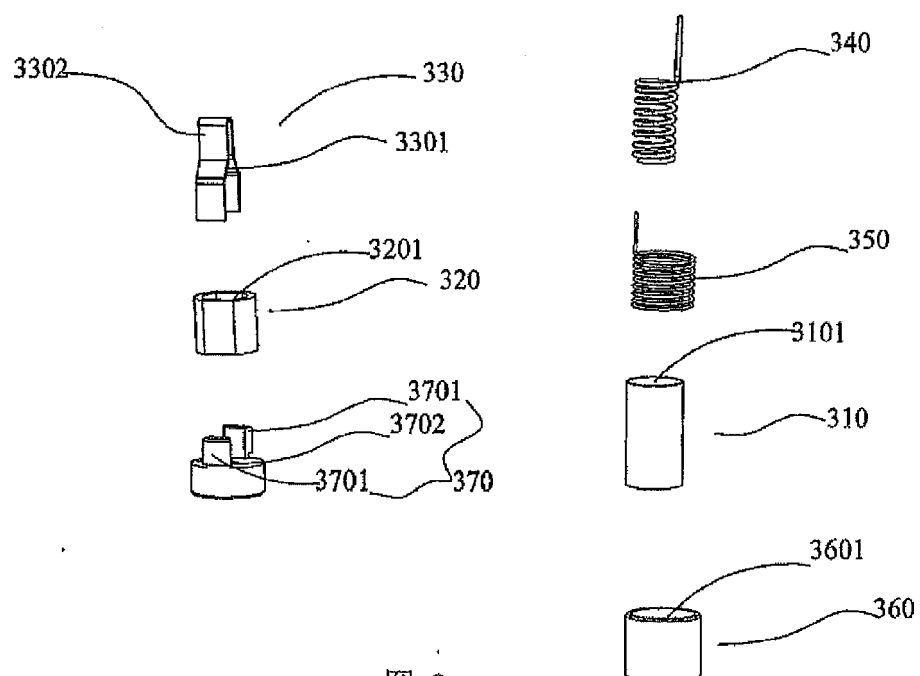


图 3



图 5

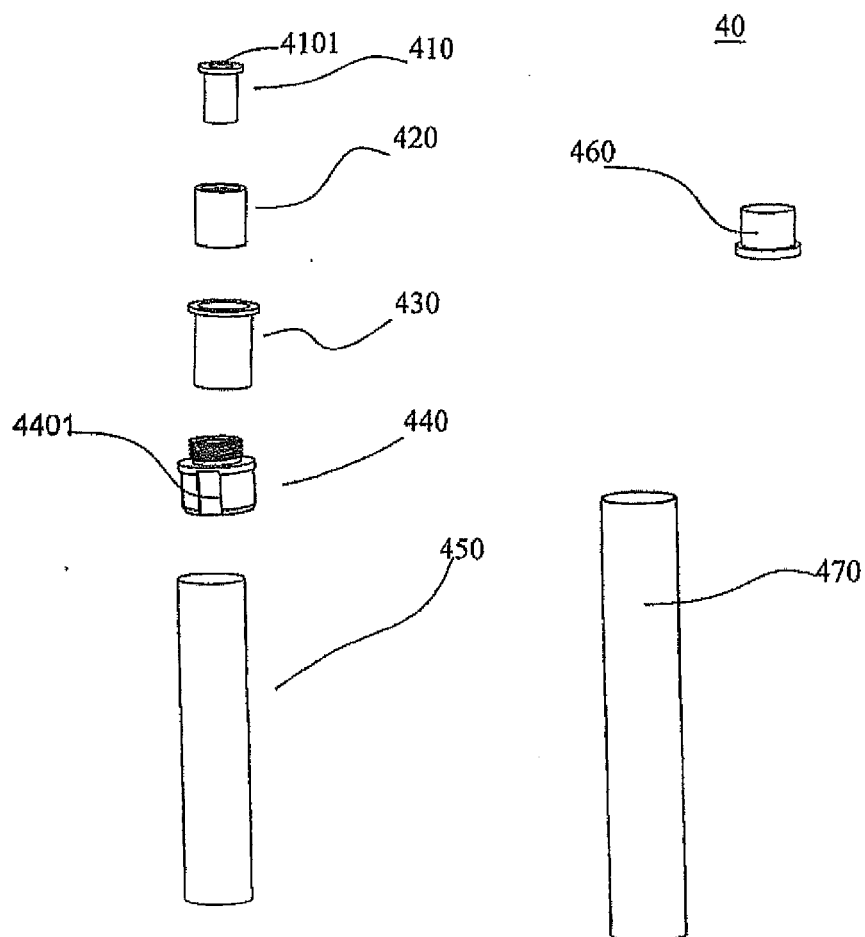


图 4

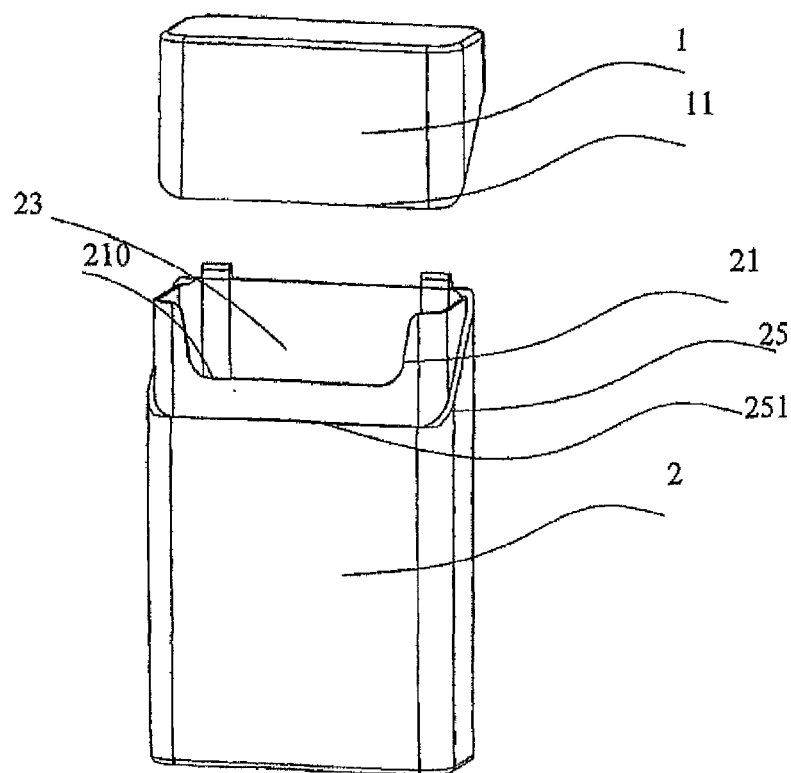
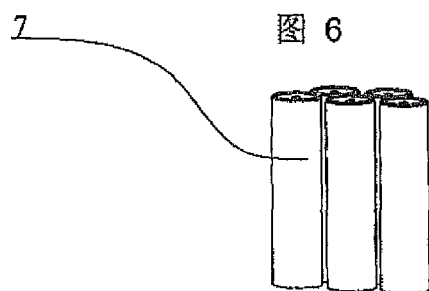


图 6

图 8

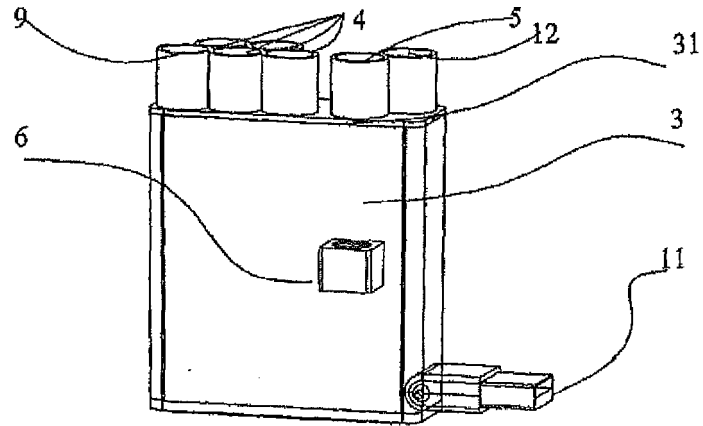


图 7

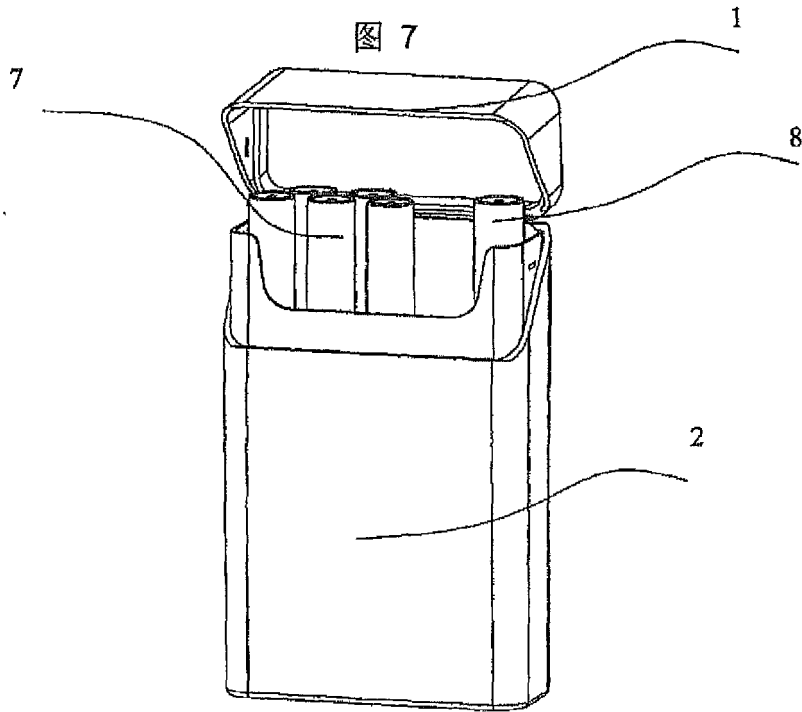


图 9

Simulation electronic cigarette and cigarette case thereof

Abstract

(CN101869356)

The invention provides a simulation electronic cigarette and a cigarette case thereof. The simulation electronic cigarette comprises a cigarette holder, a liquid carrier, an atomizer and a cigarette stem, wherein the atomizer comprises an atomizer casing, a high-temperature insulating body, an atomizing head, a porous permeating part, an electric heating wire and an adsorption body, wherein the atomizer casing is provided with a cavity and is arranged in a casing of the cigarette holder; the high-temperature resistant insulating body is arranged in the atomizer casing and is internally provided with an atomizing cavity; the atomizing head is connected to an outer circumferential surface of the high-temperature insulating body; the electric heating wire is accommodated in the atomizing cavity and is electrically connected to a battery and a control circuit in a cigarette stem tube; the adsorption body is accommodated in the atomizing cavity, is wound on the electric heating wire and is connected with the porous permeating part; and the atomizer casing, the high-temperature insulating body, the atomizing head and the cigarette stem tube are respectively provided with ventilating open pores forming a gas path with a smoke outlet. Therefore, the invention improves the service efficiency of atomizing liquid, prevents the leakage, and simplifies the work control and a charging mode of a charging battery.

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Patent Assignee History (CN101869356)

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English Claims

(CN101869356)

Claims machine translated from Chinese

1. Kinds of simulation electron smoke, it includes:

The cigarette holder, and is equipped with the smoke hole including the shell;

The liquid carrier, establishes in states in the cigarette holder and lead bearing has the liquid, and stated the liquid carrier with state the smoke hole gas connection;

The atomizer, may disassemble the connection to state the liquid carrier; As well as

The smoke pole, including connects dismantlable in states the smoke pole tube on atomizer as well as establishes, in stated the rechargeable battery and control circuit in smoke pole tube;

The characteristic lies, states atomizer to include:

The atomizer drive pipe, has the midheaven housing, and establishes in states in cigarette holder's shell;

The thermostable insulator, establishes in states in the atomizer drive pipe and in the establishment has the atomization cavity;

Atomizes the head, connects in states in the thermostable insulator's circumference surface, and with stated the liquid carrier to connect and conduction current states the liquid;

The porous seepage, establishes in states atomization as well as states in the thermostable insulator's circumference surface;

The heating wire, allows to put to state in the atomization cavity, and electric interlock in stated the rechargeable battery and states the control circuit; As well as

The adsorbable, allows to put to state in the atomization cavity, twines in states in the heating wire, and with stated the porous seepage connection;

And, states the atomizer drive pipe, to state the thermostable insulator, to state atomization as well as states the smoke pole tube to establish to have with state the smoke hole to form the gas circuit's ventilation opening.

2. The simulation electron smoke that according to claim 1, its characteristic lies, states the smoke pole establishment to have with the outside air connection and with states the atomizer drive pipe's ventilation opening connection opening, states the control circuit to include to be possible to choose and states the rechargeable battery electricity connection the barometric pressure electronic switching.

3. The simulation electron smoke that according to claim 1, its characteristic lies, atomization that states forms to be possible to pierce to state the liquid carrier to cause to state the porous seepage with state the liquid to form the liquid connection the efferent point.

4. The simulation electron smoke that according to claim 1, its characteristic lies, the diaphanous lamp hat that states the simulation electron smoke also to include the establishment to state smoke pole nose may disassemble, states in the smoke pole the establishment to have with states the control circuit as well as states the rechargeable battery electric interlock the lamp.

5. The simulation electron smoke that according to claim 2, its characteristic lies, states the smoke pole also to include with states the control circuit as well as states the rechargeable battery positive and negative distinguishes the electric interlock extremely the positive electrode roof bar as well as the cathode roof bar, states positive electrode roof bar as well as cathode roof bar when stated the simulation electron smoke work when the electric interlock in stated the heater positive and negative but extremely, in stated the positive and negative extremely electric interlock of simulation electron smoke charge and external power supply.

6. The simulation electron smoke that according to claim 2, its characteristic lies, the diaphanous lamp hat that states the simulation electron smoke also to include the establishment to state smoke pole nose may disassemble, states in the smoke pole the establishment to have with states the control circuit as well as states the battery electric interlock the battery control lamp.

7. The simulation electron smoke that according to claim 5, its characteristic lies, and states the atomizer also to include with states the heating wire as well as states the battery and control circuit form the electric interlock fixes in states the positive electrode spring and cathode spring in atomizer drive pipe.

8. The simulation electron smoke that according to claim 1, its characteristic lies, states the porous seepage is the nickel mesh, states

adsorbate for the Bolivian cordelle.

9. The simulation electron smoke that according to claim 1, its characteristic lies, and states the smoke pole also includes and states the rechargeable battery electric interlock when smoking with states the heating wire electric interlock the plug or the USB receptacle.

10. 1 kinds of simulation electron smoke cigarette cases, its characteristic lies, including:

Outside outside the shell, including the smoke lid and cigarette case main body, the smoke lid and cigarette case main body forms shell Rong Zhicang, and smoke lid and cigarette case main body in the surface are united as one body but separates in the front surfaces as well as the lateral both sides, the cigarette case main body front surface flank establishment has with smoke lid's under along the coordinate department that coordinates;

In the shell, allows to set at outside in shell's cigarette case main body;

The smoke shoots Rong Zhibu, establishment shell's upside;

Electronic smoke sufficient electric capacity sets at the department, the establishment shell's upside, allows to set at claim 1-8 stations the simulation electron smoke that;

As well as electronic smoke sufficient electrical department, establishment in shell, and including each other electric interlock charge control electric circuit, and electronic smoke electric interlock charge connection, as well as with outside power connection connection;

And, the above inside of cigarette case main body front surface or in the above establishment of shell has nearby the concave, states nearby the concave the base to be higher than coordinate departments above along, the smoke shoots Rong Zhibu the crown orthogonal in or is lower than to state nearby the concave the base, the smoke sufficient electric capacity sets at a crown orthogonal in or is lower than to state nearby the concave the base.

11. The simulation electron smoke cigarette case that according to claim 10, its characteristic lies, states the smoke to shoot Rong Zhibu to establish one along in shell's length direction row or two rows, the smoke sufficient electric capacity sets at the department with state the smoke to shoot Rong Zhibu along in shell's length direction to align.

12. The simulation electron smoke cigarette case that according to claim 11, its characteristic lies, states simulation electron smoke dismantlable, states the simulation electron smoke cigarette case also to include to establish in stated on the shell will not have rechargeable battery's electronic smoke part to carry on Rong Zhi cigarette holder Rong Zhibu. states cigarette holder Rong Zhibu to establish: This cigarette holder Rong Zhibu goes against the surface orthogonal in or is lower than to state nearby the concave the base, to state cigarette holder Rong Zhibu after to state the smoke to shoot Rong Zhibu along in shell's length direction to align, and insertion cigarette holder Rong Zhibu stated does not have rechargeable battery's electronic smoke part crown to be orthogonal with the smoke ball crown that inserting set.

13. The simulation electron smoke cigarette case that according to claim 12, its characteristic lies, states the charge connection to establish: The electronic smoke's charge part after stated the electronic smoke sufficient electric capacity to set the department inserted to state the charge connection, after causing inserted sets at to state the electronic smoke the charge part crown after inserting sets at the smoke ball crown to be orthogonal.

14. The simulation electron smoke cigarette case that according to claim 13, its characteristic lies, states charge connection for spiro union or peg grafting connection.

15. The simulation electron smoke cigarette case that according to claim 11, its characteristic lies, states the simulation electron smoke cigarette case also to include to establish in stated on shell spare electronic smoke Rong Zhibu, states spare electronic smoke Rong Zhibu to establish: This spare electronic smoke Rong Zhibu goes against the surface orthogonal in or is lower than to state nearby the concave the base, to state spare electronic smoke Rong Zhibu after to state the smoke to shoot Rong Zhibu along in shell's length direction to align, and this spare electronic smoke insertion spare electronic smoke Rong Zhibu the spare electronic smoke's crown after inserting sets at the smoke ball crown to be orthogonal.

16. The simulation electron smoke cigarette case that according to claim 10, its characteristic lies, states electronic smoke sufficient electrical department and outside power connection connection for establishment under shell may reveal outside the cigarette case main body the USB receptacle or the plug.

17. The simulation electron smoke cigarette case that according to claim 16, its characteristic lies, states the USB receptacle or in plug establishment shell's lower part, and connects to derive the installment, and shell and cigarette case main body's base downward either has to the side establishment for states the USB receptacle or the plug migration and from the slot that in outside shell reveals.

18. The simulation electron smoke cigarette case that according to claim 10, its characteristic lies, states the electronic smoke sufficient electrical department also to include the establishment shell's the battery control lamp in outside surface, and in stated on the cigarette case main body in the relevant position the establishment to have the through hole.

19. The simulation electron smoke cigarette case that according to claim 10, its characteristic lies, states the cigarette case main body in stated the electronic smoke sufficient electrical department with the outside power connection's connection spot established to tear up to reveal to state the connection spot to be easy to tear the department.

Description

(CN101869356)

Description machine translated from Chinese

Simulation electron smoke and cigarette case

Area of technology

This invention involves one kind of simulation electron smoke and cigarette case, involves one kind of enhancement atomization fluid specially the use efficiency and effectively prevents the revelation the simulation electron smoke and has the charge function simulation electron smoke cigarette case.

Background technology

Smoked the injurious to health is one kind of male knowledge general knowledge, smoking causes several million people of deaths every year, and triggered many kinds of diseases, the no-smoking is one kind of globalization tendency, all governments actively is intending to stop smoking, but let the smoker no-smoking is one kind of very difficult matter, and quantity of smoker showed the growth in the world the tendency. For the first time the age of smoking smoker getting smaller. Moreover, along with increase of smoker quantity, the leaf tobacco quantity that world needs every year is also growing, needs to use the massive farming to plant the leaf tobacco, satisfies the cigarette factory production cigarette the demand, although the tobacco industry can bring the large amount tax revenue for the government, but will create the huge hidden danger to all the people health, especially regarding the non-smoker, the harm that the second-hand smoke causes is bigger.

In order to avoid smoking the harm that causes, various countries' researchers diligently are seeking for cigarette's substitute, first made the low smoke alkali content and low tar content cigarette, but the low smoke alkali content and low tar content's cigarette regarding the smoker, the feeling in the mouth calm appetitive had the flavor, the smoker did not like. Next, researchers have researched and developed many cigarette substitutes, like no-smoking post and smoke alkali chewing gum and smoke alkali drink and so on, these products, although does not contain the tar, has the smoke feeling in the mouth, but these products changed smoker's custom, the question when cannot solve the addiction for tobacco came up the smoker to satisfy a craving, therefore, cannot be called the genuine cigarette substitute. Third, the researchers have unveiled the electronic smoke product, depends upon its design the electric circuit, will lay aside instantaneously in cigarette holder the liquid atomization, produces the smog, but in the cigarette holder the formula of liquid may requests to carry on the configuration according to the demand and feeling in the mouth, can solve smoker's demand. The subject matter that at present electronic smoke product has is: 1st, product mix is complex, like CN201197836Y and CN201079011Y structure; 2nd, uses the battery charge or electrical network's 220V alternating current carries on the charge, the replacement of battery will bring to the user inconveniently, the alternating current is the strong electricity, requests high regarding the electronic smoke's limiting pressure and constant voltage, possibly and creates to short-circuit, enables the electronic smoke product to use; 3rd, what the atomization of

Liquid uses is sprays the atomization and ultrasonic wave atomizes, this atomization way in liquid to cigarette holder flows out is not easy to control, will produce leaks the fluid the question, for example CN201197839Y and CN201079011Y possibly have this problem; 4th, in existing electronic smoke product, what uses is the air operated membrane guide pin ignition lock, this switch structure is complex, uses the times has the contact, the use after some time, will cause the contact effect not to be good, affects the use.

Although the above existing technology has provided the electronic smoke structure, but the electronic smoke lacks with the it necessary cigarette case, the cigarette case volume that at present uses is big, carries and uses inconveniently, has restricted the development of electronic smoke market. Research that although CN201094280Y gives in electronic fragrant cigarette case, proposed uses various built-in batteries to carry on the charge to the electronic smoke, the function of cigarette case charges merely. Moreover, has used the built-in battery, causes the cigarette case the structure to be complex, the production cost increases, when this cigarette case to the charge of electronic smoke needs to put in the on-line electronic cigarette the cigarette case the specific position, causes the cigarette case the contour difficult and traditional cigarette case is close. In addition, after opening the cigarette case, the internal arrangement and ordinary cigarette that it saw are completely different, this attraction to the consumer reduces.

Invention content

The above law that in view of the fact that the existing technology has, the goal of this invention is provides one kind of simulation electron smoke, it may enhance the atomization fluid the use efficiency and effectively prevents the revelation.

Another goal of this invention is provides one kind of simulation electron smoke, it causes the use of electronic smoke to be simpler more and direct, in the control, the effect is easily better.

This invention also some goals are provide one kind of simulation electron smoke, the charge pattern of its charge electron smoke, by may use the weak electricity to carry on the charge, thus enhances the security reliability.

Goal of this invention is provides one kind of simulation electron smoke cigarette case, this cigarette case may achieve with the traditional cigarette case flexible degree.

Another goal of this invention is, provides one kind of simulation electron smoke cigarette case, it does not need internal establishment battery, but may directly use the external power supply to carry on the charge.

Another goal of this invention is, provides one kind of simulation electron smoke cigarette case, it while to a simulation electron smoke charge, the consumer may use simulation electron smoke smoking of another equipment.

In order to realize the above goal of this invention, this invention has provided one kind of simulation electron smoke, it includes: The cigarette holder, and is equipped with the smoke hole including the shell; The liquid carrier, establishes in states in the cigarette holder and load bearing has the liquid, and states the liquid carrier with state the smoke hole gas connection; The atomizer, may disassemble the connection to state the liquid carrier; As well as the smoke pole, including connects diamantable in states the smoke pole tube on atomizer as well as establishes, in states the rechargeable battery and control circuit in smoke pole tube. And, states the atomizer to include: The atomizer drive pipe, has the midheaven housing, and establishes in states in cigarette holder's shell; The thermostable insulator, establishes in states in the atomizer drive pipe and in the establishment has the atomization cavity; Atomizes the head, connects in states in the thermostable insulator's circumference surface, and with states the liquid carrier to connect and conduction current states the liquid; The porous seepage, establishes in states atomization as well as states in the thermostable insulator's circumference surface; The heating wire, allows to put to state in the atomization cavity, and electric interlock in states the rechargeable battery and states the control circuit; As well as the adsorbate, allows to put to state in the atomization cavity, twines in states in the heating wire, and with states the porous seepage connection. And, states the atomizer drive pipe, to state the thermostable insulator, to state atomization as well as states the smoke pole tube to establish to have with state the smoke hole to form the gas circuit's ventilation opening.

In view of the above goal of invention, optimal, states the smoke pole establishment to have with the outside air connection and with states the atomizer drive pipe's ventilation opening connection opening, states the control circuit to include to be possible to choose and states the rechargeable battery electricity connection the barometric pressure electronic switching.

In view of the above goal of invention, optimal, states the smoke pole also to include with states the control circuit as well as states the rechargeable battery positive and negative distinguishes the electric interlock extremely the positive electrode roof bar as well as the cathode roof bar, states positive electrode roof bar as well as cathode roof bar when states the simulation electron smoke work when the electric interlock in states the heater positive and negative but extremely, in states the positive and negative extremely electric interlock of simulation electron smoke charge and external power supply.

In simulation electron smoke of this invention, optimal, atomization that states forms to be possible to pierce to state the liquid carrier to cause to state the porous seepage with state the liquid to form the liquid connection the seepage point.

The diaphanous lamp hat that in simulation electron smoke of this invention, optimal, states the simulation electron smoke also to include the establishment to state smoke pole nose may disassemble, states in the smoke pole the establishment to have with states the control circuit as well as states the rechargeable battery electric interlock the lamp.

The diaphanous lamp hat that in simulation electron smoke of this invention, optimal, states the simulation electron smoke also to include the establishment to state smoke pole nose may disassemble, states in the smoke pole the establishment to have with states the control circuit as well as states the rechargeable battery electric interlock the battery control lamp.

, and in simulation electron smoke of this invention, optimal, states the atomizer also to include with states the heating wire as well as states the rechargeable battery and control circuit form the electric interlock fixes in states the positive electrode spring and cathode spring in atomizer drive pipe.

In simulation electron smoke of this invention, optimal, states the porous seepage is the nickel mesh, states adsorbate for the Bolivian cordillo.

, and in simulation electron smoke of this invention, optimal, states the smoke pole also includes and states the rechargeable battery electric interlock when smoking with states the heating wire electric interlock the plug or the USB receptacle.

This invention-based simulation electron smoke, raised the use efficiency of atomization fluid and effectively prevents the revelation; The use of electronic smoke is simpler more and direct, is easy to control, the effect is better; Changes the electronic smoke the charge pattern, by may use the weak electricity to carry on the charge, thus enhances the security reliability.

In addition, uses this invention product to have the lifelike simulation effect, this smoke both are harmless to the smoker, when has smoking effect that smokes like a chimney, because the liquid according to needs to compound, is harmless to the human body and environment, this smoke does not need to light, the security is very high, can accept for the consumer. Moreover, the promoted use of this product, will reduce society's demand to the leaf tobacco, can the farmland.

In view of another aspect of this invention, this invention has provided one kind of simulation electron smoke cigarette case, including: Outside outside the shell, including the smoke lid and cigarette case main body, the smoke lid and cigarette case main body forms shell Rong Zhifang, and smoke lid and cigarette case main body in the surface are united as one body but separates in the front surfaces as well as the lateral both sides, the cigarette case main body front surface flank establishment has with smoke lid's under along the coordinate department that coordinates; In the shell, allows to set at outside in shell's cigarette case main body; The smoke shoots Rong Zhibu, establishment shell's upside, allows to set at the simulation electron smoke; Electronic smoke sufficient electric capacity sets at the department, the establishment shell's upside; As well as electronic smoke sufficient electrical department, establishment in shell, and including each other electric interlock charge control electric circuit, and electronic smoke electric interlock charge connection, as well as with outside power connection connection; And, the above inside of cigarette case main body front surface or in the above establishment of shell has nearby the concave, states nearby the concave the base to be higher than coordinate department's above along, the smoke shoots Rong Zhibu the crown orthogonal in or is lower than to state nearby the concave the base, the smoke sufficient electric capacity sets at a crown orthogonal in or is lower than to state nearby the concave the base.

In stated in simulation electron smoke cigarette case, optimal, states the smoke to shoot Rong Zhibu to establish one along in shell's

length direction row or two rows, the smoke sufficient electric capacity set at the department with state the smoke to shoot Rong Zhibu along in shell's length direction to align.

In stated in simulation electron smoke cigarette case, optimal, states electronic smoke dismantlable, states the simulation electron smoke cigarette case also to include to establish in stated on the shell will not have rechargeable battery's electronic smoke part to carry on Rong Zhi cigarette holder Rong Zhibu, states cigarette holder Rong Zhibu to establish: This cigarette holder Rong Zhibu goes against the surface orthogonal in or is lower than to state nearby the concave the base, to state cigarette holder Rong Zhibu after to state the smoke to shoot Rong Zhibu along in shell's length direction to align, and insertion cigarette holder Rong Zhibu stated does not have rechargeable battery's electronic smoke part crown to be orthogonal with the smoke ball crown that inserting set.

In stated in simulation electron smoke cigarette case, optimal, states the charge connection to establish: The electronic smoke's charge part after stated the electronic smoke sufficient electric capacity to set the department inserted to state the charge connection, after causing inserted sets at to state the electronic smoke the charge part crown after inserting sets at the smoke ball crown to be orthogonal.

In stated in simulation electron smoke cigarette case, optimal, states charge connection for spiro union or peg grafting connection.

In stated in simulation electron smoke cigarette case, optimal, states the simulation electron smoke cigarette case also to include to establish in stated on shell spare electronic smoke Rong Zhibu, states spare electronic smoke Rong Zhibu to establish: This spare electronic smoke Rong Zhibu goes against the surface orthogonal in or is lower than to state nearby the concave the base, to state spare electronic smoke Rong Zhibu after to state the smoke to shoot Rong Zhibu along in shell's length direction to align, and this spare electronic smoke insertion spare electron smoke Rong Zhibu the spare electronic smoke's crown after inserting sets at the smoke ball crown to be orthogonal.

In stated in simulation electron smoke cigarette case, optimal, states electronic smoke sufficient electrical department and outside power connection connection for establishment under shell may reveal outside the cigarette case main body the USB receptacle or the plug.

In stated in simulation electron smoke cigarette case, optimal, states the USB receptacle or in plug establishment shell's lower part, and connected to derive the installment, and shell and cigarette case main body's base downward either had to the side establishment for states the USB receptacle or the plug migration and from the slot that in outside shell revealed.

In stated in simulation electron smoke cigarette case, optimal, states the electronic smoke sufficient electrical department also to include the establishment shell's the battery control lamp in outside surface, and in stated on the cigarette case main body in the relevant position the establishment to have the through hole.

In stated in simulation electron smoke cigarette case, optimal, states the cigarette case main body in stated the electronic smoke sufficient electrical department with the outside power connection's connection spot established to tear up to reveal to state the connection spot to be easy to tear the department.

This invention-based the simulation electron smoke cigarette case, its cigarette case may achieve the degree of lifetime ordinary cigarette; In addition this invention's simulation electron smoke cigarette case does not need internal establishment battery, but may directly use the external power supply to carry on the charge. Has the invention simulation electron smoke cigarette case again, it while to a simulation electron smoke charge, the consumer may simultaneously use another control with simulation electron smoke smoking, thus enhanced consumer's use convenience.

Attached figure explanation

Figure 1 is to rest on this invention the overall structure drawing of simulation electron smoke;

Figure 2 is to rest on this invention the structure schematic drawing of cigarette holder and liquid carrier of simulation electron smoke;

Figure 3 based on this invention implementation way atomizer the exploded view of component;

Figure 4 based on this invention implementation way smoke pole the exploded view of component;

Figure 5 based on this invention simulation electron smoke the structure schematic drawing of lamp hat.

After Figure 6 is to rest on this invention outside shell of simulation electron smoke cigarette case's dismantles the structure schematic drawing;

Figure 7 shoots Rong Zhibu, the electronic smoke sufficient electric capacity to set at and electronic smoke previous section Rong Zhibu, the spare electronic smoke Rong Zhibu structure schematic drawing based on this invention in shell and smoke of simulation electron smoke cigarette case's, the perspective shows the electronic smoke charge connection as well as the USB receptacle;

Figure 8 based on this invention the structure schematic drawing of smoke ball;

Figure 9 based on this invention general equipment department schematic drawing of simulation electron smoke cigarette case.

Implements the way specifically

The following reference attached figure comes the detail to rest on this invention the simulation electron smoke and cigarette case.

First refers to Figure to explain that 1 to Figure 5 rests on this invention the simulation electron smoke.

Reference chart 1 to Figure 5, includes based on the simulation electron smoke of this invention: The cigarette holder 10, 101 and are equipped with the smoke hole including the shell 102; The liquid carrier 20, establish in the cigarette holder 10 shells 101 and the lead bearing has the liquid (chart not to show), and liquid carrier 20 and smoke hole 102 gas connections; The atomizer 30, may disassemble connection in the liquid carrier 20; As well as the smoke pole 40, including connect dismantlable in states atomizer 30 on the smoke pole tubes 470 as well as establishes, in stated smoke pole tube 470 in the batteries 450 and control circuit 460.

And, the aerosolization 30 include: The atomizer drive pipe 310, have microwave housing, and establishes in the cigarette holder 10 shells 101; The thermostable insulator 320, establish in the atomizer drive pipe 310 and in the establishment has the atomization cavity; Atomizes first 330, connects in the thermostable insulator 320 circumference surface, and 20 connects with the liquid carrier, by conduction current liquid; The porous seepage (chart has not shown), establishes in atomizing first 330 as well as the thermostable insulator 320 circumference surface; The heating wire (chart has not shown), allows to put to state in the atomization cavity, and electric interlock in stated the battery and states the control circuit; As well as the adsorbate (chart has not shown), allows to put to state in the atomization cavity, twines in states in the heating wire, and with stated the porous seepage connection. And, the atomizer drive pipe 310, thermostable insulators 320, atomize first 330, as well as states the smoke pole tube 470 to establish to have 102 to form the gas circuit's ventilation opening or the aperture with the smoke hole (e.g. attached figure marks 3101, 3301 and 3201 to show).

In the above implementation way, when atomizes first 330 with the liquid carrier 20 connect, then the liquid carrier 20 in liquids are guided and retained, in stated in the porous seepage, because, in stated in the atomization cavity the establishment to have the winding to state in the heating wire, and with stated the porous seepage 330 connections the adsorbates, states the liquid to affect to be adsorbed through the transfusion to state on the adsorbate, by state the liquid atomization when the heating wire heating, thus formed the smog. This may avoid directly to retaining the atomization quantity when stated porous seepage on the liquid carrier on causes to be oversized, liquid carrier 20 liquid period of revolution short flaws. In addition, because the adsorbate and stated the porous seepage between the connection, the seepage among their two used, may prevent to state the liquid that in the porous seepage retained through the atomizer drive pipe 310 and cigarette holder 10 shell 101 between gaps reveals, thus further raised the liquid carrier 20 use efficiencies.

In the above implementation way, states the thermostable insulator 320 to be possible for the croftie, the high temperature when to withstand to state the heater worked has.

In the above implementation way, states the porous seepage to be possible to be the nickel mesh, states the adsorbate to be possible for the Bolivian cordoba.

In the above implementation way, the liquid that the liquid carrier contains may contain various kinds to conform to the request ingredient, to satisfy demands of various different feeling in the mouth and kind of treatments, for example joins various treatment oral diseases and stimulates the awaking brain function Chinese medicine ingredient.

In the above implementation way, atomizes first 330 to form the safety point 3302, it may pierce the liquid carrier 20 to cause to state the porous seepage with state the liquid to form the liquid connection, as shown in Figure 3. At this time the liquid carrier 20 may have to be

possible by the siphon point 3302 to wear out in the corresponding spot establishment, to cause the aluminum foil that the liquid flows out (chart not to show).

In the above implementation way, and smoke hole 102 forms the gas circuits ventilation opening or the aperture in the atomizer drive pipe 310, thermostable insulators 320 as well as atomize the first 330 establishments, when as a result of it with the outside air connection, makes pumps this invention the simulation electron smoke to be easier, when suction ordinary cigarette suction resistance roughly quite.

In view of simulation electron smoke of this invention, to cause the use of electronic smoke is simpler more and direct, is easy to control, the effect is better, the control circuit 460 may also establish to have the barometric pressure electronic switching, it in the air current through sensing smoke pole tube changes the breakover battery 450, control circuits 460 as well as the electricity connection between heater. At this time the smoke pole 40 establishments have with the outside air connection and with state drive pipe's ventilation opening connection opening (chart not to show). When smoking simulation electron cigarette, realized through these openings inducted the surrounding air and guided to leaving the smoke hole 102, simultaneously the actuating barometric pressure electronic switching to start the atomization operation, states the gas that the air and atomization produced together from leaving the smoke hole 102 aspirations.

When to further approach the suction ordinary cigarette vision, the diaphanous lamp hat that states the simulation electron smoke also to be possible to include to establish Yu Yangen 40 noses may disassemble 50, in the smoke pole 40 establishments have with the control circuit 460 as well as the battery 450 electric interlocks lamps (have not shown). Stated the lamp to send out the theindigo red, to simulate the cigarette butt part that the ordinary cigarette fit.

In addition, to realize to introduce surrounding air the smoke pole tube 470, the lamp hat 50 week edge cocoa establishment has the air vent 601.

In based on the simulation electron smoke of this invention, the battery 450 may for the rechargeable battery. Optimal, in order to does not need the rechargeable battery to disassemble directly to carry on the charge, the smoke pole 40 also include with the control circuit 460 as well as the rechargeable battery positive and negative distinguishes the electric interlock extremely the positive electrode roof bar 410 as well as the cathode roof bar 420, positive electrode roof bar 410 as well as cathode roof bar 420 when stated the simulation electron smoke work the electric interlock in stated the heater positive and negative extremely, in stated the simulation electron smoke charge with the external power supply (chart has not shown) positive and negative extremely electric interlock. The positive electrode roof bar 410 as well as the cathode roof bar 420 between insulations may select various methods, in an implementation way, the form that as shown in Figure 4, specifically speaking, the positive electrode roof bar 410 put in the insulating sleeve 430 housings, but the insulating sleeve 430 put in the cathode roof bar 420 housings, or uses the opposite order to carry on the coverall. In addition, when to reduce the smoking resistance, may cause to install in most inside the corresponding roof bar establishment has the through hole (e.g. attached figure to mark 4401 to show), by with atomizing first 330 apertures and smoke hole 102 gas connections. At this time, in control circuit the establishment has corresponding as well as with carries on the charge control electric circuit that to the rechargeable battery with the active channel of smoking operation match the charge matches.

In addition, may substitute the place, may the establishment on the battery have one (chart has not shown) with the plug or the USB receptacle that it connects, state the plug either the USB receptacle may realize the electric interlock with the external power supply or the heating wire.

In addition, to demonstrate charge condition, diaphanous lamp hat that but may also be possible to disassemble in the smoke pole 40 smoke pole tube 470 nose establishments 50, states in smoke pole in 40 establishments and control circuit 460 as well as battery 450 electric interlocks battery control lamps. At this time, when the smoking simulation lights cigarette butt's lamp and charge battery control lamp may be the same lamp, or to have different color lamp. When the smoking simulation lights cigarette butt's lamp and charge battery control lamp for the same lamp, needs to carry on the change to the control circuit, when to realize smoking and charge the cut between different electric circuits, this is the domain male knowledge general knowledge, no longer gave unnecessary detail in this.

In based on simulation electron smoke of this invention, to overcome male knowledge electron smoke when heating wire electric interlock, because uses the aged question that the aerosol brings, and atomizer 30 may also including with state the heating wire as well as states the battery and control circuit form the electric interlock fixes in the atomizer drive pipe 310 in positive electrode springs 340 and cathode spring 350, as shown in Figure 3, Stated the electric interlock to be possible in this through the positive electrode spring 340 and cathode spring 350 soldering, braze welding, tangle and other ways realizes.

In addition, in based on the simulation electron smoke of this invention, the atomizer 30 and smoke pole 40 between union ways may for peg grafting, spiro union and so on. In an optimal implementation way, like Figure 3 and shown in Figure 4, may select the spiro union method, through establishing 360 as well as establishes in the atomizer drive pipe 310 in nuts in the smoke pole tube 470 and puts in the smoke pole tube 4701 ends screw rods 440 to realize the atomizer 30 and smoke pole 40 between unions. Certainly, may in turn, not be possible to establish in the smoke pole, but the screw rod establishes in the atomizer drive pipe.

In addition, when uses the screw rod and nut connect, may in the edge establishment and outside air of connection screw rod or nut aperture, by with atomizing the first 330 apertures and smoke hole 102 gas connections; Or like Figure 4 shows, the establishment and outside air connection's aperture 4401 on the screw rod 440 main body flanges, by with installing forms the gas connection in the aperture or the hole that smoke pole tube 470 various corresponding parts establish. At the same time, installs in the smoke pole tube 470 screw rods or the nuts may also with outside the corresponding part connection of battery charger, to realize ordinary plug like electric interlock or USB type electric interlock, thus carries on the charge of different pattern in the different voltage.

In addition, to increase atomizes the stability of head, but may also establish to have the fixed stand 370, as shown in Figure 3. At this time above establishment in thermostable insulation 320 atomization first 310 calories in fixed stand 370 two double wedges 3701 on. Simultaneously among the fixed stand 370 establishments have pass through the through hole up and down 3702, by with atomizing first 310 opening 3301 gas connections.

The next reference chart 1 as well as Figure 6 to Figure 9 showed that rests on this invention the simulation electron smoke.

Reference chart 1 as well as Figure 8 to Figure 9, includes based on this invention's simulation electron smoke cigarette case: Outside outside the shell, including the smoke lid 1 and cigarette case main body 2, the smoke lid 1 and cigarette case main body 2 forms shell Rong Zhiliang 23, and smoke lid 1 and cigarette case main body 2 in the surface is united as one body but separates in the front surfaces and lateral both sides, the above inside establishments of cigarette case main body 2 front surface have nearly the concave 21, has in the cigarette case main body 2 front surface flank establishment with smoke lid 1 under along the coordinate department that 11 coordinate 25, under along 11 along 251 forms the seal when the cigarette case closure with coordinate department 25 above, nearby the concave 21 bases 210 is higher than coordinate department 25 above along 251; In the shell 3, allow to set at outside shell's cigarette case main body 2 in; The smoke shoots Rong Zhibu 4, establishment shell 3 upside, and smoke shoots Rong Zhibu 4 crowns orthogonal in or is lower than nearby the concave 21 bases 210; Electronic smoke sufficient electric capacity sets at the department 5, establishment shell 3 upside, and electronic smoke sufficient electric capacity sets at the department 5 crowns orthogonal in or is lower than nearby the concave 21 bases 210; As well as the electronic smoke sufficient electrical department (chart has not shown), establishment shell 3, and (chart has not shown) including each other electric interlock charge control electric circuit, 6, as well as with the outside power connection connection (chart has not shown) with the electronic smoke electric interlock charge connection. In addition, nearby the cigarette case main body 2 front surface's above inside establishment's concave 21 may substitute the establishment in shell 3 on, specifically speaking, in shell 3 above 31 and two sides on the front surfaces extend, to form nearby similar cigarette case main body 2 front surface above inside establishment concave, nearby the concave base that at this time forms is still higher than coordinate department 25 above along 251.

In based on this invention simulation electron smoke cigarette case, when to approach the ordinary cigarette cigarette case opens effect, optimal, the smoke shoots Rong Zhibu 4 to establish one along in shell 3 length directions row or two rows, after to cause the electronic smoke the smoke ball 7 to insert to the smoke shoots Rong Zhibu 4, after the ordinary cigarette cigarette case opens sees each cigarette

the filter tip.

In based on this invention simulation electron smoke cigarette case, when to approach the ordinary cigarette cigarette case opens effect, optimal, the electronic smoke sufficient electric capacity sets at the department 5 with state the smoke of platoon to shoot Rong Zhibu along in shell 3 length directions 4 to align. At this time, further optimal, the charge connection 6 positions are: In sets at the department after the electronic smoke sufficient electric capacity 6 the electronic smoke 8 below festival 81 (content rechargeable battery) inserts to state the charge connection 6, after causing to insert sets the electronic smoke 8 below festival 81 crown with the smoke ball 7 crown that inserting sets at orthogonal or approximately orthogonal. From this, 81 inserts after the electronic smoke 8 below festival to the electronic smoke sufficient electric capacity sets at the department 5, after the ordinary cigarette cigarette case opens say that the neat emission the belt filters mouth's smoke.

In addition, in prevent to lay aside the loss that the electronic smoke previous section 82 create at w1, and simultaneously when to approach the ordinary cigarette cigarette case opens the effect, 81 inserts at the electronic smoke 8 below festival to the electronic smoke sufficient electric capacity sets at the department 5, may 82 insert the electronic smoke 8 previous section to cigarette holder Rong Zhibu 12 (or may substitute place, cigarette holder Rong Zhibu 12 equals directly in smoke shoots Rong Zhibu 4), at this time, cigarette holder Rong Zhibu 12 establishments: Cigarette holder Rong Zhibu 12 top surfaces orthogonal in or are lower than to state nearby the concave 21 base 210, cigarette holder Rong Zhibu 12 after to state the smoke of platoon to shoot Rong Zhibu 4 to align along in shell 3 length directions, smoke ball 7 crown that and insertion cigarette holder Rong Zhibu 12 electronic smoke 8 previous section 82 crown with inserting set at orthogonal or roughly orthogonal. May substitute the place, because electronic smoke various establishment same of charge connection, if electronic smoke for dismantlable, may have rechargeable battery's part to load the electronic smoke removable section in there. Otherwise may really the electronic smoke straight insertion (e.g. charge connection reason located at electronic smoke).

In based on this invention simulation electron smoke cigarette case, in avoiding only having an electronic cigarette to inconvenient (i.e., this electronic smoke charge that the consumer creates but consumer needs to put up electronic smoke, but according to becoming inconvenient), optimal, the shell 3 also establishes to have spare electronic smoke Rong Zhibu 9, may another electronic smoke insertion, thus the consumer may simultaneously conveniently use another electronic cigarette. When in order to approach the ordinary cigarette cigarette case opens effect, spare electronic smoke Rong Zhibu 9 establishments are: This spare electronic smoke Rong Zhibu 9 top surfaces orthogonal in or are lower than to state nearby the concave 21 bases 210, to state spare electronic smoke Rong Zhibu 9 after to state the smoke to shoot Rong Zhibu along in shell 3 length directions 4 to align, and this spare electronic smoke insertion spare electronic smoke Rong Zhibu 9 the spare electronic smoke's crown after inserting sets at the smoke ball 7 crown orthogonal or roughly orthogonal.

In based on this invention simulation electron smoke cigarette case, for 8 carries on the charge to the electronic smoke, electronic smoke sufficient electrical department and outside power connection connection shell 3 lower parts for establishment may reveal cigarette case main body 2 beside the USB receptacles 11 or the plug (chart has not shown).

In based on this invention simulation electron smoke cigarette case, optimal, states USB or in plug establishment shell 3 lower parts, and connects to derive the instalment (chart not in show), and shell 3 and cigarette case main body 2 bases downward either have to state the USB receptacle or the plug migration and (e.g. guide trough and manhole) (chart have not shown) from the slot that to the side establishment the cigarette case main body 2 reveals.

In based on this invention simulation electron smoke cigarette case, optimal, the electronic smoke sufficient electrical department also includes the establishment the battery control lamps in shell 3 outside surface (chart not to show), and establishment in the cigarette case main body 2 on relevant positions has the through hole (chart not to show), when by to electronic smoke 8 the rechargeable batteries carry on the charge, through the battery control lamp demonstrates the charge condition.

In based on this invention simulation electron smoke cigarette case, optimal, in the box main body 2 bases the establishment has to be easy to tear (chart not to show), it corresponds to stated the connection spot establishment of electronic smoke sufficient electrical department and outside power connection. After opening cigarette case packing plastic membrane, may be easy to tear the department to tear up, thus reveals to state the connection spot.

In based on this invention simulation electron smoke cigarette case, optimal, states electronic smoke sufficient electrical department and electronic smoke 8 below festival 81 electric interlocks charge connections for spiro union or peg grafting connection.

Outside based on this invention's simulation electron smoke cigarette case, states the shell and in the shell (e.g. plastic) by the insulation material is made.

In order to simplify the fabrication technology, in shell may shoot Rong Zhibu, the electronic smoke sufficient electric capacity to set at and electronic smoke previous section Rong Zhibu, spare electronic smoke Rong Zhibu, cigarette holder Rong Zhibu with the smoke and other body formation.

In the above explanation, states the length direction is being parallel that shown in Figure 8 in the paper surface direction, the width direction for with the paper surface vertical direction, highly the direction for with the direction that the above length direction and width direction are vertical, the definition and ordinary cigarette of cigarette case's this direction the definition of length, width and high direction is consistent.

Description

(CN101869356)

仿真电子烟及其烟盒

技术领域

本发明涉及一种仿真电子烟及其烟盒，特别涉及一种提高雾化液的使用效率并有效防止泄露的仿真电子烟及其具有充电功能的仿真电子烟烟盒。

背景技术

吸烟有害健康是一种常识，吸烟可导致数百万人的死亡，并引发多种疾病，吸烟是一种全球化的趋势，各国政府都在积极的寻找对策，但让吸烟者戒烟是一件非常困难的事情，且烟民的数量在全球呈增长的趋势，首次吸烟的年龄越来越小。另外，随着居民健康意识的提高，全球每年销售的电子烟也在增长，需要利用大量的特殊原料进行生产，满足工厂生产卷烟的需求，虽然烟草行业已经为政府带来巨额的税收，但对全球健康造成巨大的隐患，特别是对于发展中国家来说，二手烟造成的危害更大。

为了避免吸烟造成的危害，世界各地的研究人员都在努力寻找香烟的替代品，首先制造出了低烟碱含量和低焦油含量的香烟，但低烟碱含量和低焦油含量的香烟对于吸烟者来说，口感没有味道，烟民不喜欢，其次，研究人员研发了很多香烟的替代品，如电子烟、烟嘴、电子烟、电子烟等，这些产品虽然不含焦油，又具有好的口感，但这些产品改变了吸烟者的习惯，也解决不了烟民上瘾的问题，因此，不能将电子烟作为真正的香烟替代品；第三，研究人员推出了电子烟产品，依靠其设计的电路，利用将电子烟中的液体雾化，产生烟雾，而电子烟中的液体可以按照需求和口味要求进行配制，能够解决烟民的需求，目前电子烟产品存在的不足问题有：1、产品结构复杂，如CN201107839Y和CN201079011Y的结构；2、采用电池充电或电网的220V交流电来进行充电，电池的更换会给使用者带来不便，交流电属于强电，对于电子烟的电路，安全隐患大，有可能造成短路，使电子烟产品不能使用；3、液体的雾化采用的是超声波化和超声波雾化，这种雾化方式对液体雾化不均匀，会产生雾化不均匀的问题，例如CN201107839Y和CN201079011Y就存在这个问题；4、在现有的电子烟产品中，采用的是气动驱动抽气式点火开关，该开关结构复杂，安装困难且连接处，使用一段时间后会导致密封效果不好，影响使用。

尽管上述现有技术提供了电子烟的结构，但是电子烟缺乏与之配套的装置，目前使用的原电池体积较大，携带和使用不便，制约了电子烟市场的发展，尽管CN201094280Y在电子烟盒方面提出的研究，提出了采用各种内置电池对电子烟进行充电，刻意的将电池只是充电，另外，采用了内置电池，使得烟盒的结构复杂，制造成本增加，该烟盒在电子烟充电时需要将电子烟放入烟盒的特定位置，导致烟盒的外形与常规烟盒接近，此外，打开烟盒之后，其看到的内部结构与普通烟盒完全不同，这样对消费者的吸引力降低。

发明内容

鉴于现有技术存在的上述缺陷，本发明的目的在于提供一种仿真电子烟，其可提高雾化液的使用效率并有效防止泄露。

本发明的另一个目的在于提供一种仿真电子烟，其使得电子烟的使用更简便，易于控制，效果更佳。

本发明还有目的在于提供一种仿真电子烟，其改变电子烟的充电模式，以利用弱电进行充电，从而提高安全性。

本发明的目的在于提供一种仿真电子烟烟盒，该烟盒可以达到与传统烟盒强大的程度。

本发明的另一个目的在于，提供一种仿真电子烟烟盒，其内部设置电池，而可直接利用外部电源进行充电。

本发明的另一个目的在于，提供一种仿真电子烟烟盒，其在一支仿真电子烟充电的同时，消费者可使用另一支配套的仿真电子烟吸烟。

为了实现本发明的上述目的，本发明提供了一种仿真电子烟，其包括：烟嘴，包括壳体并设有出烟孔，壳体承载部，设置于所述烟嘴内并承载有液体，且所述壳体承载部与所述出烟孔气体流通；雾化器，可拆卸地连接于所述壳体承载部；以及烟杆，包括可拆卸地连接于所述壳体承载部的烟杆管以及设置于所述烟杆管内的充电电路及控制电路，其中，所述雾化器包括：雾化器壳体，具有中空腔体且设置于所述烟嘴的壳体中，耐高温绝缘体，设置于所述雾化器壳体内且设置有雾化腔；雾化头，连接于所述耐高温绝缘体的外周面上，并与所述壳体承载部相连并导引所述液体；多孔渗透件，设置于所述雾化头以及所述耐高温绝缘体的外周面上；电热丝，设置于所述雾化腔内，且电连接于所述充电电路和所述控制电路；以及吸嘴体，设置于所述雾化腔内，连接于所述电热丝上且与所述多孔渗透件连接，其中，所述雾化器壳体、所述耐高温绝缘体、所述雾化头以及所述烟杆管均设置于所述出烟孔形成气体通路的通气孔内。

针对本发明的上述目的，优选地，所述烟杆管设有与外界空气连通并与所述雾化器壳体的通气孔连通的开孔，所述控制电路包括有可选择地与所述充电电路电连接的气压电子开关。

针对本发明的上述目的，优选地，所述烟杆还包括与所述控制电路以及所述充电电路的正负极分别电连接的正极顶针以及负极顶针，所述正极顶针以及负极顶针与所述仿真电子烟工作时电连接于所述电热丝的汇流极而在所述仿真电子烟充电时与外部电源的正负极电连接。

在本发明的仿真电子烟中，优选地，所述雾化头形成有可刺穿所述壳体承载部以使所述多孔渗透件与所述液体形成液体流通的突出部。

在本发明的仿真电子烟中，优选地，所述仿真电子烟还包括有设置于所述烟杆端部的可拆装的遮光灯帽，所述烟杆内设置有所述控制电路以及所述充电电路电连接的灯。

在本发明的仿真电子烟中，优选地，所述仿真电子烟还包括设置于所述烟杆端部的可拆装的遮光灯帽，所述烟杆内设置有所述控制电路以及所述充电电路电连接的灯。

在本发明的仿真电子烟中，优选地，所述雾化器还包括与所述电热丝以及所述充电电路和所述控制电路电连接的目判定上所述雾化器壳体

内的正极顶针和负极顶针。

在本发明的仿真电子烟中，优选地，所述多孔渗透件为纤维丝，所述烟杆管为碳纤维丝。

在本发明的仿真电子烟中，优选地，所述烟杆还包括有与所述充电电路电连接的工在吸烟时与所述电热丝电连接的插头或USB接口。

基于本发明的仿真电子烟，提高了雾化器的使用效率并有效防止烟液；电子烟的使用更简便，易于控制，效果更佳；改变电子烟的充电模式，以利用弱电进行充电，从而提高安全性。

此外，使用本发明的产品具有逼真的仿真效果，该烟嘴对吸烟者无害，又具有吸烟时吞云吐雾的效果，由于壳体是按照需要配制的，对人体和环境无害，该烟嘴无毒，安全性很高，能够为消费者所接受，另外，该产品的推广使用，会减少社会对烟草的投入，能够保护环境。

针对本发明的另一方面，本发明提供了一种仿真电子烟烟盒，包括：外壳体，包括制盒盖和烟盒本体，制盒盖和烟盒本体形成外壳体容置腔，且制盒盖和烟盒本体在表面或一体均在前表面以及侧向两侧上分开，烟盒本体的表面外侧设置有与制盒盖的下坡相配合的配合部；内壳体，设置在外壳体的烟盒本体内部，容纳雾化器，设置在内壳体的上部，容纳仿真电子烟；电子烟充电装置部，设置在内壳体的上部；以及电子烟充电电路，设置在内壳体中，且包括接收电连接的充电控制电路、与电子烟电连接的充电接口，以及与外界电源连接的接口；其中，制盒盖本体的上表面或侧面的上部设置有凹部，所述凹部的底边或配合部的上边沿，容纳雾化器的顶部并齐于或低于所述凹部的底边，烟盒本体容置腔的顶部并齐于或低于所述凹部的底边。

在本发明的仿真电子烟烟盒中，优选地，所述电子烟容置腔沿烟盒本体的长度方向设置成一排或两排，烟盒本体容置腔沿烟盒本体的长度方向与所述电子烟容置腔对齐。

在本发明的仿真电子烟烟盒中，优选地，所述电子烟容置腔，即该电子烟容置腔的顶部并齐于或低于所述凹部的底边，所述电子烟容置腔沿烟盒本体的长度方向与所述电子烟容置腔对齐。

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在上述说明中，所述长度方向为图8所示的平行于纸面的方向，宽度方向为与纸面垂直的方向，高度方向为与上述长度方向和宽度方向相垂直的方向，该方向的定义与普通香烟的长、宽、高方向的定义一致。



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[54]发明名称 吸烟制品

[57]摘要

本发明涉及产生类似烟草烟雾的吸烟制品,而它仅含有最小限度的不完全燃料和高温分解产物。

本吸烟制品包括一个短的可燃碳素燃料元件,一个能忍受烟雾生成物质的热稳定的基质,一个使燃料元件的一部分和基质接触的热传导构件和一个至少要围住一部份燃料的绝热外套。

本吸烟制品的烟雾“烟”在化学上是简单的道具按照艾米斯(Ames)试验测定不具有明显的诱变活性。

1、吸烟制品包括：

(a) 一个碳素燃烧元件；

(b) 一个总体上分离的烟雾发生机构包括含有烟雾形成物质的基质；以及

(c) 一个接嘴；

燃料元件和基质安排成传导热交换关系中，以便热稳定的基质在整个燃料元件燃烧时间都受到传导热的传递。

2、根据权利要求1所述的制品，其特征在于其中燃料元件长度是不到大约30毫米。

3、一个细长的吸烟制品包括：

(a) 一个可燃的燃料元件长度小于大约30毫米，且具有至少0.5克/厘米³的密度；

(b) 一个同燃料元件有传导热交换关系的烟雾发生机构；

(c) 由烟雾发生机构产生的烟雾传送给使用者的机构。

4、一个细长的吸烟制品包括：

(a) 一个燃料元件；

(b) 一个包括烟雾形成物质总体上分离的烟雾发生机构；

(c) 一个至少围住燃料元件一部分的绝热构件。

5、根据权利要求4所述的制品，其特征在于其中燃料元件和烟雾发生机构有传导热交换关系结构。

6、根据权利要求4或5的制品，其特征在于燃料元件长度小于30毫米。

7、根据权利要求1、2、3或4所述的制品，其特征在于该制品产生总湿润物质粒子通过艾米斯(Ames)试验没有诱变活性。

8、根据权利要求4、5、6或7所述的制品，其特征在于其中绝热构件是有弹性的和至少0.5毫米厚的材料。

9、根据权利要求8所述的制品，其特征在于绝热构件包括纤维的材料。

10、根据权利要求4或5所述的制品，其特征在于绝热构件至少还要围住烟雾剂发生机构的一部份。

11、根据权利要求1、3、4、5或8所述的制品，其特征在于燃料元件是可燃性的物质，而长度是不到20毫米。

12、根据权利要求1、3、4、5或8所述的制品，其特征在于其中燃料元件长度不到15毫米。

13、根据权利要求11所述的制品，其特征在于其中燃料元件具有许多纵向延伸的通道。

14、根据权利要求1、2、3、4或8所述的制品，其特征在于还含有使燃料元件和烟雾发生机构接触的热传导构件。

15、根据权利要求14所述的制品，其特征在于其中热传导构件是金属的。

16、根据权利要求15所述的制品，其特征在于其中金属的构件是至少围绕燃料元件和烟雾发生机构的一部份的金属箔。

17、根据权利要求16所述的制品，其特征在于其中金属构件围住容有烟雾形成物质的基质。

18、根据权利要求16所述的制品，其特征在于其中金属构件

是至少嵌入燃料元件和烟雾发生机构的一部份的金属棒。

19、根据权利要求16所述的制品，其特征在于其中燃料元件长度小于15毫米左右。

20、根据权利要求1、2、3或4所述的制品，其特征在于其中烟雾发生机构至少部份夹在燃料元件空腔中。

21、根据权利要求1、2、3或4所述的制品，其特征在于其中烟雾发生机构包括一个多孔的，非颗粒状基质，其并具有至少部份地经由的纵向通道。

22、根据权利要求1、2、3或4所述的制品，其特征在于其中在F T C吸烟条件下开始三次喷烟中制品至少释放0.6毫克左右总湿润物质粒子。

23、根据权利要求22所述的制品，其特征在于其中在F T C吸烟条件下开始三次喷烟中制品至少释放1.5毫克左右总湿润物质粒子。

24、根据权利要求1、2、3或4所述的制品，其特征在于其中制品在F C T吸烟条件下作至少六次喷烟释放至少平均每次0.8毫克左右的总湿润物质粒子。

25、根据权利要求1、3或4所述的制品，其特征在于其中烟雾发生机构包括有从大约35毫克至85毫克的烟雾形成物的基质。

26、根据权利要求1、3或4所述的制品，其特征在于至少大约15%重量的烟雾形成物在F T C吸烟条件下被释放作为总湿润物质粒子。

27、根据权利要求1、3或4所述的制品，其特征在于还包含安置在燃料元件的口端和制品的口端之间的烟叶填料。

28、根据权利要求1、3或4所述的制品，其特征在于其中燃料元件实质上在冒烟期间不产生明显的侧流烟雾。

29、根据权利要求3、4、5或8所述的制品，其特征在于其中燃料元件包括一种含碳的物质。

30、根据权利要求29所述的制品，其特征在于其中燃料元件的长度不到20毫米。

31、根据权利要求29所述的制品，其特征在于其中燃料元件的长度不到15毫米。

32、一个细长吸烟制品包括：

- (a) 长度小于30毫米的燃料元件，
- (b) 总体上分离的含有烟雾形成物质载体的烟雾发生机构；
- (c) 使热从燃料元件传导到烟雾发生机构用的机构；
- (d) 至少要围住燃料元件一部分的绝热机构；

33、根据权利要求32所述的吸烟制品，其特征在于其中热传导机构包括使燃料元件和烟雾发生机构接触的热传导构件。

34、根据权利要求33所述的制品，其特征在于其中热传导构件围绕烟雾形成物质组成的载体。

35、根据权利要求33所述的制品，其特征在于其中绝热构件是有弹性的并至少有0.5毫米厚。

36、根据权利要求32所述的制品，其特征在于其中燃料元件包括一种含碳物质。

37、根据权利要求36所述的制品，其特征在于其中燃料元件长度不到15毫米。

38、根据权利要求32、33、34或35所述的制品，其特征在于

吸烟制品

本发明涉及会产生类似于烟草烟雾的吸烟制品，而且该烟雾仅仅含有极其少量的不完全燃烧物或高温热解产物。

许多年以来，特别是近20至30年间已经推荐过许多吸烟制品，但是这些制品中没有一件曾经获得过商业上的成功。

尽管经过数十年的关心和努力，可是在市场上仍还没有给吸普通香烟提供便利和有益的吸烟制品，而不产生相当大量的不完全燃烧物或高温分解产物。

本发明涉及在产品使用期限的开始和结束都能够产生相当大的量的烟雾的吸烟制品，而没有烟雾形成物的有效热损失和相当大量的高温分解或不完全燃烧产物，并更可取的是没有相当大量的侧流烟雾。根据本发明的吸烟制品在没有燃烧烟叶时就会给使用者提供吸香烟的感觉和益处。

这些和其它的优点是通过细长的香烟型吸烟制品来获得，使用一种“燃烧元件”最好是用碳素材料，连结一个与燃烧元件有传导热交换关系的并实际上是分离的烟雾发生机构。在点燃时，燃料元件就产生热量，该热量用来挥发烟雾发生机构的烟雾生成物质或各种物质。于是这些挥发物特别在抽烟期间吸向嘴端，并进入吸烟者嘴里，是类似于普通香烟的烟雾。

最好，燃料元件的长度小于30毫米，其最佳长度小于15毫米，具有至少0.5克/厘米³的密度，并且设有一个或一个以上纵向的通道。有利的是，烟雾发生机构包括含有一种或一种以上烟雾生

United States Patent [19]

Sensabaugh, Jr. et al.

[11] Patent Number: 4,793,365

[45] Date of Patent: Dec. 27, 1988

[54] SMOKING ARTICLE

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[21] Appl. No.: 650,604

[22] Filed: Sep. 14, 1984

[51] Int. Cl.⁴ A24D 1/00; A24D 1/02;
A24D 1/18; A24F 1/00

[52] U.S. Cl. 131/194; 131/335;
131/360; 131/361; 131/364; 128/202.21

[58] Field of Search 131/360, 361, 364, 359,
131/194, 335, 195, 196, 197

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Primary Examiner—V. Millin

Attorney, Agent, or Firm—Grover M. Myers; David G. Conlin

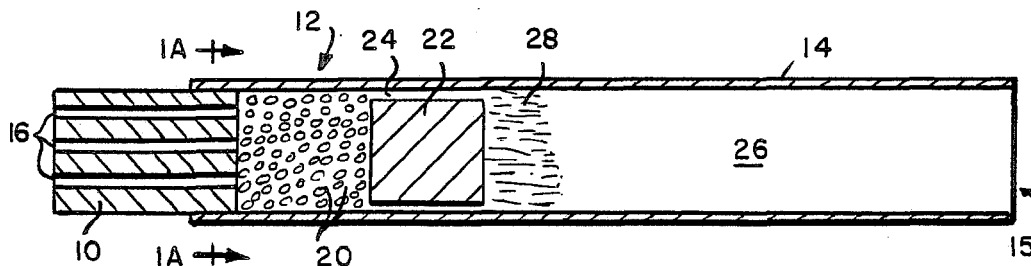
[57] ABSTRACT

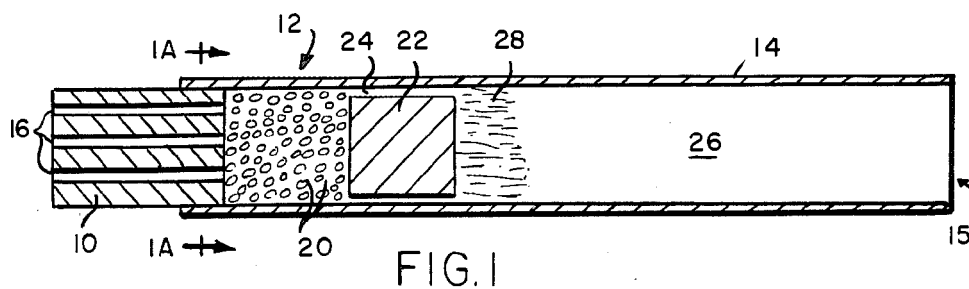
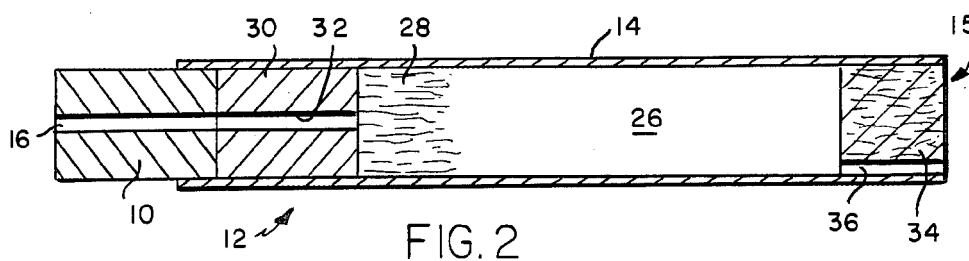
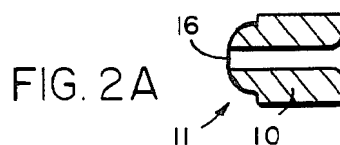
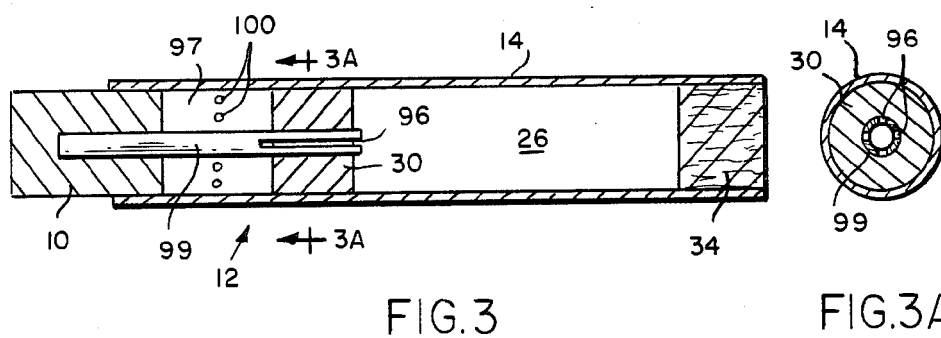
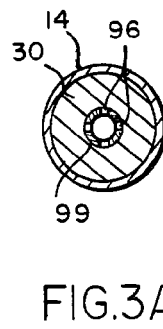
The present invention relates to a smoking article which produces an aerosol that resembles tobacco smoke, but contains no more than a minimal amount of incomplete combustion or pyrolysis products.

The smoking article of the present invention provides an aerosol "smoke" which is chemically simple, consisting essentially of oxides of carbon, air, water, and the aerosol which carries any desired flavorants or other desired volatile materials, and trace amounts of other materials. The aerosol "smoke" has no significant mutagenic activity as measured by the Ames Test. In addition, the article may be made virtually ashless so that the user does not have to remove any ash during use.

One embodiment of the present smoking article comprises a short combustible carbonaceous fuel element; a short heat stable, preferably carbonaceous substrate bearing an aerosol forming substance, and a relatively long mouthend piece. The fuel element and the substrate are arranged in a heat exchange relationship, thereby causing aerosol formation without significant degradation of the aerosol former.

50 Claims, 3 Drawing Sheets





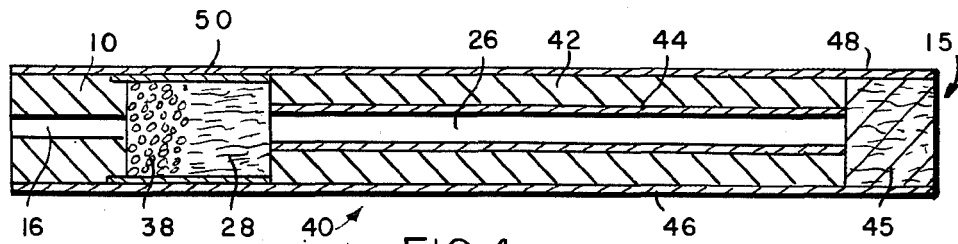


FIG. 4

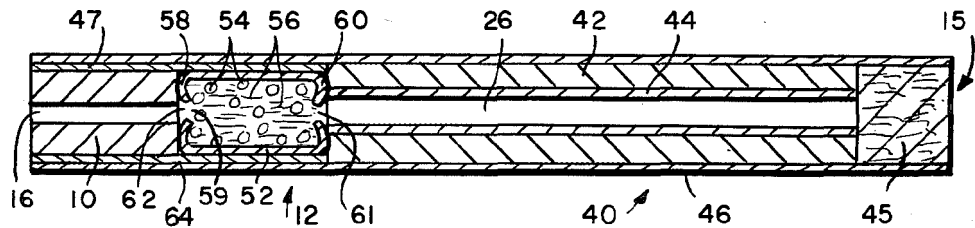


FIG. 5

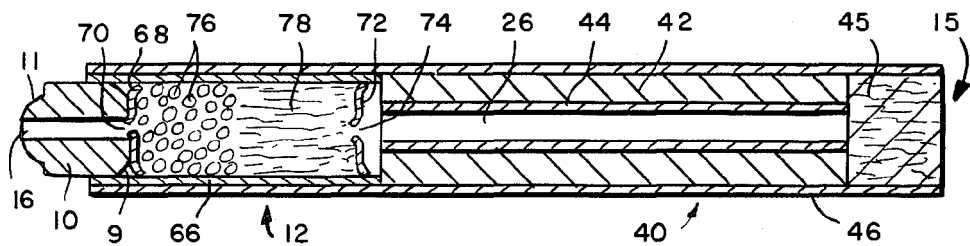


FIG. 6

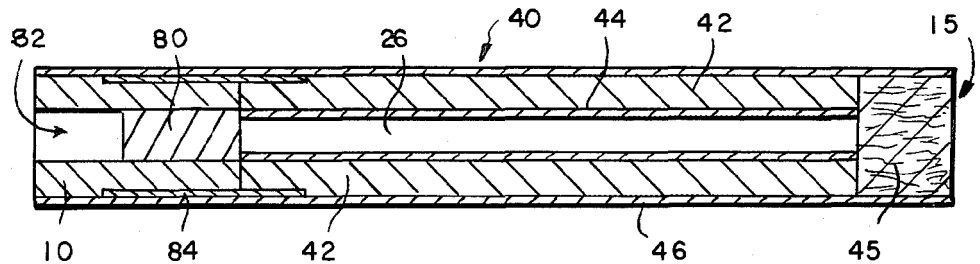
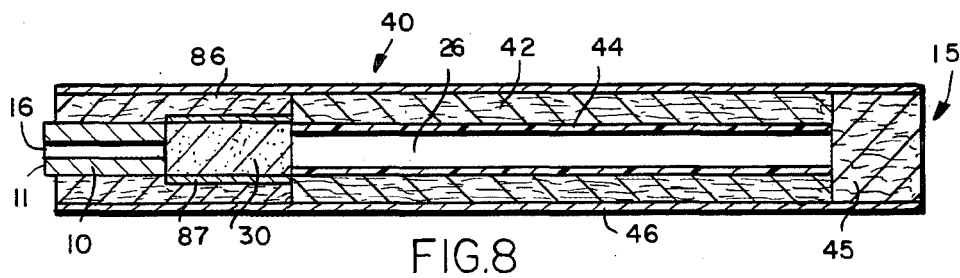
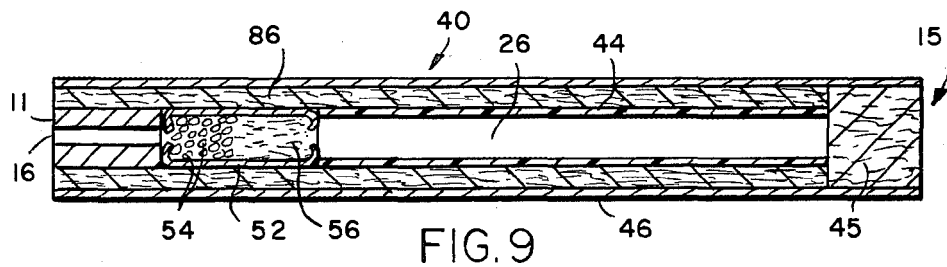
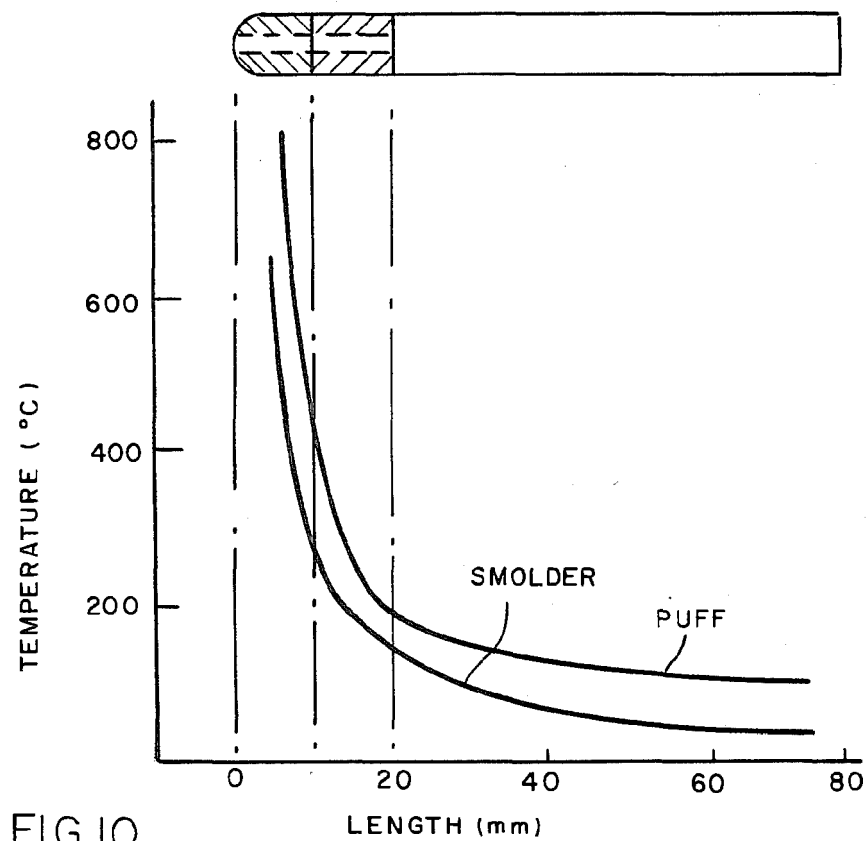


FIG. 7



SMOKING ARTICLE

BACKGROUND OF THE INVENTION

The present invention relates to a smoking article which produces an aerosol that resembles tobacco smoke which contains no more than a minimal amount of incomplete combustion or pyrolysis products.

Many smoking articles have been proposed through the years, especially over the last 20 to 30 years. But none of these products has ever realized any commercial success.

Tobacco substitutes have been made from a wide variety of treated and untreated plant material, such as cornstalks, eucalyptus leaves, lettuce leaves, corn leaves, cornsilk, alfalfa, and the like. Numerous patents teach proposed tobacco substitutes made by modifying cellulosic materials, such as by oxidation, by heat treatment, or by the addition of materials to modify the properties of cellulose. One of the most complete lists of these substitutes is found in U.S. Pat. No. 4,079,742 to Rainer et al. Despite these extensive efforts, it is believed that none of these products has been found to be completely satisfactory as a tobacco substitute.

Many proposed smoking articles have been based on the generation of an aerosol or a vapor. Some of these products produce an aerosol or a vapor without heat. See, e.g., U.S. Pat. No. 4,284,089 to Ray. However, the aerosols or vapors from these articles fail to adequately simulate tobacco smoke.

Some proposed aerosol generating smoking articles have used a heat or fuel source in order to produce an aerosol. However, none of these articles has ever achieved any commercial success, and it is believed that none has ever been widely marketed. The absence of such smoking articles from the marketplace is believed to be due to a variety of reasons, including insufficient aerosol generation, both initially and over the life of the product, poor taste, off-taste due to the thermal degradation of the smoke former and/or flavor agents, the presence of substantial pyrolysis products and sidestream smoke, and unsightly appearance.

One of the earliest of these proposed articles was described by Siegel in U.S. Pat. No. 2,907,686. Siegel proposed a cigarette substitute which included an absorbent carbon fuel, preferably a 2½ inch stick of charcoal, which was burnable to produce hot gases, and a flavoring agent carried by the fuel, which was adapted to be distilled off incident to the production of the hot gases. Siegel also proposed that a separate carrier could be used for the flavoring agent, such as a clay, and that a smoke-forming agent, such as glycerol, could be admixed with the flavoring agent. Siegel's proposed cigarette substitute would be coated with a concentrated sugar solution to provide an impervious coat and to force the hot gases and flavoring agents to flow toward the mouth of the user. It is believed that the presence of the flavoring and/or smoke-forming agents in the fuel of Siegel's article would cause substantial thermal degradation of those agents and an attendant off-taste. Moreover, it is believed that the article would end to produce substantial sidestream smoke containing the aforementioned unpleasant thermal degradation products.

Another such article was described by Ellis et al. in U.S. Pat. No. 3,258,015. Ellis et al. proposed a smoking article which has an outer cylinder of fuel having good smoldering characteristics, preferably fine cut tobacco

or reconstituted tobacco, surrounding a metal tube containing tobacco, reconstituted tobacco, or other source of nicotine and water vapor. On smoking, the burning fuel heated the nicotine source material to cause the release of nicotine vapor and potentially aerosol generating material, including water vapor. This was mixed with heated air which entered the open end of the tube. A substantial disadvantage of this article was the ultimate protrusion of the metal tube as the tobacco fuel was consumed. Other apparent disadvantages of this proposed smoking article include the presence of substantial tobacco pyrolysis products, the substantial tobacco sidestream smoke and ash, and the possible pyrolysis of the nicotine source material in the metal tube.

In U.S. Pat. No. 3,356,094, Ellis et al. modified their original design to eliminate the protruding metal tube. This new design employed a tube made out of a material, such as certain inorganic salts or an epoxy bonded ceramic, which became frangible upon heating. This frangible tube was then removed when the smoker eliminated ash from the end of the article. Even though the appearance of the article was very similar to a conventional cigarette, apparently no commercial product was ever marketed.

In U.S. Pat. No. 3,738,374, Bennett proposed the use of carbon or graphite fibers, mat, or cloth associated with an oxidizing agent as a substitute cigarette filler. Flavor was provided by the incorporation of a flavor or fragrance into the mouthend of an optional filter tip.

U.S. Pat. Nos. 3,943,941 and 4,044,777 to Boyd et al. and British Patent No. 1,431,045 proposed the use of a fibrous carbon fuel which was mixed or impregnated with volatile solids or liquids which were capable of distilling or subliming into the smoke stream to provide "smoke" to be inhaled upon burning of the fuel. Among the enumerated smoke producing agents were polyhydric alcohols, such as propylene glycol, glycerol, and 1,3 butylene glycol, and glyceryl esters, such as triacetin. Despite Boyd et al.'s desire that the volatile materials distill without chemical change, it is believed that the mixture of these materials with the fuel would lead to substantial thermal decomposition of the volatile materials and to bitter off-tastes. Similar products were proposed in U.S. Pat. No. 4,286,604 to Ehretsmann et al. and in U.S. Pat. No. 4,326,544 to Hardwick et al.

Bolt et al., in U.S. Pat. No. 4,340,072 proposed a smoking article having a fuel rod with a central air passageway and a mouthend chamber containing an aerosol forming agent. The fuel rod preferably was a molding or extrusion of reconstituted tobacco and/or tobacco substitute, although the patent also proposed the use of tobacco, a mixture of tobacco substitute material and carbon, or a sodium carboxymethylcellulose (SCMC) and carbon mixture. The aerosol forming agent was proposed to be a nicotine source material, or granules or microcapsules of a flavorant in triacetin or benzyl benzoate. Upon burning, air entered the air passage where it was mixed with combustion gases from the burning rod. The flow of these hot gases reportedly ruptured the granules or microcapsules to release the volatile material. This material reportedly formed an aerosol and/or was transferred into the mainstream aerosol. It is believed that the articles of Bolt et al., due in part to the long fuel rod, would produce insufficient aerosol from the aerosol former to be acceptable, especially in the early puffs. The use of microcapsules or granules would further impair aerosol delivery because

of the heat needed to rupture the wall material. Moreover, total aerosol delivery would appear dependent on the use of tobacco or tobacco pyrolysis products and sidestream smoke which would not be desirable in this type smoking article.

U.S. Pat. No. 3,516,417 to Moses proposed a smoking article, with a tobacco fuel, which was identical to the article of Bolt et al., except that Moses used a double density plug of tobacco in lieu of the granular or micro-encapsulated flavorant of Bolt et al. See FIG. 4, and col. 4, 1. 17-35. This article would suffer many of the same problems as the articles proposed by Bolt et al.

Thus, despite decades of interest and effort, there is still no smoking article on the market which provides the benefits and advantages associated with conventional cigarette smoking.

SUMMARY OF THE INVENTION

The present invention relates to a smoking article which is capable of producing substantial quantities of aerosol, both initially and over the useful life of the product, without significant thermal degradation of the aerosol former and without the presence of substantial pyrolysis or incomplete combustion products or sidestream smoke. Thus, the article of the present invention is able to provide the user with the sensations and benefits of cigarette smoking without burning tobacco.

In one aspect of the present invention, the smoking article has a short, combustible carbonaceous fuel element, generally less than about 30 mm long, which is substantially free of volatile organic material. Preferably, the fuel element is less than about 15 mm in length. A physically separate aerosol generating means, such as a substrate or chamber containing an aerosol forming substance, is located in a conductive heat exchange relationship to the fuel element. preferably, the heat exchange relationship is achieved by providing a heat conductive member which efficiently conducts or transfers heat from the burning fuel element to the aerosol generating means. Advantageously, the aerosol generating means is a relatively short body, again generally less than about 30 mm long, which either abuts or is adjacent to the nonlighting end of the fuel element. Preferably, the aerosol generating means is a thermally stable substrate impregnated with one or more aerosol forming substances and is less than about 15 mm in length.

The smoking article of the present invention normally is provided with mouthend piece including means, such as a longitudinal passage, for delivering the volatile material produced by the aerosol generating means to the user. Advantageously, the article has the same overall dimensions as a conventional cigarette, and as a result, the mouthend piece and the aerosol delivery means usually extend over more than one-half the length of the article. Alternatively, the fuel element and the aerosol generating means may be produced without a built-in mouthpiece or aerosol delivery means, for use as a disposable cartridge, with a separate, reusable mouthpiece.

Upon lighting, the fuel element generates heat which is used to volatilize the aerosol forming substance or substances contained in the substrate or chamber. These volatile materials are then drawn toward the mouthend, especially during puffing, and into the user's mouth, akin to the smoke of a conventional cigarette. Because the fuel element is relatively short, the hot, burning fire cone is always close to the aerosol generating body,

which maximizes heat transfer to the aerosol generating means and the resultant production of aerosol. The use of a relatively short, low mass aerosol generating body, in close proximity to the short fuel element, also increases aerosol production by minimizing the heat sink effect of the substrate or carrier. Because the aerosol forming substance is physically separate from the fuel element, it is exposed to substantially lower temperatures than are present in the burning fire cone, which minimizes the possibility of thermal degradation of the aerosol former. Moreover, the use of a carbonaceous fuel element which is substantially free of volatile organic material eliminates the presence of substantial pyrolysis or incomplete combustion products and the presence of substantial sidestream smoke.

In another important aspect of the present invention, the smoking article is provided with means for conducting heat from the fuel element to the aerosol generating means other than the mere end to end abutment of the fuel element to the aerosol generating means. Preferably, the heat conducting means is a heat conducting member, such as a metal foil, or a metal rod, which advantageously contacts both the fuel element and the aerosol generating means. Contact of the metal foil is preferably along the external longitudinal surfaces of the fuel element and the aerosol generator. Contact of the metal rod is preferably made by embedding the rod centrally within the fuel element and the aerosol generator.

The use of the heat conducting means of the present invention substantially increases heat transfer to the aerosol generator which, in turn, volatilizes larger quantities of the aerosol former for delivery to the user. This increased heat transfer is, in part, due to the fact that the heat conducting means transfers heat both during a puff and during smolder, whereas convective heat transfer, which is primarily relied upon in most prior art aerosol generating articles, primarily delivers heat only during a puff. This increased heat transfer makes more efficient use of the available fuel energy, reduces the amount of fuel needed, helps deliver aerosol on the initial puffs, and substantially reduces material costs of the fuel. Further, it is believed that conductive heat transfer reduces the carbon fuel combustion temperature and thus greatly reduces the CO/CO₂ ratio.

In a particularly preferred embodiment of the invention, the fuel element is a pressed carbon plug or mass of carbonized fibers, generally about 10 mm or less in length, which is provided with at least one longitudinal passage to aid heat transfer to the aerosol generator. The aerosol generating means is a thermally stable, preferably carbonaceous substrate about 10 mm or less in length which is impregnated with one or more aerosol forming substances, such as a mixture of glycerol and propylene glycol. This substrate may be provided with an axial passage which may be aligned with an axial passage in the fuel element. This fuel element and substrate are joined by an encircling piece of heat conductive aluminum foil which envelops the longitudinal periphery of the nonlighting end of the fuel element and at least a portion, and preferably all, of the longitudinal periphery of the substrate.

Preferred embodiments of the invention are capable of delivering at least 0.6 mg of aerosol, measured as wet total particulate matter, in the first 3 puffs, when smoked under standard FTC smoking conditions. More preferably, preferred embodiments of the invention are capable of delivering 1.5 mg or more of aerosol in the

first 3 puffs. Most preferably, preferred embodiments of the invention are capable of delivering 3 mg or more of aerosol in the first 3 puffs when smoked under standard FTC smoking conditions. Moreover, preferred embodiments of the invention deliver an average of at least about 0.8 mg of wet total particulate matter per puff under standard FTC smoking conditions.

The smoking article of the present invention also may include a charge or plug of tobacco which is used to add a tobacco flavor to the aerosol. Preferably, the tobacco is placed at the mouthend of the aerosol generating means, or it is mixed with the carrier for the aerosol forming substance. Flavoring agents also may be incorporated into the article to flavor the aerosol delivered to the user.

The smoking article of the present invention also provides an aerosol "smoke" which is chemically simple, consisting essentially of air, oxides of carbon, water, and the aerosol which carries any desired flavorants or other desired volatile materials, and trace amounts of other materials. The aerosol "smoke" has no significant mutagenic activity using the Ames test discussed hereinafter. In addition, the article may be made virtually ashless so that the user does not have to remove any ash during use.

In another important aspect of the invention, the aerosol forming substance may be replaced, in whole or in part, by a volatile, nonaerosol substance, such as a flavoring agent and/or other volatile solid or liquid materials, to deliver flavors and/or other materials to the user, in aerosol or vapor form.

The smoking article of the present invention is described in greater detail in the accompanying drawings and in the detailed description of the invention which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 through 9 are longitudinal, sectional views of various embodiments of the invention;

FIG. 1A is a sectional view of the embodiment of FIG. 1, taken along lines 1A—1A in FIG. 1;

FIG. 2A is a longitudinal view of a modified, tapered fuel element of the embodiment of FIG. 2;

FIG. 3A is a sectional view of the embodiment of FIG. 3, taken along lines 3A—3A in FIG. 3; and

FIG. 10 is the average peak temperature profile of the smoking article of Example 5 during use.

DETAILED DESCRIPTION OF THE INVENTION

The embodiment of the invention illustrated in FIG. 1, which preferably has the diameter of a conventional cigarette, includes a short, combustible carbonaceous fuel element 10, an abutting aerosol generating means 12, and a foil lined paper tube 14, which forms the mouthend 15 of the article. In this embodiment, fuel element 10 is a blow pipe charcoal, a carbonized wood, which is provided with five longitudinally extending holes 16. See FIG. 1A. The fuel element 10, which is about 20 mm long, optionally may be wrapped with cigarette paper to improve lighting of the charcoal fuel. This paper may be treated with known burn additives.

Aerosol generating means 12 includes a plurality of glass beads 20 coated with an aerosol forming substance or substances, such as glycerin. The glass beads are held in place by a porous disc 22, which may be made of cellulose acetate. This disc may be provided with a

series of peripheral grooves 24 which provide passages between the disc and the foil lined tube 14.

The foil lined paper tube 14, which forms the mouthend of the article, surrounds aerosol generating means 12 and the rear, non-lighting end of fuel element 10. The tube also forms an aerosol delivery passage 26 between the aerosol generating means 12 and the mouthend 15 of the article.

The article illustrated in FIG. 1 also includes an optional mass or plug of tobacco 28 to contribute flavor to the aerosol. This tobacco charge 28 may be placed at the mouthend of disc 22, as shown in FIG. 1, or it may be placed between glass beads 20 and disc 22. It also may be placed in passage 26 at a location spaced from aerosol generator 12.

In the embodiment shown in FIG. 2, the short fuel element 10 is a pressed carbon rod or plug, about 20 mm long, which is provided with an axial hole 16. Alternatively, the fuel may be formed from carbonized fibers and preferably also provided with an axial passageway corresponding to hole 16. In this embodiment, aerosol generating means 12 includes a thermally stable conductive carbonaceous substrate 30, such as a plug of porous carbon, which is impregnated with an aerosol forming substance or substances. This substrate may be provided with an optional axial passageway 32, as is shown in FIG. 2. This embodiment also includes a mass of tobacco 28 which is preferably placed at the mouthend of substrate 30. For appearance sake, this article also includes an optional high porosity cellulose acetate filter 34, which may be provided with peripheral grooves 36 to provide passages for the aerosol forming substance between filter 34 and foil tube 14. Optionally, as shown in FIG. 2A, the lighting end 11 of the fuel element may be tapered to improve lightability.

Upon lighting any of the aforesaid embodiments, the carbonaceous fuel element 10 burns, which generates the heat used to volatilize the aerosol forming substance or substances present in aerosol generating means 12. These volatile materials are then drawn down passage 26 toward the mouthend 15, especially during puffing, and into the user's mouth, like the smoke of a conventional cigarette. Because the aerosol forming substance is physically separate from the fuel element, it is exposed to substantially lower temperatures than are present in the burning fire cone, which minimizes the possibility of thermal degradation of the aerosol former. This also results in aerosol production during puffing, but little or no aerosol production during smolder. In addition, the use of a carbonaceous fuel element and a physically separate aerosol generator eliminate the presence of substantial pyrolysis or incomplete combustion products and avoid the production of substantial sidestream smoke.

If a charge of tobacco is employed, the hot vapors of the aerosol former are swept through the bed of tobacco to extract and vaporize the volatile components in the tobacco, without the need for tobacco combustion. Thus the user of this smoking article receives an aerosol which contains the qualities and flavors of natural tobacco without the combustion products produced by a conventional cigarette.

Because of the small size and burning characteristics of the carbonaceous fuel elements employed in the present invention, the fuel element usually begins burning over substantially all of its exposed length within a few puffs. Thus, the portion of the fuel element adjacent to the aerosol generator 12 becomes hot quickly, which

significantly increases heat transfer to the aerosol generator, especially during the early and middle puffs. Because the fuel element is so short, there is never a long section of nonburning fuel to act as a heat sink, as in the prior art thermal aerosol articles. Heat transfer, and therefore aerosol delivery, also is enhanced by the use of holes 16 through the fuel, which draw hot gases to the aerosol generator, especially during puffing.

The presence of foil lined tube 14, which couples the nonlighting end of fuel 10 to aerosol generator 12, also increases heat transfer to the aerosol generator. The foil also helps to extinguish the fire cone. When only a small amount of the unburned fuel remains, heat loss through the foil acts as a heat sink which helps to extinguish the fire cone.

The foil used in this article is typically an aluminum foil of 0.35 mils (0.0089 mm) in thickness, but the thickness and/or the type of metal employed may be varied to achieve any desired degree of heat transfer. Other types of heat conducting members such as Grafoil, available from Union Carbide, also may be employed.

In the foregoing embodiments of the invention, short fuel element 10, foil lined tube 14, and passages 16 in the fuel cooperate with the aerosol generator to provide a system which is capable of producing substantial quantities of aerosol throughout the life of the fuel element, and especially during the early and middle puffs. The close proximity of the fire cone to the aerosol generator after a few puffs, together with the conductive metallic foil, results in heat delivery during puffs and during the relatively long period of smolder between puffs. Standard FTC smoking conditions consist of two second puffs separated by 58 seconds of smolder.) While not wishing to be bound by theory, it is believed that the aerosol generator is maintained at relatively high temperatures between puffs and that the additional heat delivered during puffs, which is significantly increased by the hole or holes 16 in the fuel element, is primarily utilized to vaporize the aerosol forming substance. This increased heat transfer makes more efficient use of the available fuel energy, reduces the amount of fuel needed, and helps deliver aerosol on the initial puffs. Further, the conductive heat transfer utilized in the present invention is believed to reduce the carbon fuel combustion temperature which, it is believed, reduces the CO/CO₂ ratio in the combustion products produced by the fuel. See, e.g., C. Hagg, *General Inorganic Chemistry* at p. 592 (John Wiley & Sons, 1969).

The embodiment of the invention illustrated in FIG. 3, includes a short combustible carbonaceous fuel element 10, connected to aerosol generating means 12 by a heat conductive rod 99 and by a foil lined paper tube 14, which also forms the mouthend 15 of the article. In this embodiment, fuel element 10 may be blowpipe charcoal or a pressed or extruded carbon rod or plug or other carbonaceous fuel source.

Aerosol generating means 12 includes a thermally stable carbonaceous substrate 30, such as a plug of porous carbon, which is impregnated with an aerosol forming substance or substances. This embodiment includes a void space 97 between the fuel element 10 and the substrate 30. The portion of the foil lined tube 14 surrounding this void space includes a plurality of peripheral holes 100 which permit sufficient air to enter the void space to provide appropriate pressure drop.

As shown in FIGS. 3 and 3A, the heat conducting means includes a conductive rod 99 and the foil lined tube 14. The rod 99, preferably formed of aluminum,

has at least one, preferably from 2 to 5, peripheral grooves 96 therein, to allow air passage through the substrate. The article of FIG. 3 has the advantage that the air introduced into the void space 97 contains less carbon oxidation products because it is not drawn through the burning fuel.

In general, the combustible carbonaceous fuel elements which may be employed in practicing the invention are generally less than about 30 mm long. Advantageously the fuel element is about 20 mm or less in length, preferably about 15 mm or less in length. In most current preferred embodiments, the fuel element is between about 3 mm to about 10 mm in length. These lengths are sufficient to provide fuel for at least about 7 to 10 puffs, the normal number of puffs obtained with a conventional cigarette under FTC smoking conditions. Preferably, the fuel is provided with means for passing hot gases to the substrate, such as one or more longitudinally extending holes 16 in FIGS. 1 and 2. It is believed the holes also aid in decreasing heat transfer in later puffs by increasing in size.

The fuel elements are primarily formed of a carbonaceous material. Preferably, the carbon content of the fuel is at least 80%, most preferably about 90% or more, by weight. High carbon content fuels are preferred because they produce minimal pyrolysis and incomplete combustion products, little or no visible sidestream smoke, minimal ash, and high heat capacity. However, lower carbon content fuel elements are within the scope of this invention, especially where a nonburning inert filler is used.

The carbonaceous materials used in or as the fuel may be derived from virtually any of the numerous carbon sources known to those skilled in the art. Preferably, the carbonaceous material is obtained by the pyrolysis or carbonization of cellulosic materials, such as wood, cotton, rayon, tobacco, coconut, paper, and the like, although carbonaceous materials from other sources may be used.

In most instances, the carbonaceous material should be capable of being ignited by a conventional cigarette lighter without the use of an oxidizing agent. Burning characteristics of this type may generally be obtained from a cellulosic material which has been pyrolyzed at temperatures between about 400° C. to about 1000° C., preferably between about 500° C. to about 950° C., in an inert atmosphere or under a vacuum. The pyrolysis time is not believed to be important, as long as the temperature at the center of the pyrolyzed mass has reached the aforesaid temperature range for at least a few minutes.

While undesirable in most cases, carbonaceous materials which require the use of an oxidizing agent to render them ignitable by a cigarette lighter are within the scope of this invention, as are carbonaceous materials which require the use of a glow retardant or other type of combustion modifying agent. Such combustion modifying agents are disclosed in many prior art patents and publications and are known to those of ordinary skill in the art.

The carbonaceous fuel elements used in practicing the invention are substantially free of volatile organic material. By that, it is meant that the fuel element is not impregnated or mixed with substantial amounts of volatile organic materials, such as volatile aerosol forming or flavoring agents, which could degrade at the combustion temperatures of the fuel. However, small amounts of water, which are naturally absorbed by the fuel, may be present in the fuel. Similarly, small

amounts of aerosol forming substances may migrate from the aerosol generator and thus also may be present in the fuel.

A preferred carbonaceous fuel element is a pressed carbon plug prepared from porous carbon and a binder, by conventional pressure forming techniques. A preferred activated carbon for pressure forming is PCB-G, and a preferred non-activated carbon is PXC, both available from Calgon Carbon Corporation, Pittsburgh, PA. Other preferred nonactivated carbons for pressure forming are prepared from pyrolyzed cotton linters or pyrolyzed papers, such as Grande Prairie Canadian Kraft available from Buckeye Cellulose Corp., Memphis, TN.

The binders which may be used in preparing such a fuel element are well known in the art. A preferred binder is sodium carboxymethylcellulose (SCMC), which may be used alone, which is preferred, or in conjunction with materials such as sodium chloride, vermiculite, bentonite, calcium carbonate, and the like. Other useful binders include gums, such as guar gum, and other cellulose derivatives, such as methylcellulose and carboxymethylcellulose (CMC).

A wide range of binder concentrations can be utilized. Preferably, the amount of binder is limited to minimize contribution of the binder to undesirable combustion products. On the other hand, sufficient binder must be included to hold the fuel element together during manufacture and use. The amount used will thus depend on the cohesiveness of the carbon in the fuel.

In general, the fuel is prepared by admixing from about 50 to 99 weight percent, preferably about 80 to 95 weight percent, of the carbonaceous material, with from 1 to 50 weight percent, preferably about 5 to 20 weight percent of the binder, with sufficient water to make a paste. The paste is homogenized by mixing and then dried to reduce the moisture content to about 5 to 10 weight percent. The dried paste is then ground to a particle size of about -20 to +100 mesh size. This ground material is treated with water to raise the moisture level to about 30 weight percent, and the moist solid is fed to forming means, such as a conventional pill press, wherein a die punch pressure of from 1,000 pounds (455 kg) to 10,000 pounds (4550 kg), preferably about 5,000 pounds (2273 kg), of load is applied to create a pressed pellet having the desired dimensions. The pressed pellet is then dried at from about 55° to about 100° C. to reduce the moisture content to between 5 to 10 weight percent. The longitudinal passage or passages 16, if desired, may be drilled using conventional techniques, or they may be formed at the time of pressing.

Alternatively, the forming means used may be a standard extruder. In that case, the amount of water used is just sufficient to obtain a stiff dough consistency. The dough is then extruded into the desired shape followed by drying, e.g., at 80° C. overnight.

If desired, the aforesaid pressed carbon fuel element may be pyrolyzed after formation, for example, to about 650° C. for two hours, to convert the binder to carbon and thereby form a virtually 100% carbon fuel plug. Alternatively, a virtually pure carbon plug can be formed by using sufficient pressure.

The pressed carbon fuel elements also may contain one or more additives to improve burning, such as up to about 5 weight percent sodium chloride to improve smoldering characteristics and as a glow retardant. Also, up to about 5 weight percent of potassium carbonate may be included to improve lightability. Additives

to improve physical characteristics, such as clays like kaolins, serpentines, attapulgites, and the like also may be used.

Another preferred carbonaceous fuel element is a carbon fiber fuel, which may be prepared by carbonizing a fibrous precursor, such as cotton, rayon, paper, polyacrylonitrile, and the like. Generally, pyrolysis at about 650° C. to 1000° C., preferably at about 950° C., for about 30 minutes, in an inert atmosphere or vacuum, is sufficient to produce a suitable carbon fiber with good burning characteristics. Combustion modifying additives also may be added to these preferred fuels.

The aerosol generating means used in practicing the invention is physically separate from the fuel element. By physically separate it is meant that the substrate or body which contains the aerosol forming materials is not mixed with, or a part of, the fuel. As noted previously, this arrangement helps reduce or eliminate thermal degradation of the aerosol forming substance and the presence of sidestream smoke. While not a part of the fuel, the aerosol generator preferably is in a conductive heat exchange relationship with the fuel element. As used herein, a conductive heat exchange relationship is defined as a physical arrangement of the substrate and the fuel element whereby conductive heat transfer from the burning fuel element takes place throughout the burning period of the fuel element. Preferably, the heat exchange relationship is achieved by providing heat conductive means which efficiently conducts or transfers heat from the burning fuel element to the aerosol generating means. In most preferred embodiments, the aerosol generator abuts or is adjacent to the fuel element so that the fuel and the aerosol generator are in a heat exchange relationship throughout the burning of the fuel element.

Preferably, the aerosol generating means includes one or more thermally stable materials which carry one or more aerosol forming substances. As used herein, a thermally stable material is one capable of withstanding the high temperature, e.g., 400°-600° C., which exist near the fuel without decomposition or burning. The use of such material is believed to help maintain the simple "smoke" chemistry of the aerosol, as evidenced by the lack of Ames test activity which is described in greater detail hereinafter. While not preferred, other aerosol generating means, such as heat rupturable microcapsules, or solid aerosol forming substances, are within the scope of the invention, provided they are capable of releasing sufficient aerosol forming vapors to satisfactorily resemble tobacco smoke.

The thermally stable materials which may be used as the carrier or substrate for the aerosol forming substance are well known to those skilled in the art. Useful carriers should be porous or in particulate form, and must be capable of retaining an aerosol forming compound and releasing a potential aerosol forming vapor upon heating by the fuel. Useful thermally stable materials include thermally stable adsorbent carbons, such as electrode grade carbons, graphite, activate, or non-activated carbons, and the like. Other suitable materials include inorganic solids such as ceramics, alumina, vermiculite, clays such as bentonite, glass beads, and the like. The currently preferred substrate materials are carbon felts, fibers, and mats, activated carbons, and porous carbons such as PC-25 and PG-60 available from Union Carbide.

The aerosol generating means used in the invention is usually no more than about 30 mm, preferably no more

than 20 mm from the lighting end 11 of the article. The aerosol generator is usually less than about 20 mm in length. The preferred length is between about 5 to 15 mm. If a non-particulate substrate is used, it may be provided with one or more holes, such as hole 32 in FIG. 2, to increase the surface area of the substrate and to increase air flow and heat transfer into passageway 26.

The aerosol forming substance or substances used in the invention must be capable of forming an aerosol at the temperatures present in the aerosol generating means. Such substances preferably will be composed of carbon, hydrogen and oxygen, but they may include other materials. The boiling point of the substance and/or the mixture of substances can range up to about 500° C. Substances having these characteristics include polyhydric alcohols, such as glycerin and propylene glycol, as well as aliphatic esters of mono-, di-, or polycarboxylic acids, such as methyl stearate dimethyl dodecadioate, dimethyl tetradecadioate, and others.

Preferably, the aerosol forming substances will include a mixture of a high boiling, low vapor pressure substance and a low boiling, high vapor pressure substance. It is believed, on early puffs, the low boiling substance will provide most of the initial aerosol, while, when the temperature in the aerosol generator increases, the high boiling substance will provide most of the aerosol.

The preferred aerosol forming substances are polyhydric alcohols, or mixtures of polyhydric alcohols. A more preferred aerosol former is a mixture of glycerin and propylene glycol, which most preferably contains about 50 weight percent of each.

The aerosol forming substance may be dispersed on or within the carrier or substrate material, in a concentration sufficient to permeate or coat the material, by any known technique. For example, the aerosol forming substance may be applied full strength or in a dilute solution by dipping, spraying, vapor deposition, or similar techniques. Solid aerosol forming components may be admixed with the substrate material and distributed evenly throughout prior to formation of the final substrate.

While the loading of the aerosol forming substance will vary from carrier to carrier and from aerosol forming substance to aerosol forming substance, the amount of liquid aerosol forming substances may generally vary from about 20 mg to about 120 mg, preferably from about 35 mg to about 85 mg, and most preferably from about 45 mg to about 65 mg. As much as possible of the aerosol former carried on the substrate should be delivered to the user as WTPM. Preferably, above about 2 weight percent, more preferably above about 15 weight percent, and most preferably above about 20 weight percent of the aerosol former carried on the substrate is delivered to the user as WTPM.

The aerosol generating means also may include one or more volatile flavoring agents, such as menthol, vanillin, artificial coffee, tobacco extracts, nicotine, caffeine, liquors, and other agents which impart flavor to the aerosol. It also may include any other desirable volatile solid or liquid materials. Alternatively, these optional agents may be placed between the aerosol generator and the mouthend, such as in a separate substrate or chamber in passage 26 which connects the aerosol generator to the mouthend, or in the optional tobacco charge. If desired, these volatile agents may be used in lieu of part or all of the aerosol forming sub-

stance, so that the article delivers a nonaerosol flavor or other material to the user.

Articles of the type disclosed herein may be used or may be modified for use as drug delivery articles, for delivery of volatile pharmacologically or physiologically active materials such as ephedrine, metaproterenol, terbutaline or the like.

In most embodiments of the invention, the fuel and aerosol generator will be attached to a mouthend piece, such as foil lined tube 14, although a mouthend piece may be provided separately, e.g., in the form of a cigarette holder. This element of the article provides the enclosure which channels the vaporized aerosol forming substance into the mouth of the user. Due to its length, preferably about 50 to 60 mm or more, it also keeps the hot fire cone away from the mouth and fingers of the user.

Suitable mouthpieces should be inert with respect to the aerosol forming substances, should have a water or liquid proof inner layer, should offer minimum aerosol loss by condensation or filtration, and should be capable of withstanding the temperature at the interface with the other elements of the article. Preferred mouthpieces include the foil lined tube of FIGS. 1-3 and the cellulose-acetate tube employed in the embodiment of FIG. 4, as described hereinafter. Other suitable mouthpieces will be apparent to those of ordinary skill in the art.

The mouthend pieces of the invention may include an optional "filter" tip, which is used to give the article the appearance of the conventional filtered cigarette. Such filters include low density cellulose acetate filters and hollow or baffled plastic filters, such as those made of polypropylene. In addition, the entire length of article or any portion thereof may be overwrapped with cigarette paper.

The aerosol produced by the preferred articles of the present invention is chemically simple, consisting essentially of air, oxides of carbon, the aerosol which carries any desired flavorants or other desired volatile materials, water, and trace amounts of other materials. The wet total particulate matter (WTPM) produced by the preferred articles of this invention has no mutagenic activity as measured by the Ames test, i.e., there is no significant dose response relationship between the WTPM of the present invention and the number of revertants occurring in standard test microorganisms exposed to such products. According to the proponents of the Ames test, a significant dose dependent response indicates the presence of mutagenic materials in the products tested. See Ames et al., *Mut. Res.*, 31:347-364 (1975); Nagao et al., *Mut. Res.*, 42:335 (1977).

A further benefit from the preferred embodiments of the present invention is the relative lack of ash produced during use in comparison to ash from a conventional cigarette. As the preferred carbon fuel source is burned, it is essentially converted to oxides of carbon, with relatively little ash generation, and thus there is no need to dispose of ashes while using the article.

The following embodiments include the current best modes of carrying out the invention as of the filing of this application, many of which are the result of efforts by our co-workers. However, these embodiments are described herein in order to disclose the best known modes for carrying out our invention.

The embodiment illustrated in FIG. 4 includes a fibrous carbon fuel element 10, such as carbonized cotton or rayon. The fuel element includes a single axial hole

16. The substrate 38 of the aerosol generator is a granular, thermally stable carbon. A mass of tobacco 28 is located immediately behind the substrate. This article is provided with a cellulose acetate tube 40, in place of the foil lined tube. This tube 40 includes an annular section 42 of cellulose acetate tow surrounding an optional plastic, e.g., polypropylene tube 44. The mouthend 15 of this element includes a low efficiency cellulose acetate filter plug 45. The entire length of the article is wrapped in cigarette-type paper 46. A cork or white ink coating 48 may be used on the mouthend to simulate tipping. A foil strip 50 is located on the inside of the paper, toward the fuel end of the article. This strip preferably extends from the rear portion of the fuel element to the mouthend of the tobacco charge 28. It may be integral with the paper or it may be a separate piece applied before the paper overwrap.

The embodiment of FIG. 5 is similar to that of FIG. 4. In this embodiment, the aerosol generating means 12 is formed by an aluminum macrocapsule 52 which is filled with a granular substrate or, as shown in the drawing, a mixture of a granular substrate 54, and tobacco 56. The macrocapsule 52 is crimped in at its ends 58, 60 to enclose the material inside and to inhibit migration of the aerosol former. The crimped end 58, at the fuel end, preferably abuts the rear end of the fuel element to provide for conductive heat transfer. A void space 62 formed by end 58 also helps to inhibit migration of the aerosol former to the fuel. Holes 59 and 61 are provided to permit the passage of air and the aerosol forming substance. Macrocapsule 52 and fuel element 10 may be united by a conventional cigarette paper 47, as illustrated in the drawing, by a perforated ceramic paper, or a foil strip. If cigarette paper is used, a strip 64 near the rear end of the fuel should be printed or treated with sodium silicate or other known materials which cause the paper to extinguish. The entire length of the article is overwrapped with conventional cigarette paper 46.

FIG. 6 illustrates another embodiment having a pressed carbon fuel plug 10. In this embodiment, the fuel element has a tapered lighting end 11 for easier lighting and a tapered rear end 9 for easy fitting into a tubular foil wrapper 66. Abutting the rear end of the fuel element is an aluminum disc 68 with a center hole 70. A second, optional aluminum disc 72 with hole 74 is located at the mouthend of the aerosol generator 12. In between is a zone 76 of a particulate substrate and a zone 78 of tobacco. The foil wrapper 66 in which the fuel element is mounted extends back beyond the second aluminum disc 72. This embodiment also includes a hollow cellulose acetate rod 42 with an internal polypropylene tube 44, and a cellulose acetate filter plug 45. The entire length of the article is preferably wrapped with cigarette paper 46.

The embodiment shown in FIG. 7 illustrates the use of a substrate 80 embedded within a large cavity 82 in fuel element 10. In this embodiment, the fuel element preferably is formed from an extruded carbon, and the substrate 80 usually is a relatively rigid, porous material. The entire length of the article is wrapped with conventional cigarette paper 46. This embodiment may also include a foil strip 84 to couple fuel element 10 to the cellulose acetate tube 40 and to help extinguish the fuel.

The embodiments shown in FIGS. 8 and 9 include a nonburning fiber jacket 86 around fuel element 10 to insulate and concentrate the heat in the fuel element. These embodiments also help to reduce any fire causing potential of the burning fire cone.

In the embodiment shown in FIG. 8, both fuel element 10 and substrate 30 are located within an annular jacket or tube 86 of ceramic fibers, such as fiberglass.

Nonburning carbon or graphite fibers may be used in place of ceramic fibers. Fuel element 10 is preferably an extruded carbon plug having a hole 16. In the illustrated embodiment, the lighting end 11 extends slightly beyond the edge of jacket 86 for ease of lighting. Substrate 30 is a solid porous carbon material, although other types of substrates may be used. The substrate and the rear portion of the fuel element are surrounded by a piece of aluminum foil 87. As illustrated, this jacketed fuel/substrate unit is coupled to a mouthend piece, such as the elongated cellulose acetate tube 40 shown in the drawing, with an overwrap of conventional cigarette paper 46. The jacket 86 extends to the mouth end of substrate 30, but may replace cellulose acetate rod 42.

In the embodiment shown in FIG. 9, an aluminum macrocapsule 52 of the type shown in FIG. 5 is used to enclose a granular substrate 54 and tobacco 56. This macrocapsule is preferably positioned entirely within the ceramic fiber jacket 86. In addition, the lighting end 11 of fuel element 10 does not protrude beyond the forward end of fiber jacket 86. Preferably, the macrocapsule and the rear portion of the fuel element are surrounded by a piece of aluminum foil in a manner similar to that shown in FIG. 8.

Alternatively, the aluminum foil 52 which surrounds the substrate is not crimped at either end. In this embodiment, the rear end of the fuel element is inserted into one end of the foil and a polypropylene tube is inserted into the other end. The entire assembly is overwrapped with fiberglass to a diameter of a conventional cigarette.

The smoking article of the present invention will be further illustrated with reference to the following examples which aid in the understanding of the present invention, but which are not to be construed as limitations thereof. All percentages reported herein, unless otherwise specified, are percent by weight. All temperatures are expressed in degrees Celsius and are uncorrected. In all instances, the articles have a diameter of about 7 to 8 mm, the diameter of a conventional cigarette.

EXAMPLE 1

A smoking article was constructed in accordance with the embodiment of FIG. 1. The fuel element was a 25 mm long piece of blow pipe charcoal, with five 0.040 in. (1.02 mm) longitudinally extending holes made with a number 60 drill bit. The charcoal weighed 0.375 g. The fuel element was wrapped with conventional treated cigarette paper. The substrate was 500 mg of glass beads (0.64 in. [1.63 mm] average diameter) having two drops, approximately 50 mg, of glycerol coated on their surface. When packed into the tube, this substrate was about 6.5 mm long. The foil lined tube consisted of a 0.35 mil (0.0089 mm) layer of aluminum foil inside a 4.25 mil (0.108 mm) layer of white spirally wound paper. This tube surrounded the rear 5 mm of the fuel element. A short (8 mm) piece of cellulose acetate with four grooves around the periphery was used to hold the glass beads against the fuel source. An additional grooved cellulose acetate filter piece of 8 mm length was inserted into the mouthend of the tube to give the appearance of a conventional cigarette. The overall length of the article was about 70 mm.

Models of this type delivered considerable aerosol on the lighting puff, reduced amounts of aerosol on puffs 2

and 3, and good delivery of aerosol on puffs 4 through 9. Models of this type generally yielded about 5–7 mg of wet total particulate matter (WTPM), when machine smoked under standard FTC smoking conditions of a 35 ml puff volume, a two second puff duration, and a 60 second puff frequency.

EXAMPLE 2

A. Four smoking articles were constructed with 10 mm long pressed carbon fuel elements and glass bead substrates. The fuel elements were formed from 90% PCB-G and 10% SCMC, at about 5000 pounds (2273 kg) of applied load with the tapered lighting end illustrated in FIG. 2A. A single 0.040 in (1.02 mm) hole was formed down the center of each element. Three of the four fuel sources were wrapped with 8 mm wide strips of conventional cigarette paper. The fuel elements were inserted about 2 mm into 70 mm long sections of the foil lined tube described in Example 1. Glass beads, coated with the amount of glycerol indicated in the following table, were inserted into the open end of the foil lined tube and were held against the fuel element by 5 mm long foamed polypropylene filters having a series of longitudinally extending peripheral grooves. A 5 mm long low efficiency cellulose acetate filter piece was inserted into the mouthend of each article. These articles were machine smoked under standard FTC smoking conditions and the wet total particulate matter (WTPM) was collected on a series of Cambridge pads. The results of these experiments are reported in Table I.

TABLE I

	Glass Beads (wt)	Aerosol Former (wt)	WTPM (mg)/Puffs				
			1-3	4-6	7-9	10-12	Total
A	400.4 mg	40.5 mg	8.1	4.5	0.9	0	13.5
B*	405.6 mg	59.4 mg	10.2	1.9	0.7	0	12.8
C	404.0 mg	60.6 mg	7.6	6.9	0.4	0	14.9
D	803.8 mg	81.0 mg	5.9	2.5	3.7	0.9	13.0

*The fuel rod in this model was not wrapped with cigarette paper.

B. Three smoking articles similar to those described in Example 2A were constructed with 20 mm long blowpipe charcoal fuel elements of the type described in Example 1. These articles were machine smoked under standard FTC smoking conditions, and the WTPM was collected on a series of Cambridge pads. The results of these tests are reported in Table II.

TABLE II

	Glass Beads (wt)	Aerosol Former (wt)	WTPM (mg)/Puffs				
			1-3	4-6	7-9	10-12	Total
E	402.4 mg	60.6 mg	0.1	5.4	6.2	0.6	12.3
F*	404.7 mg	63.1 mg	0.5	0.9	2.2	3.1	7.0
G	500.0 mg	50.0 mg	0.3	2.9	3.0	0	6.2

*The fuel rod in this model was not wrapped with cigarette paper.

EXAMPLE 3

A. Four smoking articles were constructed as shown in FIG. 2 with a 10 mm pressed carbon fuel element having the tapered lighting end illustrated in FIG. 2A. The fuel element was made from 90% PCB-G carbon and 10% SCMC, at about 5000 pounds (2273 kg) of applied load. A 0.040 in. (1.02 mm) hole was drilled down the center of the element. The substrate for the aerosol former was cut and machined to shape from PC-25, a porous carbon sold by Union Carbide Corpo-

ration, Danbury, CT. The substrate in each article was about 2.5 mm long, and about 8 mm in diameter. It was loaded with an average of about 27 mg of a 1:1 propylene glycol-glycerol mixture. The foil lined tube mouthend piece, of the same type as used in Example 1, enclosed the rear 2 mm of the fuel element and the substrate. A plug of burley tobacco, about 100 mg was placed against the mouthend of the substrate. A short, about 5–9 mm, baffled polypropylene filter piece was placed in the mouthend of the foil lined tube. A 32 mm length of a cellulose acetate filter with a hollow polypropylene tube in the core was placed between the tobacco and the filter piece. The overall length of each article was about 78 mm.

B. Six additional articles were constructed substantially as in Example 3A, but the substrate length was increased to 5 mm, and a 0.040 in (1.02 mm) hole was drilled through the substrate. In addition, these articles did not have a cellulose acetate/polypropylene tube. About 42 mg of the propylene glycol-glycerol mixture was applied to the substrate. In addition, two plugs of burley tobacco, about 100–150 mg each, were used. The first was placed against the mouthend of the substrate, and the second one was placed against the filter piece.

C. Four additional articles were constructed substantially as in Example 3A, except that an approximately 100 mg plug of flue-cured tobacco containing about six percent by weight of diammonium monohydrogen phosphate was used in lieu of the plug of burley tobacco.

D. The smoking articles from Examples 3A-C were tested using the standard Ames Test. See Ames, et al., *Mut. Res.*, 31:347–364 (1975), as modified by Nagao et al., *Mut. Res.*, 42:335 (1977), and 113:173–215 (1983). The samples 3A and C were "smoked" on a conventional cigarette smoking machine using the conditions of a 35 ml puff volume, a two second puff duration, and a 30 second puff frequency, for ten puffs. The smoking articles of Example 3B were smoked in the same manner except that a 60 second puff frequency was used. Only one filter pad was used for each group of articles. This afforded the following wet total particulate matter (WTPM) for the indicated groups of articles:

	WTPM
Example 3A	63.4 mg
Example 3B	50.6 mg
Example 3C	69.2 mg

The filter pad for each of the above examples containing the collected WTPM was shaken for 30 minutes in DMSO to dissolve the WTPM. Each sample was then diluted to a concentration of 1 mg/ml and used "as is" in the Ames assay. Using the procedure of Nagao et al., *Mut. Res.*, 42:335–342 (1977), 1 mg/ml concentrations of WTPM were admixed with the S-9 activating system, plus the standard Ames bacterial cells, and incubated at 37° C. for twenty minutes. The bacterial strain used in this Ames assay was *Salmonella typhimurium*, TA 98. See Purchase et al., *Nature*, 264:624–627 (1976). Agar was then added to the mixture, and plates were prepared. The agar plates were incubated for two days at 37° C., and the resulting cultures were counted. Four plates were run for each dilution and the standard deviations of the colonies were compared against a pure DMSO control culture. As shown in Table III, there

was no mutagenic activity caused by the WTPM obtained from any of the smoking articles tested. This can be ascertained by comparison of the mean number of revertants per plate with the mean number of revertants obtained from the control (0 μ g WTPM/Plate). For mutagenic samples, the mean number of revertants per plate will increase with increasing doses.

TABLE III

Dose (μ g WTPM/Plate)	Mean Revertants/Plate	S.D.*
Example 3A		
Control 0	49.3	3.4
33	51.3	9.1
66	50.5	7.0
99	50.8	5.2
132	51.5	5.3
165	53.8	10.1
198	48.3	4.6
Example 3B		
Control 0	56	10.5
31.5	40	7.8
63	48.3	6.3
94.5	54.0	8.4
126	39	4.7
157.5	42.5	9.3
189	43	9.1
Example 3C		
Control 0	48.3	5.7
36	50.3	9.9
72	49.0	3.9
108	55.3	4.5
144	43.0	6.4
180	42.3	8.8
216	44.3	7.8

*Standard Deviation

EXAMPLE 4

Five smoking articles were constructed as shown in FIG. 2. Each article had a 10 mm pressed carbon fuel source as described in Example 3A. This fuel element was inserted 3 mm into one end of a 70 mm long aluminum foil lined tube of the type describe in Example 1. A 5 mm long carbon felt substrate, cut from rayon carbon felt sold by Fiber Materials, Inc., was butted against the fuel source. This substrate was loaded with an average of about 97 mg of a 1:1 mixture of glycerin and propylene glycol, about 3 mg of nicotine, and about 0.1 mg of a mixture of flavorants. A 5 mm long section of blended tobacco was butted against the mouthend of the substrate. A 5 mm long cellulose acetate filter piece was placed in the mouthend of the foil lined tube.

These articles were machine smoked under the standard FTC conditions. The aerosol from these articles was collected on a single Cambridge pad (133.3 mg WTPM), diluted in DMSO to a final concentration of 1 mg WTPM per ml and tested for Ames activity as described in Example 3D using each of the following strains: *Salmonella typhimurium* TA 1535, 1537, 1538, 98, and 100. As shown in Table IV there was no mutagenic activity caused by the WTPM collected from the articles tested.

TABLE IV

Dose*	Mean Revertants	Dose*	Mean Revertants
TA 1535		TA 1537	
Control 0	16	Control 0	14
25	13	25	13
50	14	50	14
75	17	75	11
100	14	100	13
125	13	125	13

TABLE IV-continued

Dose*	Mean Revertants	Dose*	Mean Revertants
TA 1538		TA 98	
Control 0	15	Control 0	61
25	13	25	62
50	22	50	47
75	16	75	42
100	20	100	44
125	19	125	39
150	19	150	40
TA 100			
Control 0	110		
25	109		
50	105		
75	99		
100	107		
125	108		
150	109		

* μ g WTPM/Plate

EXAMPLE 5

A smoking article was built as shown in FIG. 2 with a 10 mm pressed carbon fuel plug having the configuration shown in FIG. 2A, but with no tobacco. The fuel element was made from a mixture of 90% PCB-G activated carbon and 10% SCMC as a binder at about 5000 pounds (2273 kg) of applied load. The fuel element was provided with a 0.040 in (1.02 mm) axial hole. The substrate was a 10 mm long porous carbon plug made from Union Carbide's PC-25. It was provided with a 0.029 in. (0.74 mm) drilled axial hole, and was loaded with 40 mg of a (1:1) mixture of propylene glycol and glycerol. The foil lined tube, as in Example 1, encircled the rear 2 mm of the fuel element and formed the mouthend piece. The article did not have a filter tip, but was overwrapped with conventional cigarette paper. The total length of the article was 80 mm.

The average peak temperatures for this article are shown for both "puff" and "smolder" in FIG. 10. As shown, the temperature declines steadily between the rear end of the fuel element and mouthend. This assures the user of no unpleasant burning sensation when using a product of this invention.

EXAMPLE 6

A smoking article was constructed in accordance with the embodiment of FIG. 3. The fuel element was a 19 mm long piece of blowpipe charcoal, with no holes. Embedded 15 mm into the fuel element was a $\frac{1}{8}$ in. (3.2 mm) diameter aluminum rod, 28 mm in length. Four 9 mm $\times$ 0.025 in. (0.64 mm) peripheral grooves, spaced 90° apart were cut into the portion of the aluminum rod which pierced the substrate. The substrate was Union Carbide PC-25 carbon 8 mm in length. The grooves in the aluminum rod extended about 0.5 mm beyond the end of the substrate toward the fuel. The substrate was loaded with 150 mg of glycerol. The foil lined tube, which was the same as in Example 1, enclosed a portion of the rear of the fuel element. A gap was left between the non-burning end of the fuel element and the substrate. A series of holes were cut through the foil lined tube in this gap region to allow for air flow. A similar smoking article was constructed with a pressed carbon fuel plug.

EXAMPLE 7

A smoking article was constructed as shown in FIG. 4 with a fuel source of carbonized cotton fiber. Four slivers of cotton were tightly braided together with cotton string to form a rope with a diameter of about 0.4 in. (10.2 mm). This material was placed in a nitrogen atmosphere furnace which was heated to 950° C. It took about 1½ hours to reach that temperature, which was then held for ½ hour. A 16 mm piece was cut from this pyrolyzed material to be used as the fuel element. A 2 mm axial hole 16 was made through the element with a probe. The fuel element was inserted 2 mm into a 20 mm long foil lined tube of the type described in Example 1. 100 mg of Union Carbide PC-25, in granular form, containing 6 mg of a 1:1 propylene glycol-glycerol mixture, was inserted into the foil lined tube. A 5 mm long plug of tobacco, about 60 mg, was located immediately behind the granular substrate in the foil lined tube. A 48 mm long annular cellulose acetate tube with an internal 4.5 mm I.D. polypropylene tube was inserted about 3 mm into the foil lined tube. A second foil lined tube, 50 mm in length, has inserted over the cellulose acetate tube until it abutted against the 20 mm foil lined tube. A 5 mm long cellulose acetate filter plug was inserted into the end of this second foil lined tube. The overall length was 84 mm. When lit, this article produced substantial amounts of aerosol throughout the first six puffs with a tobacco flavor.

EXAMPLE 8

A smoking article was constructed as shown in FIG. 5 with a 15 mm long fibrous fuel element substantially as described in Example 7. The macrocapsule 52 was formed from a 15 mm long piece of 4 mil (0.10 mm) thick aluminum foil, which was crimped to form a 12 mm long capsule. This macrocapsule was loosely filled with 100 mg of granulated PG-60 carbon obtained from Union Carbide, and 50 mg of blended tobacco. The granular carbon was impregnated with 60 mg of a 1:1 mixture of propylene glycol and glycerol. The macrocapsule, the fuel element, and the mouthend piece were united by an 85 mm long piece of conventional cigarette paper.

EXAMPLE 9

A smoking article was constructed in accordance with the embodiment of FIG. 6 with a 7 mm long pressed carbon fuel element containing 90% PXC carbon and 10% SCMC. The center hole was 0.040 in. (1.02 mm) in diameter. This fuel plug was inserted into a 17 mm long aluminum foil lined tube so that 3 mm of the fuel element was inside the tube. An 8 mm diameter disc of 3.5 mil (0.089 mm) aluminum foil, with a 0.049 in. (1.24 mm) diameter center hole, was inserted into the other end of the tube and butted against the end of the fuel source.

Union Carbide PG-60 carbon was granulated and sieved to a particle size of -6 to +10 mesh. 80 mg of this material was used as the substrate, and 80 mg of a 1:1 mixture of glycerin and propylene glycol was loaded on this substrate. The impregnated granules were inserted into the foil tube and rested against the foil disk on the end of the fuel source. 50 mg of blended tobacco was loosely placed against the substrate granules. An additional foil disk with a 0.049 in. (1.24 mm) central hole was inserted into the foil tube on the mouthend of the tobacco. A long hollow cellulose acetate

rod with a hollow polypropylene tube as described in Example 7 was inserted 3 mm into the foil lined tube. A second foil lined tube was inserted over the cellulose acetate rod against the end of the 17 mm foil lined tube. This model delivered 11.0 mg of aerosol in the first three puffs when "smoked" under standard FTC smoking conditions. Total aerosol delivery for nine puffs was 24.9 mg.

EXAMPLE 10

A smoking article having the fuel element and substrate configuration of FIG. 7 was made using a 15 mm long annular pressed carbon fuel element with an inner diameter of about 4 mm and an outer diameter of about 8 mm. The fuel was made from 90% PCB-G activated carbon and 10% SCMC. The substrate was a 10 mm long piece formed of Union Carbide PC-25 carbon with an external diameter of about 4 mm. The substrate, loaded with 55 mg of a 1:1 glycerin/propylene glycol mixture, was inserted within the end of the fuel closer to the mouthend of the article. This fuel/substrate combination was inserted 7 mm into a 70 mm foil lined tube which had a short cellulose acetate filter at the mouthend. The length of the article was about 77 mm.

The article delivered substantial amounts of aerosol on the first three puffs, and over the useful life of the fuel element.

EXAMPLE 11

A modified version of the smoking article of FIG. 9 was made as follows: A 9.5 mm long carbon fuel source with a 4.5 mm diameter and a 1 mm diameter central hole was extruded from a mixture of 10% SCMC, 5% potassium carbonate, and 85% carbonized paper mixed with 10% water. The mixture had a dough-like consistency and was fed into an extruder. The extruded material was cut to length after drying at 80° C. overnight. The macrocapsule was made from a 22 mm long piece of 0.0089 mm thick aluminum formed into a cylinder of 4.5 mm I.D. The macrocapsule was filled with (a) 70 mg of vermiculite containing 50 mg of a 1:1 mixture of propylene glycol and glycerin, add (b) 30 mg of burley tobacco to which 6% glycerin and 6% propylene glycol had been added. The fuel source and macrocapsule were joined by inserting the fuel source about 2 mm into the end of the macrocapsule. A 35 mm long polypropylene tube of 4.5 mm I.D. was inserted in the other end of the macrocapsule. The fuel source, macrocapsule and polypropylene tube were thus joined to form a 65 mm long, 4.5 mm diameter segment. This segment was wrapped with several layers of Manniglas 1000 from Manning Paper Company until a circumference of 24.7 mm was reached. The unit was then combined with a 5 mm long cellulose acetate filter and wrapped with cigarette paper. When smoked under standard FTC smoking conditions, the article delivered 8 mg of WTPM over the initial three puffs; 7 mg WTPM over puffs 4-6; and 5 mg WTPM over puffs 7-9. Total aerosol delivery over the 9 puffs was 20 mg. When placed horizontally on a piece of tissue paper, the article did not ignite or even scorch the tissue paper.

What is claimed is:

1. A cigarette-type smoking article comprising:

- (a) a carbonaceous fuel element;
- (b) a physically separate aerosol generating means including a volatile substance, the aerosol generating means being longitudinally adjacent to the fuel element; and

(c) a mouthend piece;
the fuel element and the aerosol generating means being arranged in a conductive heat exchange relationship by contact between the aerosol generating means and a part of the fuel element such that the aerosol generating means receives conductive heat transfer substantially throughout the time of burning of the fuel element.

2. A smoking article comprising:

(a) a carbonaceous fuel element;

(b) a physically separate aerosol generating means including a volatile substance; and

(c) a heat conducting member which contacts both the fuel element and the aerosol generating means; the fuel element and the aerosol generating means being arranged in a conductive heat exchange relationship such that the aerosol generating means receives conductive heat transfer substantially throughout the time of burning of the fuel element.

3. A smoking article comprising:

(a) a carbonaceous fuel element;

(b) a physically separate aerosol generating means including a volatile substance; and

(c) heat conducting member which encompasses at least a portion of the fuel element;

the fuel element and the aerosol generating means being arranged in a conductive heat exchange relationship such that the aerosol generating means receives conductive heat transfer substantially throughout the time of burning of the fuel element.

4. The article of claim 2, wherein the heat conducting member encompasses at least a portion of the aerosol generating means.

5. A smoking article comprising:

(a) a carbonaceous fuel element;

(b) a physically separate aerosol generating means including a volatile substance; and

(c) a heat conducting member at least partially within the fuel element;

the fuel element and the aerosol generating means being arranged in a conductive heat exchange relationship such that the aerosol generating means receives conductive heat transfer substantially throughout the time of burning of the fuel element.

6. The article of claim 1 or 2, wherein the aerosol generating means comprises a heat stable substrate bearing a volatile substance.

7. The article of claim 7, wherein the heat conducting member comprises a conductive rod embedded within at least a portion of both the fuel element and the aerosol generating means.

8. A cigarette type article of claim 1, 2, 3, 5 or 7 wherein the fuel element is less than about 30 mm in length.

9. A cigarette type article of claim 1, 2, 3, 5 or 7 wherein the fuel element is less than about 15 mm in length.

10. The article of claim 6, wherein the substrate is loaded with from about 35 mg to 85 mg of volatile substance.

11. The article of claim 1 or 2, wherein above about 15 weight percent of the volatile substance carried by the substrate is delivered as wet total particulate matter under smoking conditions of 35 ml puffs of 2 seconds duration separated by 58 seconds of smolder.

12. The article of claim 1, 2, 3, 4, 5 or 7 charge of tobacco located between the mouth end of the fuel element and the mouth end of the article.

13. The article of claim 1 or 2, wherein the volatile substance includes at least one substance selected from the group of aerosol producing substances, flavor producing substances, pharmacologically active substances, and physiologically active substances.

14. The article of claim 1 or 2, wherein the smoke produced consists essentially of the oxides of carbon, air, water, the volatile substance, other desired volatiles and trace amounts of other materials.

15. The article of claim 2, 3, 4, 5, or 7 wherein the fuel element is substantially free of volatile organic material.

16. A cigarette-type smoking article comprising:

(a) a carbonaceous fuel element less than about 30 mm in length prior to smoking;

(b) a physically separate aerosol generating means including a volatile substance; and

(c) means for delivering the volatile substance to the user.

17. The article of claim 16, further comprising a heat conducting member for conducting heat from the fuel element to the aerosol generating means.

18. The article of claim 17, wherein the heat conducting member encompasses at least a portion of the fuel element.

19. The article of claim 17, wherein the heat conducting member encompasses at least a portion of both the fuel element and the aerosol generating means.

20. The article of claim 17 wherein the heat conducting member is at least partially embedded within the fuel element.

21. The article of claim 16 or 17, wherein the volatile substance includes at least one substance selected from the group of aerosol producing substances, flavor producing substances, pharmacologically active substances and physiologically active substances.

22. The article of claim 16, 17, or 18 wherein the portion of the volatile substance closest to the fuel element is less than about 30 mm from the lighting end of the fuel element.

23. The article of claim 16, 17, 18 or 20 wherein the fuel element is less than 20 mm in length.

24. The article of claim 16, 17, 18 19 or 20 wherein the fuel element is less than 15 mm in length.

25. A cigarette-type article comprising:

(a) a carbonaceous fuel element less than 30 mm in length;

(b) a mouthend piece;

(c) a carrier between the non-lighting end of the fuel element and the mouthend piece bearing an aerosol forming substance;

(d) a heat conducting member for conducting heat from the fuel element to the carrier; and

(e) a passageway for delivering the aerosol forming substance to the mouthend piece.

26. The article of claim 25, wherein the heat conducting member encompasses at least a portion of the fuel element.

27. The article of claim 25, wherein the heat conducting member encompasses at least a portion of both the fuel element and the carrier.

28. The article of claim 25, 26, 27, wherein the fuel element is less than 15 mm in length.

29. The article of claim 25, 26, 27, wherein the portion of the carrier closest to the fuel element is less than 20 mm from the lighting end of the fuel element.

30. A disposable cartridge smoking article for use with a separate mouthpiece comprising:

- (a) a carbonaceous fuel element less than about 30 mm in length prior to smoking;
 - (b) a physically separate carrier adjacent to the fuel element including at least one substance selected from the group consisting of aerosol producing substances, flavor producing substances, pharmacologically active substances, and physiologically active substances; and
 - (c) means for coupling the carrier to the fuel element.
31. The article of claim 30 further comprising a heat conducting member which contacts the fuel element and the carrier.
32. The article of claim 30, further comprising a heat conducting member which comprises a metallic member which circumscribes a portion of the external longitudinal periphery of the fuel element and at least a portion of the external longitudinal peripheral of the carrier.
33. The article of claim 30, further comprising a heat conducting member at least partially within the fuel element.
34. The article of claim 31, further comprising a mass of tobacco.
35. The article of claim 30, 32 or 34 wherein the fuel element is less than about 15 mm in length.
36. The article of claim 1, 2, 17, 25, 26, 27, 30 or 31, wherein the volatile substance is an aerosol forming substance and the article delivers at least about 0.6 mg of wet total particulate matter in the first three puffs under smoking conditions of 35 ml puff of 2 seconds duration separated by 58 seconds of smolder.
37. The article of claim 1, 2, 16, 17, 25, 26, 27, 30 or 31, wherein the volatile substance is an aerosol forming substance and the article delivers at least about 1.5 mg of wet total particulate matter in the first three puffs under smoking conditions of 35 ml puffs of 2 seconds duration separated by 58 seconds of smolder.
38. The article of claim 1, 2, 16, 17, 25, 26, 27, 30 or 31, where in the volatile substance is an aerosol forming substance and the article delivers an average of at least about 0.8 mg per puff of wet total particulate matter under smoking conditions of 35 ml puffs of 2 seconds duration separated by 58 seconds of smolder.
39. The article of claim 1, 2, 16, 17, 25, 26, 27, 30 or 31, having no mutagenic activity in the wet total particulate matter, a measured by the Ames Test.
40. The article of claim 1, 2, 16, 17, 25, 26, 27, 30, 31, 32 or 33, wherein the fuel element produces substantially no visible sidestream smoke during smolder.
41. The smoking article of claim 1, 2, 3, 4, 5, 7, 16, 17, 18, 25, 26, 27, 31, 32 or 33, wherein the fuel element is about 10 mm or less in length.
42. The smoking article of claim 16, 17, 18, 25, 26, 30, 31 or 32, wherein the fuel element is substantially free to volatile organic material.
43. A smoking article comprising:
- (a) a carbonaceous fuel element;
 - (b) a physically separate aerosol generating means spaced from the lighting end of the fuel element, which means includes a volatile substance; and
 - (c) a heat conducting member spaced from the lighting end of the fuel element which conducts heat from the fuel element to the aerosol generating means.
44. A smoking article comprising:
- (a) a carbonaceous fuel element less than about 30 mm in length; generating means

- (b) a physically separate aerosol spaced from the lighting end of the fuel element which means includes a volatile substance;
 - (c) a heat conducting member for conducting heat from the fuel element to the aerosol generating means, the member being spaced from the lighting end of the fuel element; and
 - (d) means for delivering the volatile substance to the user.
45. The article of claim 44, wherein the fuel element is less than 15 mm in length and the heat conducting member encompasses a portion of the fuel element and at least a portion of the aerosol generating means.
46. The article of claim 44 or 45 wherein the fuel element is substantially free of volatile organic material.
47. The article of claim 44 or 45, wherein the portion of the volatile material closest to the fuel element is less than about 20 mm from the lighting end of the fuel element.
48. A smoking article comprising:
- (a) a carbonaceous fuel element less than 30 mm in length;
 - (b) a mouthend piece;
 - (c) a carrier between the non-lightning end of the fuel element and the mouthend piece bearing an aerosol forming substance;
 - (d) a heat conducting member spaced from the lighting end of the fuel element for conducting heat from the fuel element to the carrier; and
 - (e) a passageway for delivering the aerosol forming substance to the mouthend piece.
49. The article of claim 48, wherein the fuel element is less than 15 mm in length and the heat conducting member encompasses a portion of the fuel element and at least a portion of the carrier.
50. The article of claim 48 or 49, wherein the heat conducting member is metallic.
51. The article of claim 48 or 49, wherein the portion of the carrier closes to the fuel element is less than 20 mm from the lighting end of the fuel element.
52. The article of claim 48 or 49 further comprising a mass of tobacco between the non-lighting end of the fuel element and the mouth end of the article.
53. The article of claim 52, wherein the fuel element is substantially free of volatile organic material.
54. A disposable cartridge smoking article for use with a separate mouthend piece comprising:
- (a) a carbonaceous fuel element less than about 30 mm in length;
 - (b) a physically separate carrier adjacent to the fuel element, including at least one substance selected from the group consisting of aerosol producing substances, flavor producing substances, pharmacologically active substances, and physiologically active substances; and
 - (c) a heat conducting member which couples the carrier to the fuel element, said member being spaced from the lighting end of the fuel element.
55. The smoking article of claim 34, wherein the article delivers an average of at least about 0.8 mg per puff of wet total particulate matter for at least 7 puffs.
56. The article of claim 30, 31, 32, 54, wherein the article has a diameter of about 8 mm or less.
57. The article of claim 43, wherein the heat conductive member contacts both the fuel element and the aerosol generating means.
58. The article of claim 1, 2, 3, 4 or 5, which has the size and shape of a cigarette.
59. The article of claim 58, wherein the heat conductive member is a metallic member.
- * * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

Page 1 of 7

PATENT NO. : 4,793,365

DATED : 12/27/88

INVENTOR(S) : Andrew J. Sensabaugh, Jr., et al.

It is certified that error appears in the above—identified patent and that said Letters Patent is hereby corrected as shown below:

At number [56] on the cover sheet, under U.S. Patent Documents, insert the following:

235,885	12/1880	Lindsley	3,586,005	6/1971	Lippman
346,025	7/1886	Cook	3,608,560	9/1971	Briskin
492,676	2/1883	Harris	3,614,956	10/1971	Thornton
1,437,956	12/1922	Blair	3,667,478	6/1972	Waterbury
1,605,059	11/1926	Oakes	3,738,374	6/1973	Bennett
1,952,352	3/1934	Banks	3,831,609	8/1974	Briskin
2,108,860	2/1938	Kaufman	3,834,398	9/1974	Briskin
2,178,820	11/1938	Todoroff	3,861,401	1/1975	Briskin
2,349,551	5/1944	Helm	3,861,402	1/1975	Briskin
2,907,686	10/1959	Siegel	3,880,172	4/1975	Anderson
2,976,190	3/1961	Meyers	3,885,574	5/1975	Borthwick
3,081,777	3/1963	Sipos	3,894,543	7/1975	Anderson
3,106,210	10/1963	Reynolds	3,916,914	11/1975	Brooks
3,144,024	8/1964	Eichwald	3,931,824	1/1976	Miano
3,200,819	8/1965	Gilbert	3,943,941	3/1976	Boyd
3,236,244	2/1966	Irby	3,943,942	3/1976	Anderson
3,258,015	6/1966	Ellis	3,972,335	8/1976	Tigglebeck
3,280,823	10/1966	Bauley	4,008,723	2/1977	Borthwick
3,288,146	11/1966	Bauley	4,014,349	3/1977	Mormon
3,297,476	10/1966	Noznick	4,019,520	4/1977	Strubel
3,339,558	9/1967	Waterbury	4,019,521	3/1977	Briskin
3,356,094	12/1967	Ellis	4,044,777	8/1977	Boyd
3,424,171	1/1969	Rooker	4,055,191	10/1977	Norman
3,498,299	3/1970	White	4,079,742	3/1978	Rainer
3,516,417	6/1970	Moses	4,123,592	10/1978	Rainer
3,525,582	8/1970	Waterbury	4,133,317	1/1979	Briskin
3,529,602	9/1970	Hind	4,186,756	1/1980	Takemoto
3,545,448	12/1970	Mormon	4,195,645	4/1980	Bradley
3,584,630	6/1971	Inskeep	4,216,784	8/1980	Norman

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CERTIFICATE OF CORRECTION

Page 2 of 7

PATENT NO. : 4,793,365

DATED : 12/27/88

INVENTOR(S) : Andrew J. Sensabaugh, Jr., et al.

It is certified that error appears in the above—identified patent and that said Letters Patent is hereby corrected as shown below:

4,219,031 8/1980 Rainer
4,219,032 8/1980 Tabatznik et al.
4,284,089 8/1981 Ray
4,286,604 9/1981 Ehretzman
4,289,149 9/1981 Kyriakou
4,326,544 4/1982 Hardwick
4,340,072 7/1982 Bolt
4,347,855 9/1982 Lanzillotti
4,391,285 7/1983 Burnett
4,596,258 5/1984 Steiner

Reference "0,117,355 9/1984 Hearn" should be DELETED.

At number [56] on the cover sheet, under Foreign Patent Documents,
insert the following:

276,250	2/1968 Australia	ADD -- 0,117,355 9/1984 EPO --
074,201	3/1983 EPO	
117,355	9/1984 EPO	
370,962	2/1907 France	
998,556	9/1951 France	
1,264,962	8/1960 France	
2,033,749	11/1970 France	
1,692,936	1/1972 Germany	
2,704,218	2/1977 Germany	
582,489	10/1976 Switzerland	
1,185,887	3/1970 United Kingdom	
1,431,045	4/1973 United Kingdom	
1,597,105	9/1981 United Kingdom	
1,597,106	9/1981 United Kingdom	

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 4,793,365

Page 3 of 7

DATED : 12/27/88

INVENTOR(S) : Andrew J. Sensabaugh, Jr., et al.

It is certified that error appears in the above—identified patent and that said Letters Patent is hereby corrected as shown below:

At number [56], on the cover sheet, under Other Publications, insert the following:

Ames et al., Mutation Research, 31:347 - 364 (1975)

Gilbert, Herbert A., "Smokeless Cigarette" - Materials submitted to the Senate Committee on Commerce

Guinness Book of World Records, Pgs. 242 - 243 (1985 edition)

Guinness Book of World Records, Pg. 194 (1966 edition)

Kiefer et al., "Factors that Affect Elution of Plasticizer from Cigarette Filters," Eastman Kodak Pub. No. FTR-65.

Lyerly, "Direct Vapor Chromatographic Determination of *** Triacetin in Cigarette Smoke," Tob. Sci. 50:26 (1967)

Miller, K. "Now A 'Smokeless Cigaret' ," Beaver County Times, July 1967

Nagao et al., Mutation Research, 42:335 - 342 (1977)

Maron et al., Mutation Research, 113:173 (1983)

Reynolds, M.L., "Influence of Filter Additives on Smoke Composition," Rec. Adv. Tob. Sci., 4:47 (1978)

Sittig, Tobacco Substitutes, Noyes Data Corporation - 1976, Chemical Technology Review No. 67

Hagg, C., General Inorganic Chemistry, pg. 592 (John Wiley & Sons 1969)

Purchase et al., Nature, 264:624-627 (1976)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

Page 4 of 7

PATENT NO. : 4,793,365

DATED : 12/27/88

INVENTOR(S) : Andrew J. Sensabaugh, Jr., et al.

It is certified that error appears in the above—identified patent and that said Letters Patent is hereby corrected as shown below:

At Abstract, line 26, change "relationships" to --relationship--.

At Column 1, line 61, change "end" to --tend--.

At Column 2, line 50, change "Tee" to --The--.

At Column 6, line 19, change "ma" to --may--.

At Column 7, line 9, change "fill" to --foil--.

At Column 10, line 59 change "activate,," to --activated,--.

At Column 13, line 12, change "o" to --on--.

At Column 13, line 30, change "o" to --of--.

At Column 15, line 12, insert --carbon-- after PCB-G.

At Column 18, Table IV, TA 98 move column of numbers --62,47,42,44,39,40-- to the right under the heading Mean Revertants column.

At Column 21, line 47, change "7" to --5--.

At Column 21, line 51, insert --4-- after 3,.

At Column 21, line 53, insert --prior to smoking-- after length.

At Column 21, line 54, insert --4-- after 3,.

At Column 21, line 56, insert --prior to smoking -- after length.

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 4,793,365

Page 5 of 7

DATED : 12/27/88

INVENTOR(S) : Andrew J. Sensabaugh, Jr., et al.

It is certified that error appears in the above—identified patent and that said Letters Patent is hereby corrected as shown below:

At Column 21, line 65, insert -- further comprising a-- after 7,.

At Column 22, line 14, insert --located at the lighting end of the article-- after smoking.

At Column 22, line 40, insert --19-- after 18.

At Column 22, line 46, insert --prior to smoking-- after length.

At Column 23, line 2, insert --located at the lighting end of the article-- after smoking.

At Column 23, line 17, change "peripheral" to --periphery--.

At Column 23, line 26, delete "or".

At Column 23, line 26, insert --16-- after 2,.

At Column 23, line 26, insert --43,44,48 or 54-- after 31,.

At Column 23, line 32, delete "or".

At Column 23, line 33, insert --43,44,48 or 54-- after 31,.

At Column 23, line 34, change "lest" to --least--.

At Column 23, line 38, delete "or".

At Column 23, line 39, insert --43,44,48 or 54-- after 31,.

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 4,793,365

Page 6 of 7

DATED : 12/27/88

INVENTOR(S) : Andrew J. Sensabaugh, Jr., et al.

It is certified that error appears in the above—identified patent and that said Letters Patent is hereby corrected as shown below:

At Column 23, line 44, delete "or".

At Column 23, line 45, insert --43,44,48 or 54-- after 31,.

At Column 23, line 46, change "a" to --as--.

At Column 23, line 48, delete "or".

At Column 23, line 48, insert --43,44,48 or 54-- after 31,.

At Column 23, line 67, change "lengthy generating means" to --length--.

At Column 23, line 67, insert --prior to smoking-- after length.

At Column 24, line 1, insert --generating means-- after aerosol.

At Column 24, line 18, change "form" to --from--.

At Column 24, line 22, insert --prior to smoking-- after length.

At Column 24, line 39, change "closes" to --closest--.

At Column 24, line 49, insert --prior to smoking-- after length.

At Column 24, line 59, change "34" to --38--.

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

Page 7 of 7

PATENT NO. : 4,793,365

DATED : 12/27/88

INVENTOR(S) : Andrew J. Sensabaugh, Jr., et al

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

At column 18, Table IV, TA 98 move column of numbers --25,50,75,100,125, 150-- to the right, below the numeral "0".

Signed and Sealed this
Sixth Day of April, 1993

Attest:

STEPHEN G. KUNIN

Attesting Officer

Acting Commissioner of Patents and Trademarks



19 BUNDESREPUBLIK
DEUTSCHLAND



DEUTSCHES
PATENT- UND
MARKENAMT

12 Offenlegungsschrift
10 DE 198 54 005 A 1

51 Int. Cl. 7:
A 61 M 15/00
A 24 F 47/00
A 24 B 13/00

21 Aktenzeichen: 198 54 005.1
22 Anmeldetag: 12. 11. 1998
43 Offenlegungstag: 18. 5. 2000

DE 198 54 005 A 1

71 Anmelder:
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Uexküll & Stolberg, 22607 Hamburg

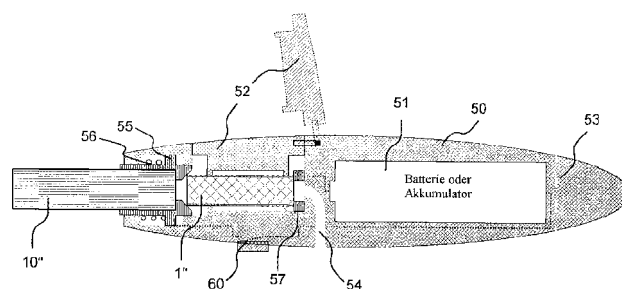
72 Erfinder:
Pienemann, Thomas, Dr., 21224 Rosengarten, DE

Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Prüfungsantrag gem. § 44 PatG ist gestellt

54 System zur Bereitstellung eines inhalierbaren Aerosols

57 Ein System zur Bereitstellung eines inhalierbaren Aerosols enthält eine Substratportion (1'') und eine Inhalier-
vorrichtung. Die Substratportion (1'') weist mindestens
einen Heizwiderstand auf und enthält innerhalb einer Um-
hüllung aerosolbildendes Material, wobei die Umhüllung
eine Lufteintrittsöffnung und eine Aerosolaustrittsöff-
nung hat. Dabei ist vorzugsweise die Umhüllung der Sub-
stratportion (1'') zumindest abschnittsweise elektrisch
leitfähig und bildet den mindestens einen Heizwider-
stand. Die Inhaliervorrichtung hat ein Gehäuse (50), eine
Aufnahmeeinrichtung (55, 57) zum Halten der Substrat-
portion (1'') und mit einer Spannungsquelle (51) in Ver-
bindung stehende oder in Verbindung bringbare Kontakte
(55, 57) zum Zuführen von elektrischer Leistung zu dem
mindestens einen Heizwiderstand der Substratportion
(1'').



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Die Erfindung betrifft ein System zur Bereitstellung eines inhalierbaren Aerosols sowie die Komponenten eines derartigen Systems. Dieses System ist insbesondere als Rauchartikel zur Bereitstellung von Rauchaerosol für Raucher geeignet.

Beim Abrauchen konventioneller Zigaretten wird der größte Teil des Tabaks nicht während der Züge, sondern in den Zugpausen verbrannt. Dies führt zur Bildung des sogenannten Nebenstromrauchs, der von Nichtrauchern oft als belästigend empfunden wird.

Zur Überwindung dieses Problems sind zahlreiche neue Rauchartikel, in denen während der Zugpausen kein Tabak verbrannt wird, vorgeschlagen worden. Ein gemeinsames Prinzip solcher Entwicklungen ist, daß nicht die Verbrennungswärme des Tabaks, sondern andere Energiequellen zur Freisetzung des Rauchaerosols genutzt werden. Hierdurch wird nicht nur die Entstehung von Nebenstromrauch weitgehend vermieden, sondern durch eine geänderte Temperaturführung während der Züge kann auch eine bevorzugte Freisetzung von Aromasubstanzen erreicht und die Bildung von reizenden oder unerwünschten Nebenprodukten reduziert werden. Häufig kommen in den vorgeschlagenen Rauchartikeln zur Aerosolbildung statt Tabak Ersatzmaterialien wie spezielle Folientabake oder mit Aromasubstanzen beaufschlagte Trägermaterialien zur Anwendung.

So ist ein zigarettenförmiger Rauchartikel bekannt, bei dem die Wärmeenergie eines glimmenden Kohleelements auf eine in Innern der Zigarette angeordnete Aluminiumkapsel übertragen wird, die ein aerosolbildendes Material enthält.

Bei einer Modifikation dieses Rauchartikels kommt als aerosolbildendes Material ein spezieller, mit hohen Mengen an Glycerin beaufschlagter Folientabak zum Einsatz.

Beiden vorgenannten Rauchartikeln ist gemeinsam, daß die Verbrennungsgase des Heizelements mit dem Rauchaerosol inhaliert werden, was zu einer erhöhten Aufnahme von Kohlenmonoxid durch den Raucher führt. Die räumliche Trennung von Energiequelle und Aerosolbildner führt aufgrund der schwierigen Wärmeübertragung zu einem Geschmacksdefizit bei den ersten Zügen. Weiterhin muß der gesamte Rauchartikel, der im Gegensatz zu herkömmlichen Zigaretten seine Länge beibehält, nach dem Abrauchen entsorgt werden. Dies führt zu einem erhöhten Anfall komplex zusammengesetzter Reststoffe und damit verbundenen Entsorgungsproblemen.

Nach einem anderen Prinzip arbeitet ein weiterer vorbekannter Rauchartikel. Dabei wird ein zigarettenförmiger Gegenstand mit Filter- und Tabakteil am tabakseitigen Ende in ein elektronisch gesteuertes Abrauchgerät gesteckt. In dem Abrauchgerät erfolgt mit Hilfe von elektrischen Heizelementen eine Erhitzung des tabakhaltigen Teils an mit den Zügen radial aufeinanderfolgenden Stellen. Dieses Prinzip bedingt eine aufwendige Konstruktion des Abrauchgeräts, das mit mehreren Heizelementen und einer komplizierten elektronischen Steuerung ausgerüstet sein muß. Die Handhabung eines derartigen Geräts ist aufgrund der Größe und Gestaltung aufwendig und unterscheidet sich deutlich von der einer herkömmlichen Zigarette.

Es ist Aufgabe der vorliegenden Erfindung, ein System zur Bereitstellung eines inhalierbaren Aerosols zu schaffen, das einen einfachen Grundaufbau hat und insbesondere als Rauchartikel dienen kann, der einen ähnlichen Geschmacksindruck wie herkömmliche Zigaretten bietet, bei dessen Gebrauch jedoch zwischen den Zügen kein Nebenstromrauch erzeugt wird.

Diese Aufgabe wird gelöst durch ein System mit den

Merkmale des Anspruchs 1, das eine Inhaliervorrichtung mit den Merkmalen des Anspruchs 33 und eine Substratportion mit den Merkmalen des Anspruchs 35 aufweist und ein Mundstück mit den Merkmalen des Anspruchs 39 aufweisen kann. Vorteilhafte Ausgestaltungen der Erfindung ergeben sich aus den abhängigen Ansprüchen.

Das erfindungsgemäße System zur Bereitstellung eines inhalierbaren Aerosols ist insbesondere als Rauchartikel geeignet, dessen Funktionsweise auf dem Erhitzen eines aerosolbildenden Materials während der Züge beruht. Dabei wird eine vorzugsweise zylindrische Substratportion, die mindestens einen Heizwiderstand aufweist und innerhalb einer Umhüllung das aerosolbildende Material enthält, in einer speziellen, vorzugsweise zigaretten- oder cigarrenförmigen Inhaliervorrichtung abgeraucht. Als Heizwiderstand dient vorzugsweise die Umhüllung der Substratportion, die zu diesem Zweck zumindest abschnittsweise elektrisch leitfähig ist. Die Substratportion wird in der Inhaliervorrichtung während der Züge durch Zuführung elektrischer Energie in die leitfähige Umhüllung erhitzt, so daß sich Aerosol bildet, das durch Ziehen von Luft durch die Lufteintrittsöffnung der Umhüllung über die Aerosolaustrittsöffnung der Umhüllung vom Raucher aufgenommen werden kann. Durch den Gebrauch des Rauchartikels wird die Bildung von Nebenstromrauch in den Zugpausen vermieden.

Das Grundprinzip der Erfindung beruht also auf einer möglichst nahen räumlichen Anordnung von Wärmequelle und Aerosolbildner. Dies wird dadurch erreicht, daß die Substratportion selbst den Heizwiderstand (oder auch mehrere Heizwiderstände) aufweist, der vorzugsweise als leitfähige Umhüllung der Substratportion gestaltet ist und durch Anlegen einer Spannung über die Kontakte in der Inhaliervorrichtung erhitzt wird.

Gegenüber den oben erwähnten vorbekannten Rauchartikeln besitzt das erfindungsgemäße System den Vorteil, daß trotz einfacher Konstruktion keine Verbrennungsgase inhaliert werden und die nach Gebrauch verbleibenden Reststoffe umweltverträglich entsorgbar gestaltet werden können.

Im folgenden wird die Erfindung anhand von Ausführungsbeispielen näher erläutert. Die Zeichnungen zeigen in **Fig. 1a** eine perspektivische Ansicht einer Substratportion gemäß der Erfindung,

Fig. 1b einen Längsschnitt durch die Substratportion gemäß **Fig. 1a**,

Fig. 1c einen Querschnitt durch die Substratportion gemäß **Fig. 1a**,

Fig. 2a einen Längsschnitt durch eine andere Ausführungsform einer Substratportion gemäß der Erfindung, die ein integriertes Mundstück aufweist,

Fig. 2b eine perspektivische Ansicht einer Ausführungsform einer Substratportion, bei der eine Anzahl axial beabstandeter Zonen elektrischer Leitfähigkeit vorgesehen ist,

Fig. 2c eine perspektivische Ansicht einer Ausführungsform einer Substratportion, bei der eine Anzahl in Umfangsrichtung beabstandeter Zonen elektrischer Leitfähigkeit vorgesehen ist,

Fig. 3 einen schematischen Längsschnitt durch eine Inhaliervorrichtung gemäß der Erfindung, in die die Substratportion gemäß **Fig. 2a** eingesetzt ist und die ein separates Gehäuse für Steuerungskomponenten und Stromversorgung aufweist,

Fig. 4a einen schematischen Längsschnitt durch eine andere Ausführungsform einer Inhaliervorrichtung gemäß der Erfindung, die für die Verwendung eines separaten Mundstücks konstruiert ist und die ein separates Gehäuse für Steuerungskomponenten und Stromversorgung aufweist, mit eingesetzter Substratportion und eingesetztem Mund-

stück,

Fig. 4b eine Veranschaulichung der Benutzung des Systems gemäß **Fig. 4a** durch einen Raucher und

Fig. 5 einen schematischen Längsschnitt durch eine weitere Ausführungsform einer Inhaliervorrichtung gemäß der Erfindung, die für die Verwendung eines separaten Mundstücks konstruiert ist und bei der sich die Stromversorgung im Gehäuse befindet, mit eingesetzter Substratportion und eingesetztem Mundstück.

Eine bevorzugte Ausführungsform einer Substratportion **1** ist in den **Fig. 1a bis 1c** dargestellt. Die Substratportion **1** besitzt im Ausführungsbeispiel eine zylindrische Form, wie aus den **Fig. 1a bis 1c** ersichtlich. Sie enthält ein aerosolbildendes Material **2**, das mit einer radial (d. h. auf dem Zylindermantel) angeordneten elektrisch leitfähigen Umhüllung **3** umgeben ist.

Das aerosolbildende Material **2** kann z. B. aus geschnittenem Blatttabak, geschnittenen Tabakrippen, rekonstituiertem Tabak oder aus einem mit Aromasubstanzen behandelten Trägermaterial bestehen. Der Einsatz von Blatt- und Rippenschnitt kann auch in expandierter Form erfolgen, wie sie z. B. durch Anwendung des in den Patentschriften DE 29 03 300, DE 31 19 330 und DE 34 14 625 beschriebenen Verfahrens erhalten wird. Als Trägermaterialien für Aromastoffe können sowohl organische Materialien wie z. B. Papier, als auch anorganische wie z. B. Kieselgel zur Anwendung kommen. Auch beliebige Mischungen der genannten Komponenten sind einsetzbar.

In der bevorzugten Ausführungsform enthält das Material **2** einen Anteil von etwa 3% bis 30% eines flüchtigen Polyols, z. B. Glycerin oder Propylenglykol, um die Aerosolbildung zu verstärken. Eine andere Möglichkeit, die Aerosolbildung zu verstärken, ist der Einsatz der aerosolbildenden Materialien mit einer Feuchte, die deutlich über der Gleichgewichtsfeuchte liegt. So kann z. B. Tabak, dessen Gleichgewichtsfeuchte bei ca. 10% bis 12% liegt, mit einer Feuchte von 20% verwendet werden. In diesem Fall ist durch eine geeignete Verpackung dafür zu sorgen, daß bis zum Gebrauch kein Feuchteverlust auftritt.

Die elektrisch leitfähige Umhüllung **3** kann aus mit leitenden Additiven (wie Metalle oder Graphit/Kohlenstoff) versehenem Papier oder Folientabak oder einer ebenfalls durch Additive leitfähig gemachten Kunststoffolie bestehen. Auch eine mehrlagige Umhüllung ist verwendbar, wobei die innere Lage aus Papier oder Folientabak bestehen kann und die äußere aus einem der genannten, leitfähigen Materialien.

Ebenfalls möglich ist es, die Umhüllung zunächst aus einem nicht leitfähigen Material zu bilden und anschließend vor oder nach dem Umhüllen des aerosolbildenden Materials einen leitfähigen Film aufzubringen, z. B. durch Bedampfen oder Besprühen.

Die Herstellung von Substratportionen **1** kann in einfacher Weise auf einer herkömmlichen Cigarettenstrangmaschine erfolgen: Zunächst wird in einem Formatteil ein Endlosstrang von Tabak oder Ersatzmaterial gebildet; dieser wird mit dem von einer Bobine in Herstellungsrichtung zugeführten, leitfähigen Umhüllungsmaterial umgeben und an einer Naht verleimt. Anschließend erfolgt ein Ablängen in den gewünschten Abmessungen. Eine weitere Möglichkeit der Herstellung ist das Extrudieren eines geeigneten aerosolbildenden Materials durch eine Runddüse mit anschließendem Umhüllen und Ablängen des Extrudats.

Vorzugsweise liegt der Durchmesser einer Substratportion **1** im Bereich von 5 mm bis 12 mm und die Länge im Bereich von 10 mm bis 100 mm. Besonders bevorzugt werden Durchmesser von 5 mm bis 10 mm und Längen von 15 mm bis 60 mm.

In einer bevorzugten Ausführungsform ist die Substrat-

portion **1**, wie in **Fig. 2a** dargestellt, durch eine gemeinsame Umhüllung **11** mit einem Mundstück **10** verbunden. Die Herstellung eines solchen Verbundes ist dem Fachmann aus der Fertigung von Filtercigaretten vertraut. Die Substratportion **1** kann zusätzlich in Zonen **12** eine im Vergleich zu der übrigen Umhüllung erhöhte elektrische Leitfähigkeit aufweisen, was z. B. durch Umwickeln mit Metallfolie in den Zonen **12** erreicht werden kann, um den elektrischen Kontakt mit den Kontakten in einer Inhaliervorrichtung (siehe unten) zu verbessern.

Während bei der Ausführungsform der Substratportion gemäß **Fig. 2a** die Substratportion als ein einziger zusammenhängender Heizwiderstand eingerichtet ist, sehen weitere Ausführungsformen der Substratportion eine segmentierte oder abschnittsweise Aufteilung der elektrischen Leitfähigkeit der Umhüllung vor. Dies kann z. B. wie in **Fig. 2b** oder wie in **Fig. 2c** dargestellt erfolgen.

Die Umhüllung der Substratportion gemäß **Fig. 2b** weist eine Anzahl ringförmiger Zonen **13** mit relativ hoher elektrischer Leitfähigkeit auf, wobei jeweils zwei benachbarte Zonen **13** durch eine isolierende Zone getrennt sind. Jede der Zonen **13** bildet einen separaten Heizwiderstand, der sich in einer auf die Substratportion abgestimmten Inhaliervorrichtung einzeln über entsprechende Kontakte in der Inhaliervorrichtung mit Strom versorgen läßt. Die Lage derartiger Kontakte ist in **Fig. 2b** durch Pfeile sowie die Polaritäten "+" und "-" gekennzeichnet. Bei einer Varianten dieser Ausführungsform verlaufen die einzelnen Zonen **13** nicht über den gesamten Umfang der Substratportion, sondern haben jeweils eine isolierende Unterbrechung. Bei einer anderen Variante sind die Zonen **13** in einer sich längs der Substratportion erstreckenden Zone elektrisch leitend zusammengelegt, die z. B. entlang der Kontaktstellen "-" (oder der Kontaktstellen "+") gemäß **Fig. 2b** verläuft, so daß in der Inhaliervorrichtung für diesen Pol in Art einer Masseverbindung nur ein Kontakt vorhanden sein muß.

Bei der in **Fig. 2c** gezeigten Ausführungsform einer Substratportion weist die Umhüllung der Substratportion eine Anzahl in Umfangsrichtung gegeneinander versetzter und gegeneinander isolierter elektrisch leitfähiger Zonen **15** auf. Die als separate Heizwiderstände dienenden Zonen **15** erstrecken sich über die Länge der Substratportion. In einem Endbereich der Substratportion sind sie durch eine ringartige Kontaktzone **14** elektrisch leitend zusammengelegt, wobei der elektrische Widerstand der Kontaktzone **14** vorzugsweise kleiner ist als der einer Zone **15**. An diesem Ende ist in einer an die Substratportion angepaßten Inhaliervorrichtung nur ein "-"-Kontakt erforderlich, während am anderen Ende eine Anzahl von Kontakten vorgesehen ist, die in **Fig. 2c** mit Pfeilen gekennzeichnet und mit "+" bezeichnet sind. Die "+"-Kontakte ermöglichen ein separates Ansteuern der Zonen **15**. Um die erforderliche Ausrichtung der Substratportion in der Inhaliervorrichtung in definierter Winkelposition zu gewährleisten, ist im Ausführungsbeispiel eine Positioniereinrichtung in Form einer Kerbe **16** vorgesehen, in die beim Einsetzen der Substratportion in die Inhaliervorrichtung ein entsprechender Führungsvorsprung an der Inhaliervorrichtung eingreift.

Ein Ausführungsbeispiel einer Inhaliervorrichtung (nachfolgend Rauchgerät genannt) wird im folgenden anhand der **Fig. 3** beschrieben. Dieses Rauchgerät ist zur Benutzung mit einer Substratportion gemäß **Fig. 2a** eingerichtet.

Wie **Fig. 3** zeigt, befinden sich in einem Gehäuse **20** zwei Kontakte (Elektroden) **21** und **22**, über die der Kontakt zur leitfähigen Umhüllung einer von dem Rauchgerät aufgenommenen Substratportion hergestellt wird. Der Hohlraum im Innern des Gehäuses **20** und die Kontakte **21** und **22** bilden dabei eine Aufnahmeeinrichtung zum Halten der Sub-

stratportion. Durch eine Öffnung **24** kann Luft durch die Substratportion gezogen werden. Über eine elektrische Verbindung **25** ist der Kontakt **21** direkt mit einer in einem separaten Gehäuse angeordneten Versorgungseinheit **30** verbunden. Die Verbindung zum Kontakt **22** verläuft über einen Schalter **23**, mit dem der Stromkreis geschlossen werden kann. Die Versorgungseinheit **30** enthält eine Batterie oder einen Akkumulator **31** sowie optional eine Steuerung **32**. Im Falle eines Akkumulators kann dieser über Steckkontakte **33** aufgeladen werden.

Der Gebrauch des Rauchgerätes geht wie folgt vor sich: Das Rauchgerät ist mit der Versorgungseinheit **30** über ein Kabel (Verbindung **25**) verbunden (siehe auch **Fig. 4b**). Die mit dem Mundstück **10** versehene Substratportion **1** wird in eine konisch ausgestaltete Öffnung an einer der Stirnseiten des Gehäuses **20** geschoben, bis sie einen Anschlag bei dem Kontakt **21** erreicht, siehe **Fig. 3**. Das Rauchgerät wird nun zum Mund geführt und der Schalter **23** betätigt. Durch Schließen des Stromkreises wird die Substratportion durch den über die Kontakte **21** und **22** durch die als Heizwiderstand wirkende Umhüllung fließenden Strom erhitzt, und das entstehende Aerosol kann durch das Mundstück **10** entnommen werden. Das Abschalten geschieht durch Loslassen des Schalters **23** oder durch die Steuerung **32**. Auf diese Weise können mehrere Züge entnommen werden. Nach Gebrauch wird die Substratportion **1** mit dem Mundstück **10** aus dem Rauchgerät entnommen und entsorgt. Von Zeit zu Zeit ist ein Batteriewechsel oder Aufladen des Akkumulators **31** in der Versorgungseinheit **30** notwendig.

Fig. 4a zeigt eine andere Ausführungsform des Systems, die sich von der vorhergehenden dadurch unterscheidet, daß Mundstück **10'** und Substratportion **1'** nicht miteinander verbunden sind. Das Mundstück **10'** wird in einen Sockel **42** eingesteckt, der nach Einlegen der Substratportion **1'** in ein Rauchgerät, das ein Gehäuse **40** aufweist, mit dem Gehäuse **40** verschraubt wird. Der Sockel **42** dient gleichzeitig als Kontakt. Funktion und Gebrauch dieses Rauchgeräts und der übrigen Komponenten des Systems entsprechen ansonsten dem vorherigen Ausführungsbeispiel. In **Fig. 4a** sind der zweite Kontakt mit **41**, der Schalter mit **43**, die Öffnung für die Luftzuführung mit **44**, das Verbindungskabel mit **45**, die Versorgungseinheit mit **30'**, die Batterie oder der Akkumulator mit **31'**, die Steuerung mit **32'** und die Steckkontakte mit **33'** bezeichnet.

Der Gebrauch des Rauchartikels ist in **Fig. 4b** dargestellt. Das Rauchgerät mit Mundstück und Substratportion kann wie eine herkömmliche Zigarette gehandhabt werden; die Versorgungseinheit wird bevorzugt in einer Brusttasche, Gürtelhalterung o. ä. getragen. Beide Teile sind durch ein hochflexibles Kabel (Verbindungskabel **45**) ausreichender Länge miteinander verbunden.

Eine einteilige Ausführungsform des Rauchgeräts mit cigarrenähnlicher Form ist in **Fig. 5** dargestellt. Ein Gehäuse **50** besitzt am vorderen Ende eine abschraubbare Kappe **53**, durch die ein Wechsel einer Batterie bzw. eines Akkumulators **51** möglich ist. Ein schwenkbare Klappe **52**, die auch in aufgeschwenktem Zustand eingezeichnet ist, dient zum Einlegen einer Substratportion **1"**. Beim Öffnen der Klappe **52** wird über ein nicht dargestelltes Gestänge gleichzeitig ein Aufnahmeteil **55** gegen die Kraft einer Schraubenfeder **56** nach hinten bewegt, um das Einlegen der Substratportion **1"** zu erleichtern. Die bei geschlossener Klappe **52** wirkende Kraft der Schraubenfeder **56** bewirkt eine Fixierung der Substratportion **1"** zwischen einem Kontakt **57** und dem Aufnahmeteil **55**, das gleichzeitig als Gegenkontakt dient. Durch Schließen eines Schalters **60** fließt zwischen den Kontakten **55**, **57** Strom über die leitfähige Umhüllung der Substratportion **1"**, so daß diese erwärmt wird. Das Rau-

chaerosol kann durch Ziehen an einem in das Aufnahmeteil **55** eingesteckten Mundstück **10"** entnommen werden, das als separate Komponente gestaltet ist und in diesem Ausführungsbeispiel nicht fest mit der Substratportion **1"** verbunden ist. Dabei strömt Luft durch einen Kanal **54** nach und tritt an der vorderen Stirnseite der Substratportion **1"** in die Substratportion **1"** ein.

In einem Rauchgerät, das für die Benutzung einer Substratportion gemäß **Fig. 2b** oder gemäß **Fig. 2c** eingerichtet ist, befinden sich Kontakte, die paarweise einer als Heizwiderstand dienenden Zone **13** bzw. **15** zugeordnet sind. Wenn, wie oben beschrieben, ein gemeinsamer Pol elektrisch leitend zusammengelegt ist, braucht dafür nur ein Kontakt vorhanden zu sein. Durch sequentielle Stromversorgung jeweils einer Zone **13** bzw. **15** kann jeweils ein neuer Teil der Substratportion erhitzt werden, wodurch eine gleichmäßigere Aerosolausbeute über die Züge erreicht wird. Dies ergibt ein weitgehend konstantes Geschmacksangebot pro Zug. Die Steuerung kann beispielsweise über einen Zugdetektor erfolgen, der auf die Druckänderung beim Ansagen von Luft durch den Benutzer reagiert und über eine Schalteinrichtung die Stromversorgung einer der Zonen **13** bzw. **15** bewirkt. Beim nächsten Zug spricht die Schalteinrichtung wieder an, aber eine elektronische Schaltung sorgt dafür, daß der Heizstrom über die zugeordneten Kontakte diesmal an eine andere, noch nicht benutzte Zone **13** bzw. **15** gelegt wird, usw..

Für die Konstruktion des Mundstückes **10**, **10'** oder **10"** sind grundsätzlich alle dem Fachmann aus der Zigarettenindustrie bekannten Prinzipien anwendbar. Im einfachsten Fall besteht das Mundstück aus einer hohlen Papier- oder Kartonrolle. Bevorzugt wird jedoch die Ausführung als Filtermundstück. In diesem Fall ist ein Filtermaterial wie Celluloseacetat, Polypropylen oder Papier mit einer ein- oder mehrlagigen Umhüllung versehen. Auch eine den bekannten Mehrfachfiltern entsprechende Konstruktion kann verwendet werden, bei der in axialer Richtung mehrere Segmente mit unterschiedlichen Eigenschaften hintereinander angeordnet und durch eine äußere Umhüllung verbunden sind. In diesem Fall können ein oder mehrere Segmente mit axialen Bohrungen versehen sein. Bei allen genannten Konstruktionen besteht weiterhin die Möglichkeit des Einsatzes einer zonenperforierten Umhüllung oder einer nachträglichen Perforation der Umhüllung z. B. mit Hilfe eines Laserstrahls. Hierdurch kann bei den Zügen der Rauch durch Hinzuströmen von Außenluft verdünnt werden. Weitere Varianten des Systems bzw. seiner Komponenten ergeben sich unmittelbar aus den Ansprüchen.

Im folgenden ist ein weiteres Beispiel für eine Substratportion mit Mundstück und seine Benutzung in dem System angegeben.

Beispiel

Eine American-Blend-Tabakmischung mit einem Gehalt von
30% Burley-Tabak
40% expandiertem Virginia-Tabak
20% nicht expandiertem Virginia-Tabak und
10% Orient-Tabak
wurde konditioniert und mit 12 Gew.-% eines wäßrigen Casings mit einem Glyceringehalt von 80 Gew.-% besprüht. Anschließend wurde der Tabak mit 0,8 mm Schnittbreite geschnitten und auf eine Feuchte von 12% abgetrocknet. 180 kg dieses Schnittabaks wurden mit 20 kg expandiertem Rippenschnitt vermischt.

Aus dieser Mischung wurde auf einer Zigarettenstrangmaschine ein Endlosstrang mit einem Durchmesser von

6 mm und einer Stopfdichte von 200 mg/ml hergestellt. Als Umhüllungsmaterial kam ein durch Graphitzusatz leitfähig gemachtes, luftundurchlässiges Papier zum Einsatz. Der Endlossrang wurde in Einzelportionen von 40 mm Länge geschnitten, und diese wurden in bekannter Weise durch ein Mundstückbelagpapier mit einem Acetatfilterstöpsel verbunden.

Die so erhaltene Substratportion wurde in einem Rauchgerät nach **Fig. 3** abgeraucht, ohne daß sichtbare Mengen Nebenstromrauch entstanden. Der Geschmack wurde von Probanden als gleichmäßig und dem herkömmlicher Cigaretten gleichwertig beurteilt.

Patentansprüche

1. System zur Bereitstellung eines inhalierbaren Aerosols, mit
 - einer Substratportion (**1; 1'; 1''**), die mindestens einen Heizwiderstand (**3; 13; 15**) aufweist und innerhalb einer Umhüllung (**3**) aerosolbildendes Material (**2**) enthält, wobei die Umhüllung (**3**) eine Lufteintrittsöffnung und eine Aerosolaustrittsöffnung aufweist, und
 - einer Inhaliervorrichtung, die ein Gehäuse (**20; 40; 50**), eine Aufnahmeeinrichtung zum Halten der Substratportion (**1; 1'; 1''**) und mit einer Spannungsquelle (**31; 31'; 51**) in Verbindung stehende oder in Verbindung bringbare Kontakte (**21, 22; 41, 42; 55, 57**) zum Zuführen von elektrischer Leistung zu dem mindestens einen Heizwiderstand (**3; 13; 15**) der Substratportion (**1; 1'; 1''**) aufweist.
2. System nach Anspruch 1, gekennzeichnet durch ein Mundstück (**10; 10'; 10''**), das separat (**10'; 10''**) mit der Inhaliervorrichtung verbindbar ist oder mit der Substratportion (**1**) verbunden ist und im Betriebszustand mit der Aerosolaustrittsöffnung der Substratportion (**1; 1'; 1''**) in Verbindung steht.
3. System nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Umhüllung (**3**) der Substratportion (**1; 1'; 1''**) zumindest abschnittsweise elektrisch leitfähig ist und als mindestens ein Heizwiderstand (**3; 13; 15**) eingerichtet ist.
4. System nach Anspruch 3, dadurch gekennzeichnet, daß die Umhüllung (**3**) der Substratportion als ein einziger zusammenhängender Heizwiderstand eingerichtet ist.
5. System nach Anspruch 3, dadurch gekennzeichnet, daß die Substratportion eine Längsachse hat und die Umhüllung der Substratportion eine Anzahl axial gegeneinander versetzter und gegeneinander isolierter Heizwiderstände (**13**) aufweist, die vorzugsweise in einer sich längs der Substratportion erstreckenden Zone elektrisch leitend zusammengelegt sind.
6. System nach Anspruch 3, dadurch gekennzeichnet, daß die Substratportion eine Längsachse hat und die Umhüllung der Substratportion eine Anzahl in Umfangsrichtung gegeneinander versetzter und gegeneinander isolierter Heizwiderstände (**15**) aufweist, die sich vorzugsweise über die Länge der Substratportion erstrecken und die vorzugsweise in einem Endbereich (**14**) der Substratportion elektrisch leitend zusammengelegt sind, wobei die Substratportion vorzugsweise eine an die Inhaliervorrichtung angepaßte Positioniereinrichtung (**16**) zum Einsetzen in die Inhaliervorrichtung in definierter Winkelposition aufweist.
7. System nach einem der Ansprüche 3 bis 6, dadurch gekennzeichnet, daß die Umhüllung (**3**) der Substrat-

portion (**1; 1'; 1''**) Metallfolie, metallbeschichtetes oder metallhaltiges Papier, kohlehaltiges Papier, graphithaltiges Papier, einen elektrisch leitfähigen Film, mit leitfähigen Additiven versehene Kunststoffolie und/oder mit leitfähigen Additiven versehenen Folientabak aufweist.

8. System nach einem der Ansprüche 3 bis 7, dadurch gekennzeichnet, daß die Umhüllung (**3**) der Substratportion (**1; 1'; 1''**) mehrere Lagen von Umhüllungsmaterialien aufweist, wobei die äußere Lage elektrisch leitendes Material aufweist und die innere Lage vorzugsweise aus Papier oder Folientabak besteht.

9. System nach einem der Ansprüche 3 bis 8, dadurch gekennzeichnet, daß die Umhüllung (**3**) der Substratportion (**1; 1'; 1''**) in dem Bereich zwischen den Kontakten (**21, 22; 41, 42; 55, 57**) zugeordneten Kontakten (**21, 22; 41, 42; 55, 57**) der Inhaliervorrichtung einen elektrischen Widerstand von 0,1 Ohm bis 1000 Ohm aufweist.

10. System nach einem der Ansprüche 3 bis 9, dadurch gekennzeichnet, daß die mit den Kontakten (**21, 22; 41, 42; 55, 57**) der Inhaliervorrichtung in Kontakt bringbaren Zonen (**12**) der Umhüllung (**3**) der Substratportion (**1**) eine gegenüber dem übrigen Material der Umhüllung (**3**) erhöhte elektrische Leitfähigkeit aufweisen, vorzugsweise durch Metallbeschichtung.

11. System nach einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, daß die Substratportion (**1; 1'; 1''**) eine zylindrische Form mit einer Länge von 10 mm bis 100 mm, vorzugsweise von 15 mm bis 60 mm, und einem Durchmesser von 4 mm bis 12 mm, vorzugsweise von 5 mm bis 10 mm, aufweist.

12. System nach einem der Ansprüche 3 bis 10 und nach Anspruch 11, dadurch gekennzeichnet, daß die zumindest abschnittsweise elektrisch leitfähige Umhüllung (**3**) der Substratportion (**1; 1'; 1''**) als Zylindermantel angeordnet ist und die Stirnseiten des Zylinders als Lufteintrittsöffnung und als Aerosolaustrittsöffnung eingerichtet sind.

13. System nach einem der Ansprüche 1 bis 12, dadurch gekennzeichnet, daß das aerosolbildende Material (**2**) der Substratportion (**1; 1'; 1''**) Schnittabak, geschnittene Tabakrippen, Folientabakschnitt und/oder ein extrudiertes Tabakmaterial aufweist.

14. System nach einem der Ansprüche 1 bis 13, dadurch gekennzeichnet, daß das aerosolbildende Material (**2**) der Substratportion (**1; 1'; 1''**) ein mit Aromasubstanzen beaufschlagtes Trägermaterial aufweist.

15. System nach einem der Ansprüche 1 bis 14, dadurch gekennzeichnet, daß das aerosolbildende Material (**2**) der Substratportion (**1; 1'; 1''**) ein verdampfbares Polyol, vorzugsweise Glycerin oder Propylenglykol, zu einem Anteil von 5 Gew.-% bis 50 Gew.-%, vorzugsweise von 10 Gew.-% bis 30 Gew.-% enthält.

16. System nach einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß die Inhaliervorrichtung mindestens einen Schalter (**23; 43; 60**) für den mindestens einen Heizwiderstand (**3; 13; 15**) aufweist.

17. System nach einem der Ansprüche 1 bis 16, dadurch gekennzeichnet, daß die Inhaliervorrichtung einen Zugdetektor aufweist, der zusammen mit einer Schalteinrichtung dazu eingerichtet ist, den durch einen Heizwiderstand (**3; 13; 15**) der Substratportion (**1; 1'; 1''**) führenden Stromkreis in Abhängigkeit von der auf die Lufteintrittsöffnung der Substratportion (**1; 1'; 1''**) gerichteten Strömungsgeschwindigkeit zu schalten.

18. System nach einem der Ansprüche 1 bis 17, dadurch gekennzeichnet, daß die Inhaliervorrichtung eine

Schaltung, vorzugsweise eine elektronische Schaltung (32; 32'), zum Steuern der von dem mindestens einen Heizwiderstand (3; 13; 15) der Substratportion (1; 1'; 1'') abgegebenen Leistung aufweist.

19. System nach Anspruch 18 in Verbindung mit Anspruch 4, dadurch gekennzeichnet, daß die Schaltung (32; 32') der Inhamervorrichtung dazu eingerichtet ist, die Spannung oder den Strom für den Heizwiderstand (3) der Substratportion (1; 1'; 1'') dergestalt zu steuern, daß die Heizleistung beim ersten Zug auf einen höheren Wert als bei den Folgezügen eingestellt wird, sowie nach einer definierten Zugzeit die Leistungszufuhr zu unterbrechen, um eine Überhitzung zu vermeiden.

20. System nach Anspruch 18 in Verbindung mit Anspruch 5 oder 6, dadurch gekennzeichnet, daß die Schaltung (32; 32') der Inhamervorrichtung dazu eingerichtet ist, zum sequentiellen Einschalten der einzelnen Heizwiderstände (13; 15) den einzelnen Heizwiderständen (13; 15) zugeordnete Kontakte sequentiell anzusteuern.

21. System nach einem der Ansprüche 18 bis 20, dadurch gekennzeichnet, daß die Schaltung im Innern des Gehäuses der Inhamervorrichtung untergebracht ist.

22. System nach einem der Ansprüche 18 bis 20, dadurch gekennzeichnet, daß die Schaltung (32; 32') in einem separaten Gehäuse (30; 30') untergebracht ist, das mit dem Gehäuse (20; 40) der Inhamervorrichtung über ein Kabel (25; 45) verbunden oder verbindbar ist.

23. System nach einem der Ansprüche 1 bis 22, dadurch gekennzeichnet, daß für die Leistungszufuhr an die Kontakte (21, 22; 41, 42; 55, 57) der Inhamervorrichtung eine Batterie oder ein Akkumulator (31; 31'; 51) vorgesehen ist, die bzw. der in dem Gehäuse (50) der Inhamervorrichtung oder in einem separaten Gehäuse (30; 30') untergebracht oder unterbringbar ist.

24. System nach einem der Ansprüche 1 bis 23, dadurch gekennzeichnet, daß das Gehäuse (50) der Inhamervorrichtung eine cigarrenähnliche Form aufweist.

25. System nach einem der Ansprüche 1 bis 23, dadurch gekennzeichnet, daß das Gehäuse (20; 40) der Inhamervorrichtung eine cigarettenenähnliche Form aufweist.

26. System nach einem der Ansprüche 2 bis 25 in Verbindung mit Anspruch 2, dadurch gekennzeichnet, daß das Mundstück (10; 10'; 10'') eine Länge von 10 mm bis 50 mm und einen Durchmesser von 4 mm bis 12 mm aufweist.

27. System nach einem der Ansprüche 2 bis 26 in Verbindung mit Anspruch 2, dadurch gekennzeichnet, daß das Mundstück (10; 10'; 10'') eine hohle Papier- oder Kartonhülle aufweist.

28. System nach einem der Ansprüche 2 bis 26 in Verbindung mit Anspruch 2, dadurch gekennzeichnet, daß das Mundstück (10; 10'; 10'') als Filtermundstück ausgebildet ist, wobei das Filtermaterial vorzugsweise Celluloseacetat, Papier, Myria und/oder Polypropylen mit einer ein- oder mehrlagigen Papierumhüllung aufweist.

29. System nach Anspruch 28, dadurch gekennzeichnet, daß das Mundstück (10; 10'; 10'') einen Filterstöpsel aus mehreren in axialer Richtung hintereinander angeordneten Teilelementen aufweist, von denen vorzugsweise eines oder mehrere axiale Bohrungen aufweisen.

30. System nach einem der Ansprüche 2 bis 29 in Verbindung mit Anspruch 2, dadurch gekennzeichnet, daß das Mundstück (10; 10'; 10'') eine oder mehrere Perforationszonen aufweist.

31. System nach einem der Ansprüche 2 bis 30 in Verbindung mit Anspruch 2, dadurch gekennzeichnet, daß die Substratportion (1) und das Mundstück (10) einen ähnlichen Durchmesser aufweisen und miteinander verbunden sind.

32. System nach Anspruch 31, dadurch gekennzeichnet, daß die Substratportion (1) und das Mundstück (10) durch eine gemeinsame Umwicklung (11) mit einem Mundstückbelagpapier verbunden sind.

33. Inhamervorrichtung, mit einem Gehäuse (20; 40; 50), mit einer Aufnahmeeinrichtung zum Halten einer ein aerosolbildendes Material aufweisenden Substratportion (1; 1'; 1'') und mit einer Spannungsquelle (31; 31'; 51) in Verbindung stehenden oder in Verbindung bringbaren Kontakten (21, 22; 41, 42; 55, 57) zum Zuführen von elektrischer Leistung zu mindestens einem Heizwiderstand der Substratportion (1; 1'; 1'').

34. Inhamervorrichtung nach Anspruch 33, gekennzeichnet durch Merkmale der Inhamervorrichtung aus einem der Ansprüche 16 bis 25.

35. Substratportion, die zur Verwendung mit einer Inhamervorrichtung nach Anspruch 33 oder 34 eingerichtet ist und die mindestens einen Heizwiderstand (3; 13; 15) aufweist und innerhalb einer Umhüllung (3) aerosolbildendes Material (2) enthält, wobei die Umhüllung (3) eine Lufteintrittsöffnung und eine Aerosolaustrittsöffnung aufweist.

36. Substratportion nach Anspruch 35, gekennzeichnet durch Merkmale der Substratportion (1; 1'; 1'') aus einem der Ansprüche 3 bis 15.

37. Substratportion nach Anspruch 35 oder 36, gekennzeichnet durch ein Mundstück (10), das mit der Substratportion (1) verbunden ist und mit der Aerosolaustrittsöffnung der Substratportion (1) in Verbindung steht.

38. Substratportion nach Anspruch 37, dadurch gekennzeichnet, daß das Mundstück (10; 10'; 10'') Merkmale aus einem der Ansprüche 26 bis 32 aufweist.

39. Mundstück, das zur Verwendung mit einer Inhamervorrichtung nach Anspruch 33 oder 34 eingerichtet ist, separat (10'; 10'') mit der Inhamervorrichtung verbindbar ist und im Betriebszustand mit der Aerosolaustrittsöffnung der Substratportion (1; 1'') in Verbindung steht.

40. Mundstück nach Anspruch 39, gekennzeichnet durch Merkmale des Mundstücks (10'; 10'') aus einem der Ansprüche 26 bis 30.

Hierzu 5 Seite(n) Zeichnungen

- Leerseite -

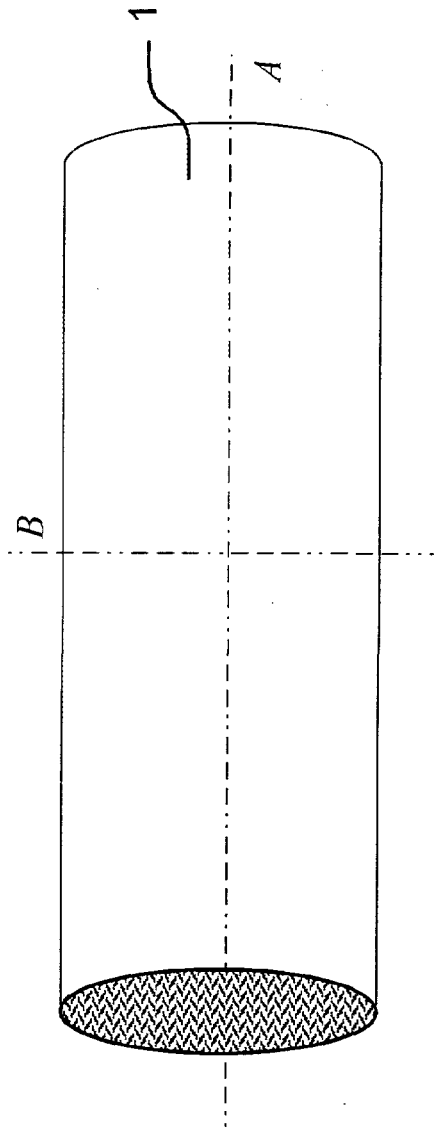


Fig. 1a

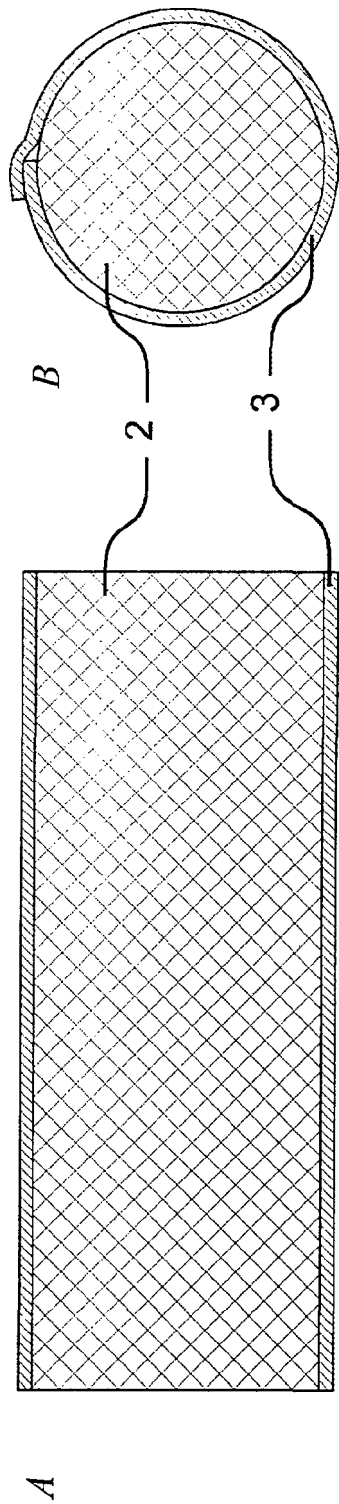


Fig. 1b

Fig. 1c

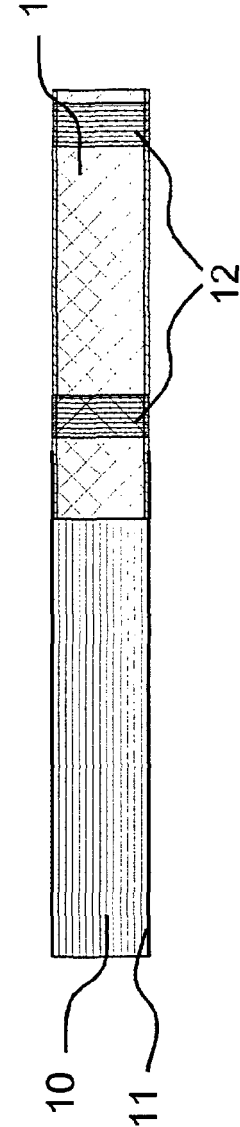


Fig. 2a

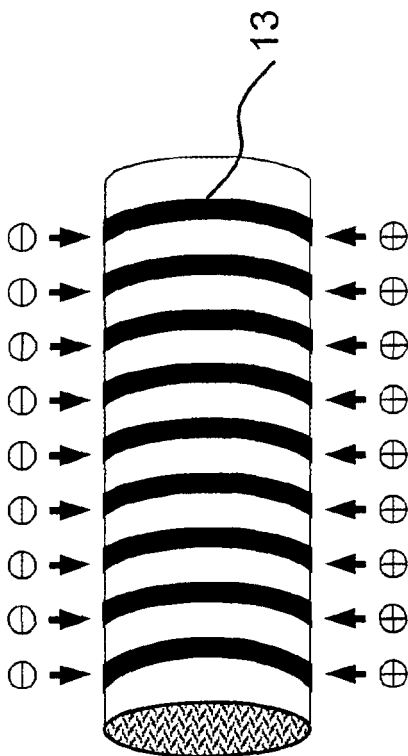


Fig. 2b

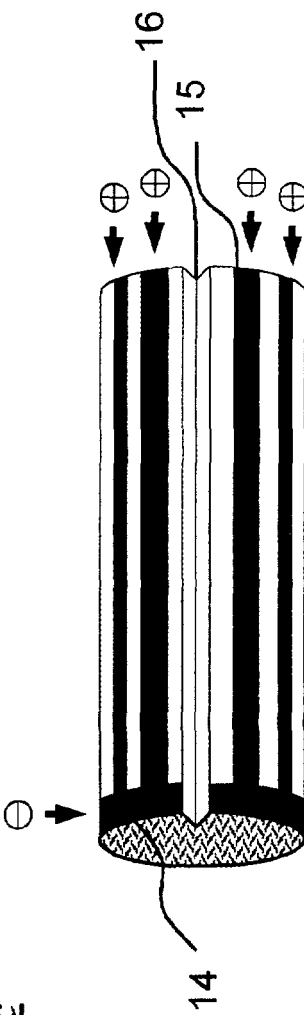
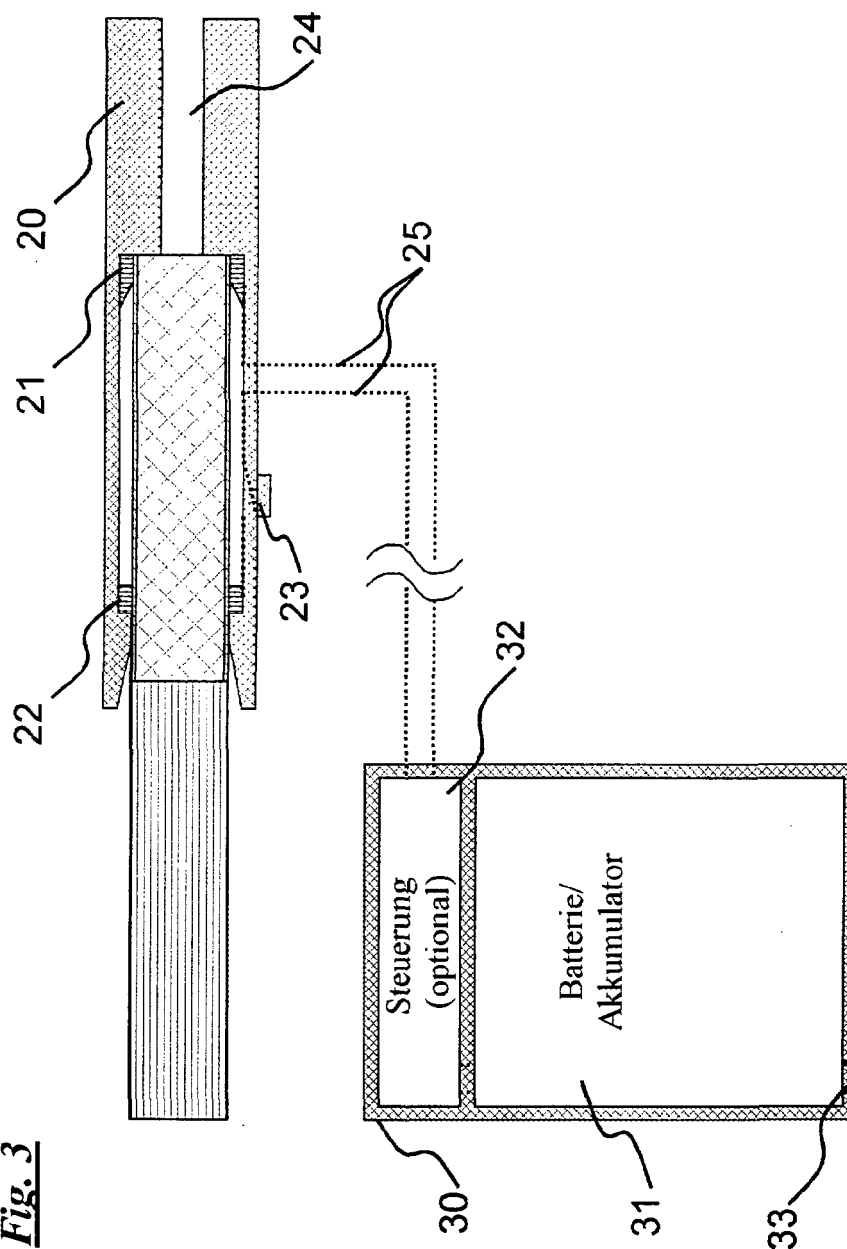


Fig. 2c

Fig. 3



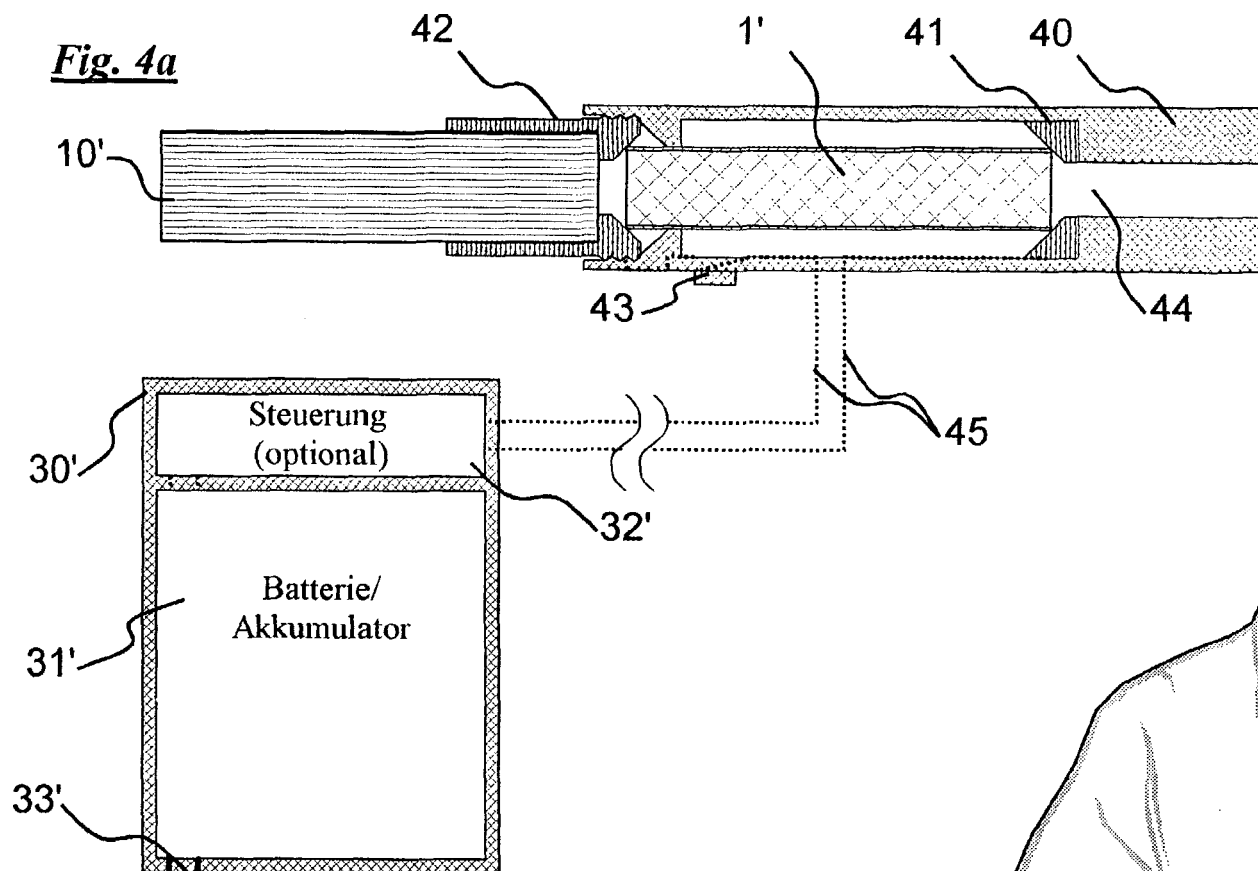
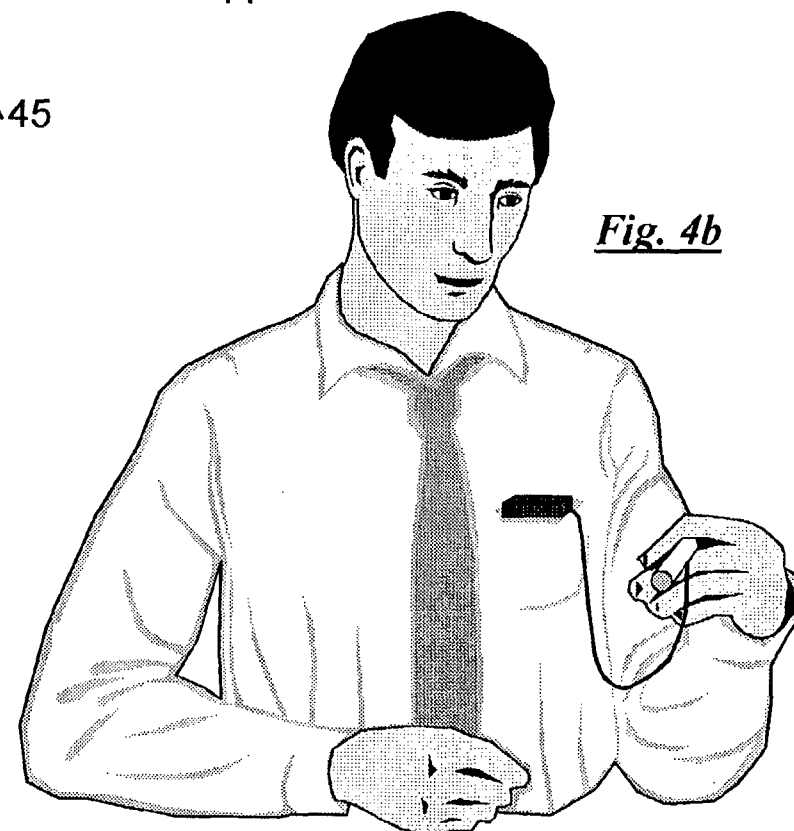
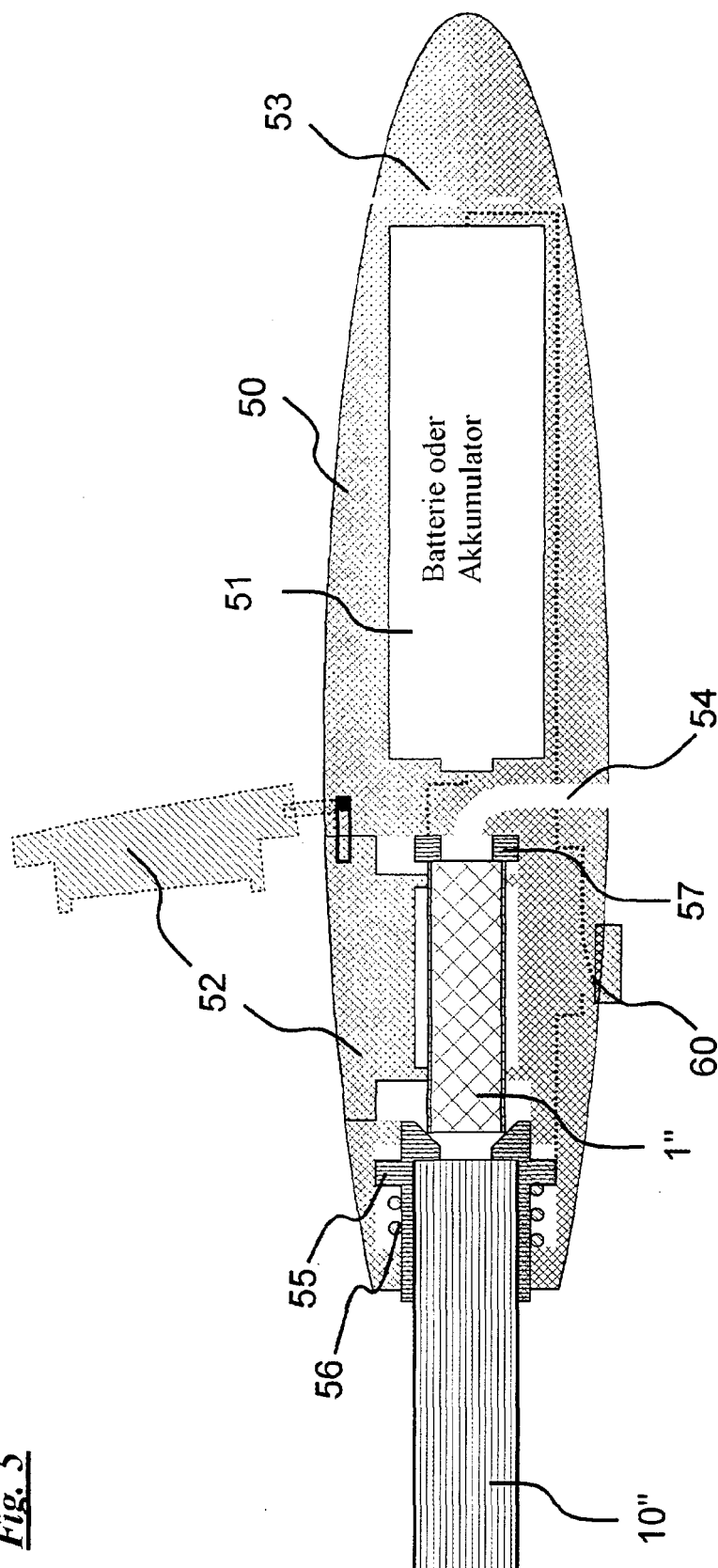


Fig. 5



Patent/Publication: DE19854005A1

Bibliography

DWPI Title

Smoking system, comprises casing with holder for substrate containing tobacco and evaporable polyol with electrical heater and power supply

Original Title

System zur Bereitstellung eines inhalierbaren Aerosols

Assignee/Applicant

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Abstract

Abstract

A system for supplying an inhalable aerosol contains a substrate portion (1") and an inhaling device. The substrate portion (1") has at least one heat resistor and contains an aerosol-forming material inside a casing which has an air inlet and an aerosol outlet. The casing of the substrate portion (1") is preferably electroconductive at least in sections and forms the at least one heat resistor. The inhaling device has a housing (50), a receiving device for holding the substrate portion (1") and contacts (55, 57) which are or can be connected to a voltage source (51) for supplying electrical power to the at least one heat resistor of the substrate portion (1").



①⑨ **BUNDESREPUBLIK
DEUTSCHLAND**



**DEUTSCHES
PATENT- UND
MARKENAMT**

⑫ **Offenlegungsschrift**
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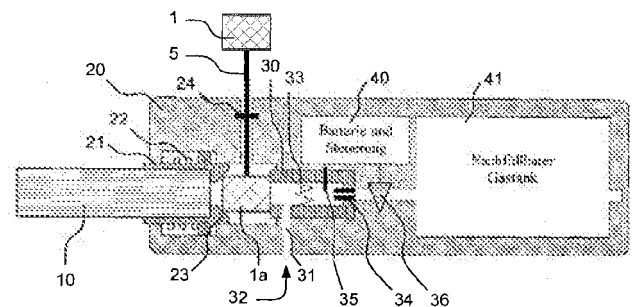
⑦② Erfinder:
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Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Prüfungsantrag gem. § 44 PatG ist gestellt

⑤④ System zur Bereitstellung eines inhalierbaren Aerosols

⑤⑦ Ein System zur Bereitstellung eines inhalierbaren Aerosols hat einen Verbund von Substratportionen und eine Inhalievorrichtung. Der Verbund von Substratportionen weist eine Anzahl von auf einem Träger (5) angeordneten Substratportionen (1) auf, wobei jede der Substratportionen (1) innerhalb einer Umhüllung, die eine Lufteintrittsöffnung und eine Aerosolaustrittsöffnung hat, aerosolbildendes Material enthält. Die Inhalievorrichtung hat ein Gehäuse (20), eine Halterung (24, 23) für den Verbund von Substratportionen und eine Heizeinrichtung (30, 33, 34, 35, 36, 40) und ist dazu eingerichtet, daß jede Substratportion des Verbunds von Substratportionen in eine Betriebsstellung (1a) bewegbar ist und in der Betriebsstellung (1a) zur Aerosolbildung erwärmbar ist. Ein Mundstück (10) steht in der Betriebsstellung (1a) einer Substratportion mit der Aerosolaustrittsöffnung dieser Substratportion (1a) in Verbindung.



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Die Erfindung betrifft ein System zur Bereitstellung eines inhalierbaren Aerosols sowie die Komponenten eines derartigen Systems. Dieses System ist insbesondere als Rauchartikel zur Bereitstellung von Rauchaerosol für Raucher geeignet.

Beim Abrauchen konventioneller Zigaretten wird der größte Teil des Tabaks nicht während der Züge, sondern in den Zugpausen verbrannt. Dies führt zur Bildung des sogenannten Nebenstromrauchs, der von Nichtrauchern oft als belästigend empfunden wird.

Zur Überwindung dieses Problems sind zahlreiche neue Rauchartikel, in denen während der Zugpausen kein Tabak verbrannt wird, vorgeschlagen worden. Ein gemeinsames Prinzip solcher Entwicklungen ist, daß nicht die Verbrennungswärme des Tabaks, sondern andere Energiequellen zur Freisetzung des Rauchaerosols genutzt werden. Hierdurch wird nicht nur die Entstehung von Nebenstromrauch weitgehend vermieden, sondern durch eine geänderte Temperaturführung während der Züge kann auch eine bevorzugte Freisetzung von Aromasubstanzen erreicht und die Bildung von reizenden oder unerwünschten Nebenprodukten reduziert werden. Häufig kommen in den vorgeschlagenen Rauchartikeln zur Aerosolbildung statt Tabak Ersatzmaterialien wie spezielle Folientabake oder mit Aromasubstanzen beaufschlagte Trägermaterialien zur Anwendung.

So ist ein zigarettenförmiger Rauchartikel bekannt, bei dem die Wärmeenergie eines glimmenden Kohleelements auf eine in Innern der Zigarette angeordnete Aluminiumkapsel übertragen wird, die ein aerosolbildendes Material enthält.

Bei einer Modifikation dieses Rauchartikels kommt als aerosolbildendes Material ein spezieller, mit hohen Mengen an Glycerin beaufschlagter Folientabak zum Einsatz.

Beiden vorgenannten Rauchartikeln ist gemeinsam, daß die Verbrennungsgase des Heizelements mit dem Rauchaerosol inhaliert werden, was zu einer erhöhten Aufnahme von Kohlenmonoxid durch den Raucher führt. Weiterhin muß der gesamte Rauchartikel, der im Gegensatz zu herkömmlichen Zigaretten seine Länge beibehält, nach dem Abrauchen entsorgt werden. Dies führt zu einem erhöhten Anfall komplex zusammengesetzter Reststoffe und damit verbundenen Entsorgungsproblemen. Ein weiterer Nachteil der vorgenannten Rauchartikel sind Geschmacksdefizite in den ersten und letzten Zügen. Diese resultieren daraus, daß bei den ersten Zügen noch keine ausreichende Erwärmung des Aerosolbildners erfolgt ist, während bei den letzten Zügen das aerosolbildende Material oder die Wärmequelle schon weitgehend aufgebraucht sind.

Die letztgenannten Nachteile können dadurch vermieden werden, daß bei jedem Zug eine neue Portion des aerosolbildenden Materials erhitzt wird. Bei einem nach diesem Prinzip arbeitenden vorbekannten Rauchartikel wird ein zigarettenförmiger Gegenstand mit Filter- und Tabakteil am tabakseitigen Ende in ein elektronisch gesteuertes Abrauchgerät gesteckt. In diesem erfolgt eine Erwärmung des tabakhaltigen Teils an mit den Zügen radial aufeinanderfolgenden Stellen durch elektrische Heizelemente. Dieses Prinzip bedingt eine aufwendige Konstruktion des Abrauchgeräts, das mit mehreren Heizelementen und einer komplizierten elektronischen Steuerung ausgerüstet sein muß. Weiterhin ist die Temperaturführung kritisch, da ein Weiterglimmen oder gar Verbrennen der gesamten Tabakportion zwischen den Zügen sicher verhindert werden muß.

Bei einer weiteren vorbekannten Anordnung dienen auf einem Band angeordnete Substratportionen zur Aerosolbildung. Die Substratportionen werden Zug für Zug in Kontakt

mit einem elektrischen Heizelement gebracht. Diese Konstruktion erlaubt nur geringe Substratmengen, und der Einsatz von Tabak als Aerosolbildner ist nicht möglich. Weiterhin ist die für das Band benötigte Aufwickelvorrichtung platzaufwendig und bedarf eines komplizierten Vorschubmechanismus.

Aufgabe der vorliegenden Erfindung ist es, ein System zur Bereitstellung eines inhalierbaren Aerosols zu schaffen, das einen einfachen Grundaufbau hat und insbesondere als Rauchartikel dienen kann, der einen ähnlichen Geschmackseindruck wie herkömmliche Zigaretten bietet, bei dessen Gebrauch jedoch zwischen den Zügen kein Nebenstromrauch erzeugt wird.

Diese Aufgabe wird gelöst durch ein System mit den Merkmalen des Anspruchs 1, das eine Inhaliervorrichtung mit den Merkmalen des Anspruchs 29 und einen Verbund von Substratportionen mit den Merkmalen des Anspruchs 31 sowie ein gemäß Anspruch 33 vorzugsweise lösbares Mundstück aufweist. Vorteilhafte Ausgestaltungen der Erfindung ergeben sich aus den abhängigen Ansprüchen.

Das erfindungsgemäße System zur Bereitstellung eines inhalierbaren Aerosols ist insbesondere als Rauchartikel geeignet, dessen Funktionsweise auf dem Erhitzen eines aerosolbildenden Materials während der Züge beruht. Eine Anzahl von vorzugsweise zylindrischen Substratportionen, die jeweils innerhalb einer Umhüllung aerosolbildendes Material enthalten, befindet sich in einer vorzugsweise linearen oder kreisförmigen Anordnung auf einem Träger. Ein derartiger Verbund von Substratportionen wird in einer speziellen Inhaliervorrichtung abgeraucht, wobei vorzugsweise bei jedem Zug eine neue Substratportion mittels chemischer oder elektrischer Energie erwärmt wird. Durch den Gebrauch des Rauchartikels wird die Bildung von Nebenstromrauch in den Zugpausen vermieden.

Eine durchschnittliche Filterzigarette liefert dem Raucher sechs bis zehn Züge mit etwa gleicher Geschmacksintensität. Das erfindungsgemäße Ziel, nämlich dem Raucher eine ähnliche Anzahl geschmacklich gleichwertiger Züge zu liefern, läßt sich mit den oben erläuterten vorbekannten Rauchartikeln kaum erreichen. Die Erfindung löst das Problem, indem anstelle eines für alle Züge verwendeten einzelnen aerosolbildenden Elements für jeden Zug eine neue Substratportion benutzt wird. Weniger bevorzugt, aber ebenfalls möglich ist auch die Nutzung jeweils einer Substratportion für zwei oder mehr Züge. Gegenüber den obenerwähnten vorbekannten Rauchartikeln besitzt das erfindungsgemäße System also die Vorteile eines über die Züge gleichbleibenden Rauchangebots sowie einer einfachen Konstruktion.

Im folgenden wird die Erfindung anhand von Ausführungsbeispielen näher erläutert. Die Zeichnungen zeigen in Fig. 1a eine perspektivische Ansicht einer Substratportion aus einem Verbund von Substratportionen gemäß der Erfindung,

Fig. 1b einen Längsschnitt durch die Substratportion gemäß Fig. 1a,

Fig. 1c einen Querschnitt durch die Substratportion gemäß Fig. 1a,

Fig. 2a eine perspektivische Ansicht eines Verbunds von Substratportionen gemäß der Erfindung, wobei die Substratportionen auf einem scheibenförmigen Träger angeordnet sind,

Fig. 2b eine perspektivische Ansicht einer anderen Ausführungsform eines Verbunds von Substratportionen gemäß der Erfindung, wobei die Substratportionen auf einem weitgehend starren linearen Träger angeordnet sind,

Fig. 2c eine perspektivische Ansicht einer weiteren Ausführungsform eines Verbunds von Substratportionen gemäß der Erfindung, wobei die Substratportionen auf einem band-

förmigen linearen Träger angeordnet sind,

Fig. 3a eine schematische Veranschaulichung für ein indirektes Heizprinzip für eine Substratportion,

Fig. 3b eine schematische Veranschaulichung für ein direktes Heizprinzip für eine Substratportion,

Fig. 4a eine Stirnansicht einer Inhaliervorrichtung gemäß der Erfindung mit einem auf einem scheibenförmigen Träger angeordneten Verbund von Substratportionen und einem eingesetzten Mundstück,

Fig. 4b einen schematischen Längsschnitt durch das System gemäß **Fig. 4a**,

Fig. 5a eine Stirnansicht einer anderen Ausführungsform einer Inhaliervorrichtung gemäß der Erfindung mit einem auf einem linearen Träger angeordneten Verbund von Substratportionen und einem eingesetzten Mundstück, und

Fig. 5b einen schematischen Längsschnitt durch das System gemäß **Fig. 5a**.

Eine bevorzugte Ausführungsform einer Substratportion **1** ist in den **Fig. 1a bis 1c** dargestellt. Die Substratportion **1** besitzt im Ausführungsbeispiel eine zylindrische Form, wie aus den **Fig. 1a bis 1c** ersichtlich. Sie enthält ein aerosolbildendes Material **2**, das mit einer radial (d. h. auf dem Zylindermantel) angeordneten Umhüllung **3** umgeben ist.

Das aerosolbildende Material **2** kann z. B. aus geschnittenem Blattabak, geschnittenen Tabakrippen, rekonstituiertem Tabak oder aus einem mit Aromasubstanzen behandelten Trägermaterial bestehen. Der Einsatz von Blatt- und Rippenschnitt kann auch in expandierter Form erfolgen, wie sie z. B. durch Anwendung des in den Patentschriften DE 29 03 300, DE 31 19 330 und DE 34 14 625 beschriebenen Verfahrens erhalten wird. Als Trägermaterialien für Aromastoffe können sowohl organische Materialien wie z. B. Papier, als auch anorganische wie z. B. Kieselgel zur Anwendung kommen. Auch beliebige Mischungen der genannten Komponenten sind einsetzbar.

In der bevorzugten Ausführungsform enthält das Material **2** einen Anteil von etwa 3% bis 30% eines verdampfbaren Polyols, z. B. Glycerin oder Propylenglykol, um die Aerosolbildung zu verstärken. Eine andere Möglichkeit, die Aerosolbildung zu verstärken, ist der Einsatz der aerosolbildenden Materialien mit einer Feuchte, die deutlich über der Gleichgewichtsfeuchte liegt. So kann z. B. Tabak, dessen Gleichgewichtsfeuchte bei ca. 10% bis 12% liegt, mit einer Feuchte von 20% verwendet werden. In diesem Fall ist durch eine geeignete Verpackung dafür zu sorgen, daß bis zum Gebrauch kein Feuchteverlust auftritt.

Die Umhüllung **3** kann aus Papier, Kunststoff- oder Metallfolie bestehen. Auch eine mehrlagige Umhüllung aus den genannten Komponenten ist verwendbar. Bevorzugt wird jedoch eine einlagige Umhüllung aus Papier oder metallkaschiertem Papier. In einer weiteren bevorzugten Ausführungsform besitzt die Umhüllung **3** eine definierte elektrische Leitfähigkeit. Dies kann z. B. durch Einsatz von Materialien wie kohlehaltigem oder metallbedampftem Papier bzw. einer Kunststoffolie, in die leitfähige Partikel eingearbeitet sind, erreicht werden.

Die Herstellung der Substratportionen **1** kann in einfacher Weise auf einer herkömmlichen Zigarettenstrangmaschine erfolgen: Zunächst wird in einem Formatteil ein Endlosstrang von Tabak oder Ersatzmaterial gebildet; dieser wird mit dem von einer Bobine in Herstellungsrichtung zugeführten Umhüllungsmaterial umgeben und an der Naht verleimt. Anschließend erfolgt Ablängen in den gewünschten Abmessungen. Eine weitere Möglichkeit der Herstellung ist das Extrudieren eines geeigneten aerosolbildenden Materials durch eine Runddüse mit anschließendem Umhüllen und Ablängen des Extrudats.

Vorzugsweise liegt der Durchmesser einer Substratpor-

tion **1** im Bereich von 3 mm bis 10 mm und die Länge im Bereich von 3 mm bis 30 mm. Besonders bevorzugt werden Durchmesser von 4 mm bis 7 mm und Längen von 5 mm bis 15 mm.

Erfindungsgemäß sind die erhaltenen Substratportionen **1** zu einem Verbund von Substratportionen zusammengefaßt. Soll z. B. ein Rauchartikel geschaffen werden, der dem Raucher acht Züge liefert, müssen bei Verwendung einer Substratportion pro Zug acht dieser Portionen miteinander verbunden werden, um eine der herkömmlichen Zigarette vergleichbare Handhabung zu erreichen. Ebenso möglich, jedoch weniger bevorzugt ist die Nutzung einer Substratportion für mehrere Züge.

Die Verbindung der Substratportionen **1** kann auf verschiedene Weise auf beliebigen Trägermaterialien (z. B. aus Karton oder Kunststoff) erfolgen. Bevorzugte Anordnungen sind in den **Fig. 2a, 2b und 2c** dargestellt. Bei der Anordnung gemäß **Fig. 2a** sind die Substratportionen **1** kreisförmig in den Aussparungen einer Trägerscheibe **5** angebracht. Eine ähnliche Anordnung auf einem linearen Träger **6** zeigt **Fig. 2b**. Durch Aufbringen der Substratportionen **1** auf einen bandförmigen Träger **7** erhält man die in **Fig. 2c** dargestellte Anordnung. Der bandförmige Träger **7** ist ebenfalls linear, kann aber flexibel sein. Die Substratportionen **1** können an dem jeweiligen Träger **5, 6 bzw. 7** z. B. durch Festkleben befestigt sein.

Zum Abrauchen eines solchen aus einem Verbund mehrerer Substratportionen bestehenden Rauchgegenstands wird eine Inhaliervorrichtung (im folgenden Rauchgerät genannt) benötigt, in der das Rauchaerosol aus den einzelnen Substratportionen freigesetzt wird. Hierbei können zwei Wirkungsprinzipien unterschieden werden:

1. Indirekt (**Fig. 3a**): Die Substratportion **1** wird während des Zuges von einem im Rauchgerät erhitzten Gas durchströmt. Dabei bildet dieses Gas zusammen mit Luft und dem freigesetzten Aerosol den von dem Benutzer inhalierten Rauch.
2. Direkt (**Fig. 3b**): Die Substratportion **1** wird erhitzt, während beim Zug kalte Umgebungsluft hindurchgesogen wird, die zusammen mit dem freigesetzten Aerosol den Rauch bildet.

Ein Ausführungsbeispiel eines Rauchgeräts mit indirekter Beheizung wird im folgenden anhand der **Fig. 4a** (Stirnansicht) und **4b** (Längsschnitt) beschrieben. Um die Übersichtlichkeit zu verbessern, sind die mechanischen Einrichtungen zum Weitertransport der Substratportionen nicht dargestellt.

In einem Gehäuse **20** ist eine Halterung für die auf einer kreisförmigen Trägerscheibe **5** angebrachten Substratportionen **1** dergestalt ausgeführt, daß die Trägerscheibe **5** um einen Bolzen **24** drehbar gelagert ist. Dieser Bolzen **24** kann entweder Bestandteil des Rauchgeräts oder des die Substratportionen **1** und die Trägerscheibe **5** aufweisenden Verbundes von Substratportionen sein. Durch die drehbare Lagerung können die Substratportionen **1** nacheinander mit Hilfe der nicht dargestellten Transporteinrichtung in eine Betriebsstellung (Abrauchposition) gebracht werden; die dort befindliche Substratportion ist mit **1a** bezeichnet.

Eine radialsymmetrische Aufnahmeeinrichtung **21** ist im Gehäuse **20** in axialer Richtung verschiebbar angeordnet. In Abrauchstellung wird die Aufnahmeeinrichtung **21** durch die Kraft einer Schraubenfeder **22** gegen die Substratportion **1a** und diese wiederum gegen eine Brennkammer **30** gedrückt. Mit Hilfe einer konischen Dichtfläche **23** wird so eine weitgehend gasdichte Abdichtung zwischen der Substratportion **1a** und der Aufnahmeeinrichtung **21** erreicht. Ein Weitertransport der Substratportionen **1** wird dagegen

durch Verschieben der Aufnahmeeinrichtung **21** gegen die Kraft der Schraubenfeder **22** ermöglicht.

Die Aufnahmeeinrichtung **21** ist zur Aufnahme eines Mundstücks **10** mit einer Bohrung versehen, deren Innendurchmesser in etwa dem Außendurchmesser des Mundstücks **10** entspricht.

Die Brennkammer **30** ist durch eine oder mehrere Bohrungen **31** mit der Außenseite des Rauchgerätes verbunden. Hierdurch kann Luft **32** in die Brennkammer **30** gelangen, um einerseits die Verbrennung, andererseits auch das Durchziehen von Luft durch die Substratportion **1a** zu ermöglichen. In der Brennkammer befinden sich ein Katalysatordraht oder -netz **33**, eine Gasdüse **34** sowie eine Zündelektrode **35**.

Weiterhin enthält das Gehäuse **20** einen von der Außenseite mit komprimierten, brennbaren Gasen nachfüllbaren Gastank **41**, der über ein Ventil **36** mit der Düse **34** verbunden ist, sowie eine Batterie und Steuerung **40**, über die auf elektrischem Wege das Ventil **36** und die Zündelektrode **35** betätigt werden.

Der Gebrauch des Rauchgerätes geht wie folgt vor sich: Zunächst wird der kreisförmige Verbund von Substratportionen **1** so in das Rauchgerät eingelegt, daß sich die erste Substratportion in der Abrauchposition **1a** befindet. Ein neues Mundstück **10** mit einem Filter wird in die Bohrung der Aufnahmeeinrichtung **21** eingesetzt. Nach Lösen einer Arretierung wird durch die Kraft der Schraubenfeder **22** eine dichte Verbindung zwischen der Aufnahmeeinrichtung **21**, dem Mundstück **10**, der Substratportion **1a** und der Brennkammer **30** hergestellt. Zur Entnahme eines Zuges wird ein Schalter betätigt, der die batteriebetriebene Steuerung **40** auslöst. Diese bewirkt ein zeitlich begrenztes Öffnen des Ventils **36**, so daß brennbares Gas aus dem Gastank **41** durch die Düse **34** in die Brennkammer **30** eintritt. Kurze Zeit später wird durch Anlegen einer Zündspannung an die Elektrode **35** ein Funken erzeugt, der dazu führt, daß sich das Gas unter Luftzutritt durch die Bohrung **31** am Katalysator **33** entzündet. Durch die Verbrennung entsteht ein heißes Gasgemisch, das zusammen mit durch die Bohrungen **31** eintretender Luft durch die Substratportion **1a** gezogen werden kann und dort das Rauchaerosol freisetzt. Nach Entnahme des Zuges wird die Gaszufuhr unterbrochen und mit Hilfe der Transporteinrichtung die nächste Substratportion **1** in Abrauchposition gebracht. Das Rauchgerät ist nun zur Entnahme des nächsten Zuges bereit. Nachdem alle Substratportionen abgeraucht sind, werden der Verbund von Substratportionen **1** und das Mundstück **10** entnommen und entsorgt.

Ein anderes Ausführungsbeispiel eines Rauchgerätes, diesmal mit direkter Beheizung, wird im folgenden anhand der Fig. 5a (Stirnan­sicht) und 5b (Längsschnitt) beschrieben. Um die Übersichtlichkeit zu verbessern, sind, die mechanischen Einrichtungen zum Weitertransport der Substratportionen nicht dargestellt.

In einem Gehäuse **50** ist eine Halterung für einen Verbund von Substratportionen, der auf einem linearen Träger **6** angebrachte Substratportionen **1** mit elektrisch leitfähiger Umhüllung **3'** aufweist, dergestalt ausgeführt, daß der Träger **6** in seiner Längsrichtung verschiebbar ist. Durch Verschieben können die Substratportionen **1** nacheinander mit Hilfe der nicht dargestellten Transporteinrichtung in die Betriebsstellung (Abrauchposition) gebracht werden, in der sich die mit **1b** bezeichnete Substratportion befindet.

Eine radialsymmetrische Aufnahmeeinrichtung **51** ist im Gehäuse **50** in axialer Richtung verschiebbar angeordnet. In Abrauchstellung wird die Aufnahmeeinrichtung **51** durch die Kraft einer Schraubenfeder **52** gegen die Substratportion **1b** und diese wiederum gegen einen Kontakt **54** gedrückt.

Mit Hilfe einer konischen Dichtfläche **53** wird so eine weitgehend gasdichte Abdichtung zwischen der Substratportion **1b** und der Aufnahmeeinrichtung **51** erreicht. Ein Weitertransport der Substratportionen **1** wird hingegen durch Verschieben der Aufnahmeeinrichtung **51** gegen die Federkraft ermöglicht.

Die Aufnahmeeinrichtung **51** ist zur Aufnahme eines Mundstücks **10** mit einer Bohrung versehen, deren Innendurchmesser in etwa dem Außendurchmesser des Mundstücks **10** entspricht.

Der ringförmige Kontakt **54** ist über ein Rohr **55** mit der Außenseite des Rauchgerätes verbunden. Hierdurch kann Luft **56** durch die Substratportion **1b** gezogen werden.

Weiterhin enthält das Gehäuse **50** eine Batterie bzw. einen nachladbaren Akkumulator **61** sowie eine Steuerungselektronik **60**, deren Ausgänge elektrisch mit der Aufnahmeeinrichtung **51** und dem Kontakt **54** verbunden sind.

Der Gebrauch dieses Rauchgerätes geht wie folgt vor sich: Zunächst wird der Verbund von Substratportionen **1** so in das Rauchgerät eingelegt, daß sich die erste Substratportion in der Abrauchposition **1b** befindet. Ein neues Filtermündstück **10** wird in die Bohrung der Aufnahmeeinrichtung **51** eingesetzt. Nach Lösen einer Arretierung wird durch die Kraft der Schraubenfeder **52** eine dichte und elektrisch leitende Verbindung zwischen der Aufnahmeeinrichtung **51**, der Substratportion **1b** und dem Kontakt **54** hergestellt. Zur Entnahme eines Zuges wird ein Schalter betätigt, der die Steuerung **60** auslöst. Diese bewirkt einen zeitlich begrenzten Stromfluß durch die als Heizwiderstand dienende leitfähige Umhüllung **3'** der Substratportion **1b**, der diese erwärmt oder erhitzt und das Rauchaerosol freisetzt. Durch das Rohr **55** eintretende Luft **56** kann nun durch die Substratportion **1b** und das Mundstück **10** gezogen werden. Nach Entnahme des Zuges wird die Stromzufuhr unterbrochen und mit Hilfe der Transporteinrichtung die nächste Substratportion **1** in Abrauchposition gebracht. Das Rauchgerät ist nun zur Entnahme des nächsten Zuges bereit. Nachdem alle Substratportionen abgeraucht sind, werden der Verbund der Substratportionen **1** und das Mundstück **10** entnommen und entsorgt.

Für die Konstruktion des Mundstückes **10** sind prinzipiell alle dem Fachmann aus der Cigarettenindustrie bekannten Prinzipien anwendbar. Im einfachsten Fall besteht das Mundstück aus einer hohlen Papier- oder Kartonrolle. Bevorzugt wird jedoch die Ausführung als Filtermündstück. In diesem Fall ist ein Filtermaterial wie Celluloseacetat, Polypropylen oder Papier mit einer ein- oder mehrlagigen Umhüllung versehen. Auch eine den bekannten Mehrfachfiltern entsprechende Konstruktion kann verwendet werden, bei der in axialer Richtung mehrere Segmente mit unterschiedlichen Eigenschaften hintereinander angeordnet und durch eine äußere Umhüllung verbunden sind. In diesem Fall können ein oder mehrere Segmente mit axialen Bohrungen versehen sein. Bei allen genannten Konstruktionen besteht weiterhin die Möglichkeit des Einsatzes einer zonenperforierten Umhüllung oder einer nachträglichen Perforation der Umhüllung z. B. mit Hilfe eines Laserstrahls. Hierdurch kann bei den Zügen der Rauch durch Hinzuströmen von Außenluft verdünnt werden.

Weitere Varianten des Systems bzw. seiner Komponenten ergeben sich unmittelbar aus den Ansprüchen.

Im folgenden sind weitere Beispiele für den Verbund von Substratportionen und seine Benutzung in dem System angegeben.

Beispiel 1

Eine American-Blend-Tabakmischung mit einem Gehalt

von

30% Burley-Tabak

40% expandiertem Virginia-Tabak

20% nicht expandiertem Virginia-Tabak und

10% Orient-Tabak

wurde konditioniert und mit 12 Gew.-% eines wäßrigen Casing mit einem Glyceringehalt von 80 Gew.-% besprüht. Anschließend wurde der Tabak mit 0,8 mm Schnittbreite geschnitten und auf eine Feuchte von 12% abgetrocknet. 180 kg dieses Schnittabaks wurden mit 20 kg expandiertem Rippenschnitt vermischt.

Aus dieser Mischung wurde auf einer Cigarettenstrangmaschine ein Endlosstrang mit einem Durchmesser von 6 mm und einer Stopfdichte von 200 mg/ml hergestellt. Als Umhüllungsmaterial kam ein auf der Außenseite aluminiumkaschirt, luftundurchlässiges Papier zum Einsatz. Der Endlosstrang wurde in Einzelportionen von 8 mm Länge geschnitten.

Jeweils acht dieser Einzelportionen wurden in den Aussparungen eines kreisförmigen Trägers aus Kartonmaterial verklebt. Man erhielt einen Verbund von Substratportionen, wie in **Fig. 2a** dargestellt.

Der so erhaltene Verbund von Substratportionen wurde in einem Rauchgerät gemäß **Fig. 4b** mit Mundstück in acht Zügen abgeraucht, ohne daß sichtbare Mengen Nebenstromrauch entstanden. Der Geschmack wurde von Probanden als gleichmäßig und dem herkömmlicher Cigaretten gleichwertig beurteilt.

Beispiel 2

Ein nach bekannten Verfahren hergestellter Papierfolientabak mit einem Gehalt an Propylenglykol von 12 Gew.-% wurde mit einer Schnittbreite von 0,8 mm geschnitten, wie in Beispiel 1 einer Cigarettenstrangmaschine zugeführt und in dieser mit einem Cigarettenpapier umhüllt, wobei das Cigarettenpapier eine Luftdurchlässigkeit von 5 CU aufwies. Durch Ablängen des Endlosstranges erhielt man Substratportionen mit gleichen Abmessungen wie im Beispiel 1; die Stopfdichte betrug 240 mg/ml. Die Substratportionen wurden wie im Beispiel 1 verbunden und abgeraucht. Eine Bildung von Nebenstromrauch konnte nicht festgestellt werden. Der Geschmack wurde von Probanden als über die Züge gleichmäßig und angenehm beurteilt.

Beispiel 3

Eine Mischung aus

72% Tabakstaub

15% Glycerin

10% Stärke und

3% Hydroxypropylcellulose

wurde auf einem handelsüblichen Doppelschnecken-Extruder durch eine Runddüse mit 4 mm Innendurchmesser extrudiert. Aufgrund des Quelleffekts erhielt man einen Endlosstrang mit 6 mm Außendurchmesser. Dieser Endlosstrang wurde mit einer dünnen Umhüllung aus kohlehaltigem Papier versehen und in Einzelportionen von 10 mm Länge zerteilt. Jede dieser Einzelportionen enthielt ca. 40 mg des extrudierten Tabakmaterials. Jeweils acht dieser Einzelportionen wurden in den Kerben eines linearen Trägers aus Kartonmaterial durch Verkleben angebracht. Man erhielt einen Verbund von Substratportionen, wie in **Fig. 2b** dargestellt.

Das Abrauchen erfolgte in einem Rauchgerät mit direkter, elektrischer Beheizung und Mundstück, wie in **Fig. 5b** dargestellt. Es konnte ebenfalls kein Nebenstromrauch beobachtet werden. Der Geschmack wurde als voll und cigaret-

tenähnlich beurteilt.

Patentansprüche

1. System zur Bereitstellung eines inhalierbaren Aerosols, mit

– einem Verbund von Substratportionen, der eine Anzahl von auf einem Träger (**5; 6; 7**) angeordneten Substratportionen (**1**) aufweist, wobei jede der Substratportionen (**1**) innerhalb einer Umhüllung (**3**), die eine Lufteintrittsöffnung und eine Aerosolaustrittsöffnung hat, aerosolbildendes Material (**2**) enthält,

– einer Inhaliovorrichtung, die ein Gehäuse (**20; 50**), eine Halterung (**23, 24; 53**) für den Verbund von Substratportionen (**1**) und eine Heizeinrichtung (**30, 33, 34, 35, 36, 40; 53, 54, 60**) aufweist und die dazu eingerichtet ist, daß jede Substratportion (**1**) des Verbunds von Substratportionen in eine Betriebsstellung (**1a; 1b**) bewegbar ist und in der Betriebsstellung (**1a; 1b**) zur Aerosolbildung erwärmt ist, und

– einem Mundstück (**10**), das in der Betriebsstellung einer Substratportion mit der Aerosolaustrittsöffnung dieser Substratportion (**1a; 1b**) in Verbindung steht.

2. System nach Anspruch 1, dadurch gekennzeichnet, daß die Substratportionen (**1**) des Verbunds von Substratportionen auf einem linearen Träger (**6; 7**) angeordnet sind.

3. System nach Anspruch 1, dadurch gekennzeichnet, daß die Substratportionen (**1**) des Verbunds von Substratportionen auf einem kreis- oder scheibenförmigen Träger (**5**) angeordnet sind.

4. System nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß der Verbund von Substratportionen sechs bis zwölf Substratportionen (**1**) enthält.

5. System nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die Substratportionen (**1**) in dem Verbund von Substratportionen jeweils eine zylindrische Form mit einer Länge von 3 mm bis 30 mm, vorzugsweise 5 mm bis 15 mm, und einem Durchmesser von 3 mm bis 10 mm, vorzugsweise von 4 mm bis 7 mm, haben, wobei die jeweilige Umhüllung (**3**) als Zylindermantel angeordnet ist und die Stirnseiten des Zylinders als Lufteintrittsöffnung und als Aerosolaustrittsöffnung eingerichtet sind.

6. System nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß das aerosolbildende Material (**2**) in dem Verbund von Substratportionen Schnittabak, geschnittene Tabakrippen, Folientabakschnitt und/oder ein extrudiertes Tabakmaterial aufweist.

7. System nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß das aerosolbildende Material (**2**) in dem Verbund von Substratportionen ein mit Aromastoffen beaufschlagtes Trägermaterial aufweist.

8. System nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß das aerosolbildende Material (**2**) in dem Verbund von Substratportionen ein verdampfbares Polyol, vorzugsweise Glycerin oder Propylenglykol, zu einem Anteil von 5 Gew.-% bis 50 Gew.-%, vorzugsweise von 10 Gew.-% bis 30 Gew.-%, enthält.

9. System nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß die Umhüllungen (**3**) der Substratportionen (**1**), in dem Verbund von Substratportionen ein weitgehend luftundurchlässiges Umhüllungsmaterial, vorzugsweise ein niedrigporöses Cigarettenpapier, aufweisen.

10. System nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß die Umhüllungen (3) der Substratportionen (1) in dem Verbund von Substratportionen ein Umhüllungsmaterial mit hoher Wärmeleitfähigkeit, vorzugsweise Metallfolie oder metallbeschichtetes Papier, aufweisen. 5

11. System nach einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, daß die Umhüllungen (3') der Substratportionen (1) in dem Verbund von Substratportionen elektrisch leitfähig sind. 10

12. System nach einem der Ansprüche 1 bis 11, dadurch gekennzeichnet, daß die Inhaliervorrichtung eine Transporteinrichtung zum Transport der Substratportionen (1) in die Betriebsstellung (1a; 1b) aufweist. 10

13. System nach einem der Ansprüche 1 bis 12, dadurch gekennzeichnet, daß die Heizeinrichtung (30, 33, 34, 35, 36, 40) der Inhaliervorrichtung dazu eingerichtet ist, die in der Betriebsstellung befindliche Substratportion (1a) mittels eines durch diese Substratportion zu ziehenden, erwärmten Luftstroms (32) zu erwärmen. 20

14. System nach einem der Ansprüche 1 bis 13, dadurch gekennzeichnet, daß die Heizeinrichtung (53, 54, 60) der Inhaliervorrichtung dazu eingerichtet ist, die in der Betriebsstellung befindliche Substratportion (1b) durch Wärmeübertragung auf die Umhüllung und/oder Erwärmung der Umhüllung (3') zu erwärmen. 25

15. System nach Anspruch 14, dadurch gekennzeichnet, daß die Heizeinrichtung der Inhaliervorrichtung dazu eingerichtet ist, die in der Betriebsstellung befindliche Substratportion durch Kontakt mit einem Heizelement zu erwärmen. 30

16. System nach einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß die Heizeinrichtung (53, 54, 60) der Inhaliervorrichtung eine elektrische Heizeinrichtung ist. 35

17. System nach Anspruch 16, dadurch gekennzeichnet, daß für die elektrische Heizeinrichtung (53, 54, 60) der Inhaliervorrichtung eine Batterie (61) oder ein Akkumulator (61) vorgesehen ist, die bzw. der in dem Gehäuse (50) der Inhaliervorrichtung oder in einem separaten Gehäuse untergebracht oder unterbringbar ist. 40

18. System nach Anspruch 16 oder 17 in Verbindung mit Anspruch 11, dadurch gekennzeichnet, daß die Heizeinrichtung (53, 54, 60) der Inhaliervorrichtung dazu eingerichtet ist, die in der Betriebsstellung befindliche Substratportion (1b) durch einen durch die leitfähige Umhüllung (3') dieser Substratportion fließenden Heizstrom zu erwärmen. 45

19. System nach einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß die Heizeinrichtung (30, 33, 34, 35, 36, 40) der Inhaliervorrichtung dazu eingerichtet ist, durch thermische oder katalytische Verbrennung Wärme zu erzeugen. 50

20. System nach Anspruch 19, dadurch gekennzeichnet, daß das Gehäuse (20) der Inhaliervorrichtung zur Aufnahme eines Brennstoffbehälters (41) für einen gasförmigen, flüssigen oder festen Brennstoff eingerichtet ist. 55

21. System nach Anspruch 19 oder 20, dadurch gekennzeichnet, daß als Brennstoff für die Heizeinrichtung (30, 33, 34, 35, 36, 40) der Inhaliervorrichtung ein Kohlenwasserstoff, vorzugsweise Propan oder Butan, vorgesehen ist. 60

22. System nach einem der Ansprüche 19 bis 21 in Verbindung mit Anspruch 13, dadurch gekennzeichnet, daß die Heizeinrichtung (30, 33, 34, 35, 36, 40) der Inhaliervorrichtung dazu eingerichtet ist, den Luftstrom 65

(32) durch Kontakt von einem brennbaren Gas/Luftgemisch mit einem Katalysator (33) zu erwärmen.

23. System nach einem der Ansprüche 1 bis 22, dadurch gekennzeichnet, daß das Mundstück (10) lösbar mit der Inhaliervorrichtung verbunden ist.

24. System nach einem der Ansprüche 1 bis 23, dadurch gekennzeichnet, daß das Mundstück (10) eine Länge von 10 mm bis 40 mm und einen Durchmesser von 6 mm bis 12 mm aufweist.

25. System nach einem der Ansprüche 1 bis 24, dadurch gekennzeichnet, daß das Mundstück (10) eine hohle Papier- oder Kartonhülle aufweist.

26. System nach einem der Ansprüche 1 bis 24, dadurch gekennzeichnet, daß das Mundstück (10) als Filtermundstück ausgebildet ist, wobei das Filtermaterial vorzugsweise Celluloseacetat, Papier, Myria und/oder Polypropylen mit einer ein- oder mehrlagigen Papierumhüllung aufweist.

27. System nach Anspruch 26, dadurch gekennzeichnet, daß das Mundstück (10) einen Filterstöpsel aus mehreren in axialer Richtung hintereinander angeordneten Teilelementen aufweist, von denen vorzugsweise eines oder mehrere axiale Bohrungen aufweisen.

28. System nach einem der Ansprüche 1 bis 27, dadurch gekennzeichnet, daß das Mundstück (10) eine oder mehrere Perforationszonen aufweist.

29. Inhaliervorrichtung mit einem Gehäuse (20; 50), mit einer Halterung (23, 24; 53) für einen Verbund von Substratportionen, der eine Anzahl von auf einem Träger (5; 6; 7) angeordneten Substratportionen (1) aufweist, wobei jede der Substratportionen (1) innerhalb einer Umhüllung (3), die eine Lufteintrittsöffnung und eine Aerosolaustrittsöffnung hat, aerosolbildendes Material (2) enthält, und mit einer Heizeinrichtung (30, 33, 34, 35, 36, 40; 53, 54, 60), wobei die Inhaliervorrichtung dazu eingerichtet ist, daß jede Substratportion (1) des Verbunds von Substratportionen in eine Betriebsstellung (1a; 1b) bewegbar ist und in der Betriebsstellung (1a; 1b) zur Aerosolbildung erwärmbar ist.

30. Inhaliervorrichtung nach Anspruch 29, gekennzeichnet durch Merkmale der Inhaliervorrichtung aus einem der Ansprüche 12 bis 22.

31. Verbund von Substratportionen, der zur Verwendung mit einer Inhaliervorrichtung nach Anspruch 29 oder 30 eingerichtet ist und der eine Anzahl von auf einem Träger (5; 6; 7) angeordneten Substratportionen (1) aufweist, wobei jede der Substratportionen (1) innerhalb einer Umhüllung (3), die eine Lufteintrittsöffnung und eine Aerosolaustrittsöffnung hat, aerosolbildendes Material (2) enthält.

32. Verbund von Substratportionen nach Anspruch 31, gekennzeichnet durch Merkmale des Verbunds von Substratportionen aus einem der Ansprüche 2 bis 11.

33. Mundstück, das zur Verwendung mit einer Inhaliervorrichtung nach Anspruch 29 oder 30 eingerichtet ist, wobei das Mundstück (10) in der Betriebsstellung einer Substratportion mit der Aerosolaustrittsöffnung dieser Substratportion (1a; 1b) in Verbindung steht, und das lösbar mit der Inhaliervorrichtung verbindbar ist.

34. Mundstück nach Anspruch 33, gekennzeichnet durch Merkmale des Mundstücks aus einem der Ansprüche 24 bis 28.

Hierzu 5 Seite(n) Zeichnungen

- Leerseite -

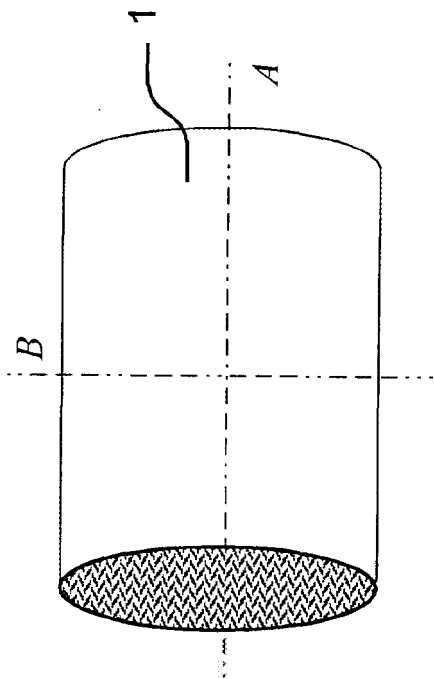


Fig. 1a

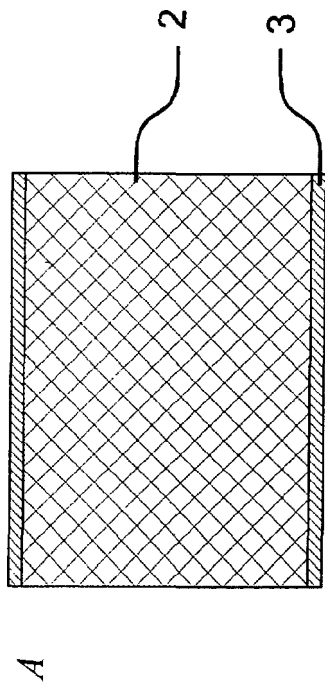


Fig. 1b

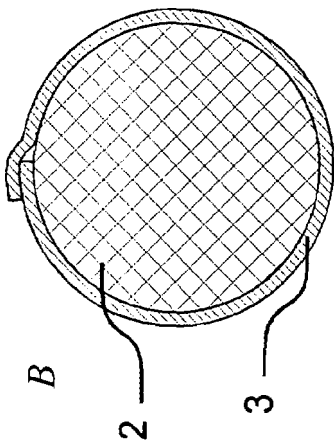


Fig. 1c

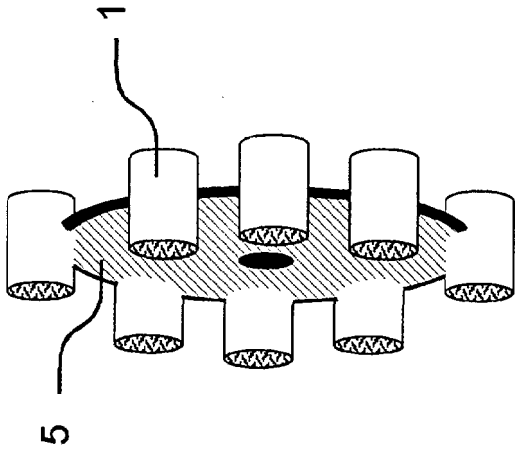


Fig. 2a

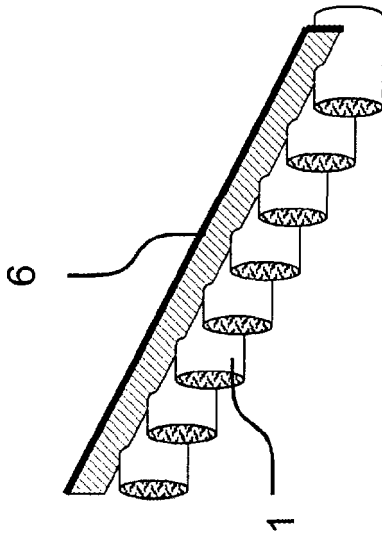


Fig. 2b

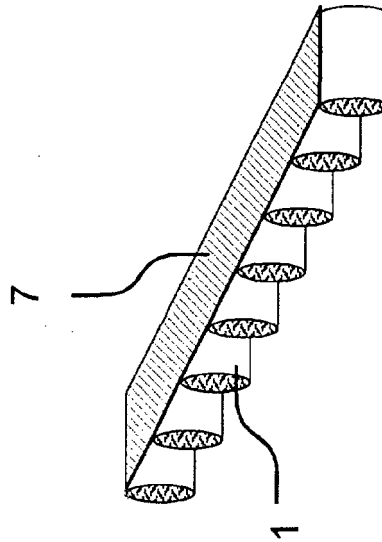


Fig. 2c

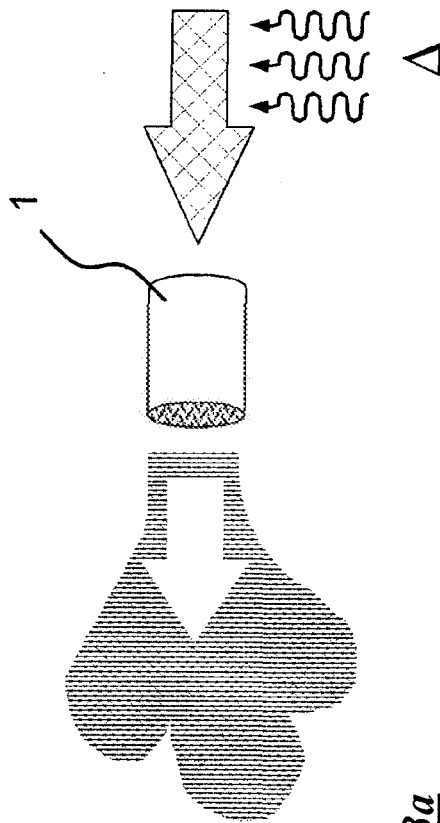


Fig. 3a

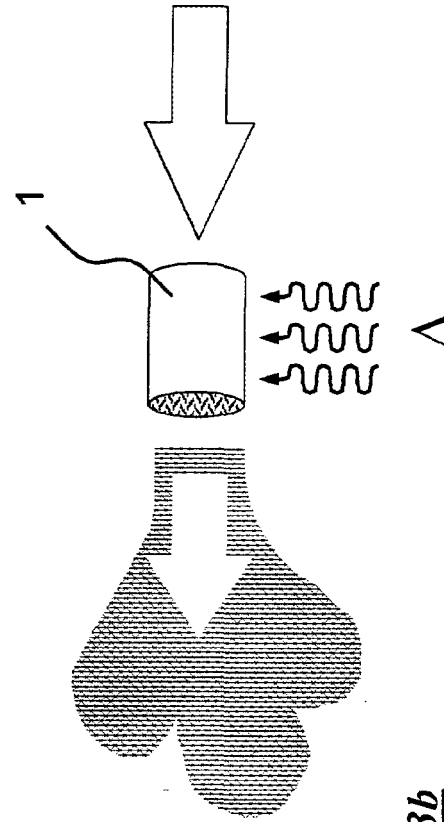


Fig. 3b

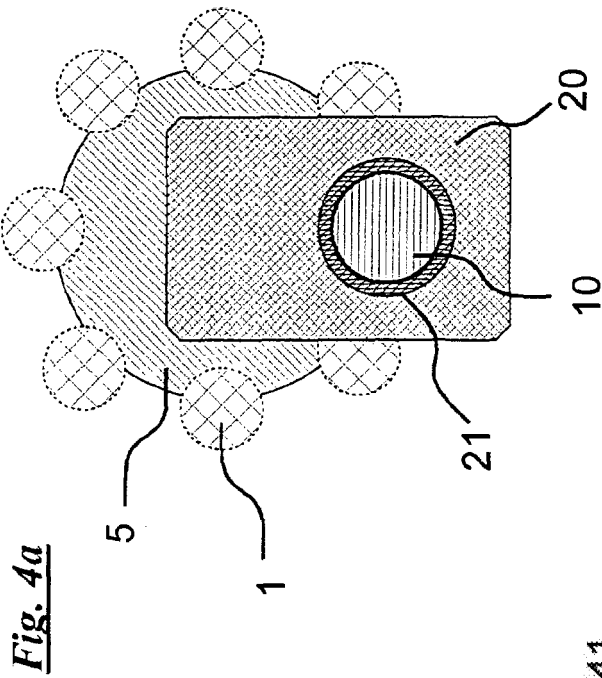
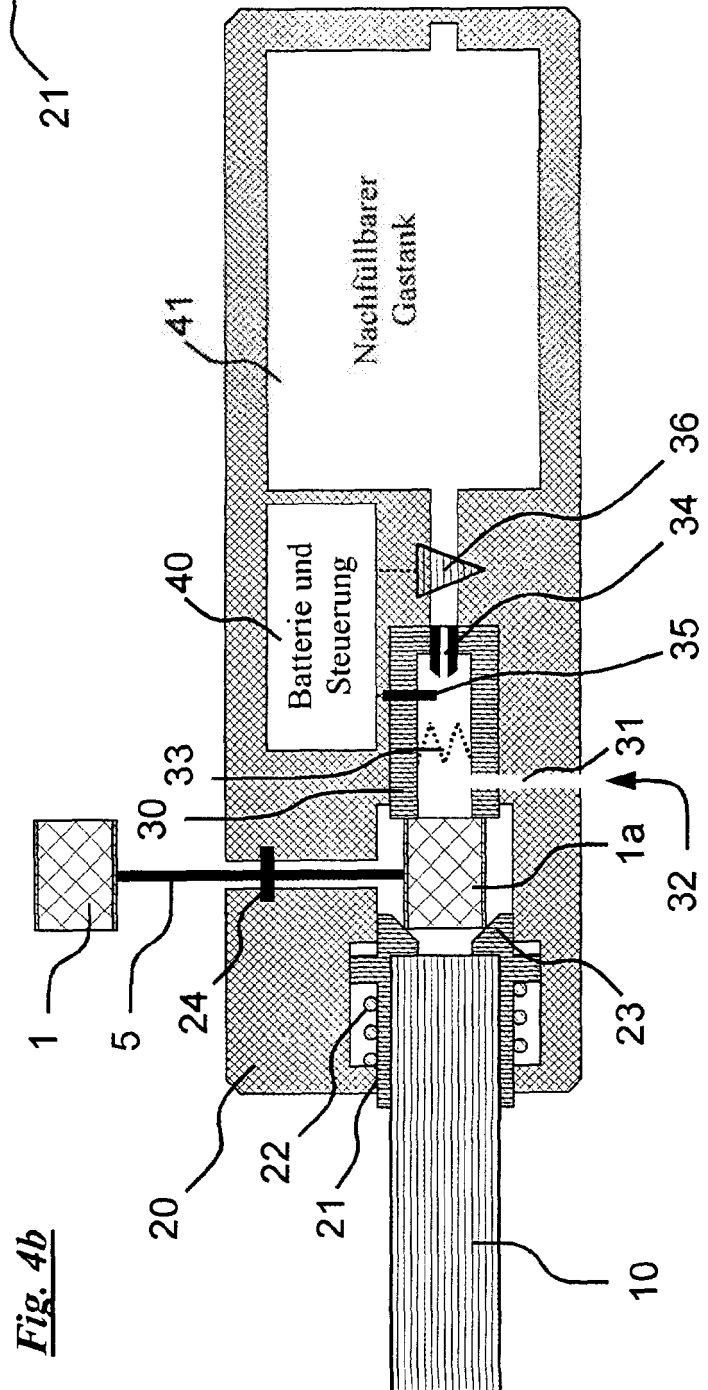


Fig. 5a

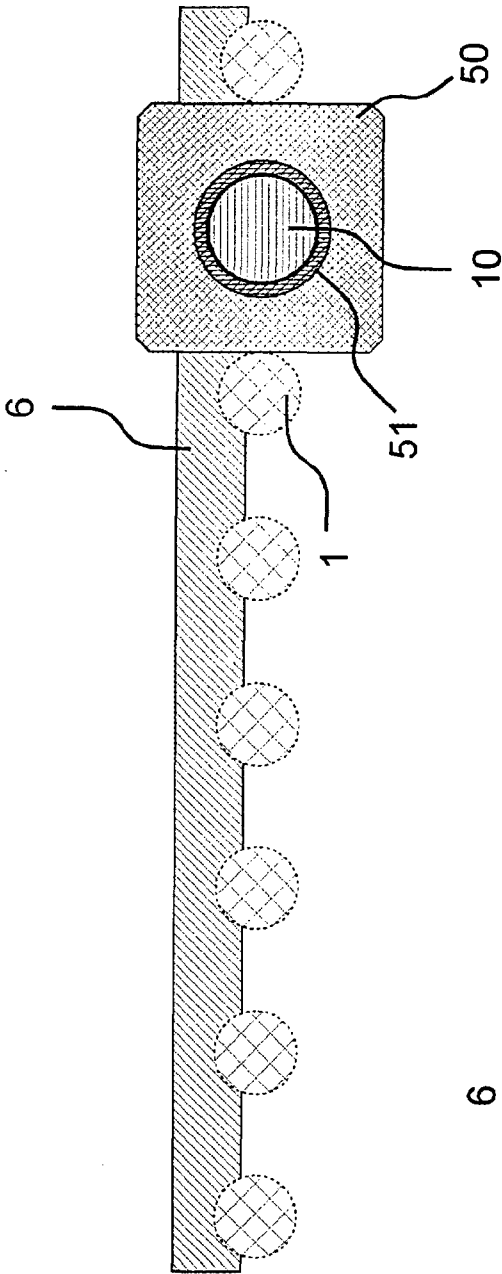
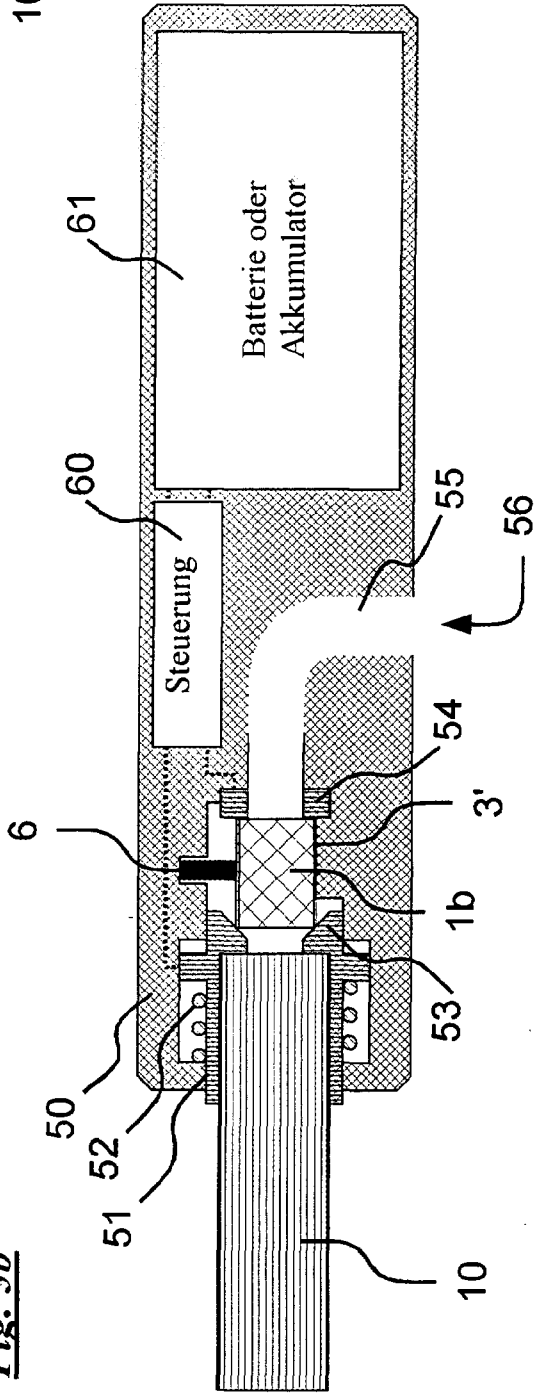


Fig. 5b



Patent/Publication: DE19854012A1

Bibliography

DWPI Title

Smoking system, includes substrates containing tobacco and material forming aerosol when heated in holder

Original Title

System zur Bereitstellung eines inhalierbaren Aerosols

Assignee/Applicant

Standardized: REEMTSMA H F & PH

Original: H.F. & Ph.F. Reemtsma GmbH, 22605 Hamburg, DE

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DE19854012A / 1998-11-12

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Abstract

Abstract

A system for supplying an inhalable aerosol has a composite of substrate portions and an inhaling device. The composite of substrate portions has a number of substrate portions (1) located on a support (5), each of the substrate portions (1) containing an aerosol-forming material inside a casing which has an air inlet and an aerosol outlet. The inhaling device has a housing (20), a holder (24, 23) for the composite of substrate portions, and a heating device (30, 33, 34, 35, 36, 40), and is configured to ensure that each substrate portion in the composite of substrate portions can be moved into an operating position (1a) and can be heated in said operating position (1a) in order to form an aerosol. When a substrate portion is in the operating position (1a), a mouthpiece (10) is connected to the aerosol outlet of this substrate portion (1a).

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CLAIMS DE19854012

1.

1. A system for providing an inhalable aerosol, with
1. a composite of substrate portions, the a number vonauf a carrier (5; 6; 7) arranged substrate portions (1), wherein each of the substrate portions (1) within an envelope (3) an air inlet opening and a aerosol exit opening, aerosol forming material (2) which the second an inhaler including a housing (20; 50), a holder (23,24; 53) for the composite vonSubstratportionen (1) and a heating device (30,33,34,35,36,40; 53,54,60) comprises and which is adapted thateach substrate portion (1) of the interconnection of Substratportionenin an operating position (1a; 1b) is movable and in rough operating position (1a; 1b) can be heated for aerosol formation, and
3. a mouthpiece (10) in the operating position of a substrate portion with the aerosol outlet opening of this substrate portion (1a; 1b) is connected.

2.

2. System according to claim 1, characterized in that dieSubstratportionen (1) the interconnection of Substratportionenauf a linear carrier (6; 7) are arranged.

3.

3. System according to claim 1, characterized in that dieSubstratportionen (1) the interconnection of Substratportionenauf a circular or disc-shaped carrier (5) are arranged.

4.

4. System according to one of claims 1 to 3, characterized in that the composite substrate of six portions biszwölf substrate portions (1).

5.

5. System according to any one of claims 1 to 4, characterized in that the substrate portions (1) in the composite respectively vonSubstratportionen a cylindrical shape with a length of 3 mm to 30 mm, preferably 5 mm to 15 mm, anda diameter of 3 mm to 10 mm, preferably from 4 mmbis 7 mm, have, with the respective wrapper (3) alsZylindermantel is arranged and the end faces desZylinders are arranged as an air inlet opening and alsAerosolaustrittsöffnung.

6.

6. System according to one of claims 1 to 5, characterized in that the aerosol forming material (2) in demVerbund of substrate portions cut tobacco, cut tobacco ribs, foil cut tobacco and / or having a extrudiertesTabakmaterial.

7.

7. System according to one of claims 1 to 6, characterized in that the aerosol forming material (2) in demVerbund of substrate portions having a Aromasubstanzenbeaufschlagtes with carrier material.

8.

8. System according to one of claims 1 to 7, characterized in that the aerosol forming material (2) in demVerbund of substrate portions of a vaporizable polyol, preferably glycerol or propylene glycol, in an amount of 5 wt.-% to 50 wt.-%, preferably from 10 wt.-% to 30 wt.-% acid.

9.

9. System according to one of claims 1 to 8, characterized in that the sheaths (3) of the substrate portions (1), in the composite of substrate portions weitgehend luftundurchlässiges a wrapping material, preferably ein niedrigporöses cigarette paper have.

10.

10. System according to one of claims 1 to 9, characterized in that the sheaths (3) of the substrate portions (1) in the composite of substrate portions Umhüllungsmaterial mit a high thermal conductivity, preferably a metal foil or metal-coated paper have.

11.

11. System according to any one of claims 1 to 10, characterized in that the casings (3') of the substrate portions (1) are elektrisch leitfähig in the composite of substrate portions.

12.

12. System according to any one of claims 1 to 11, characterized in that the inhaler device, a transport device for transporting the substrate portions (1) in thieves operating position (1a; 1b).

13.

13. System according to one of claims 1 to 12, characterized in that the heating device (30, 33, 34, 35, 36, 40) of the inhaler device is adapted to be drawn from the substrate portion located in rough operating position (1a) middle of a substrate through this portion, erwärmten Luftstroms to

heat (32).

14.

14. System according to one of claims 1 to 13, characterized in that the heating device (53,54,60) derInhaliervorrichtung is adapted to the substrate portion located in rough operating position (1b) by heat transfer to the casing and / or heating the enclosure (3 ') to heat.

15.

15. System according to claim 14, characterized in that the inhaler dieHeizeinrichtung eingerichtetist to the befindlicheSubstratportion in the operating position to heat by contact with a heating element.

16.

16. System according to one of claims 1 to 15, characterized in that the heating device (53,54,60) derInhaliervorrichtung is an electric heater.

17.

17. The system of claim 16, characterized in that forthe electric heating means (53,54,60) derInhaliervorrichtung is provided a battery (61) or an accumulator (61) or in the housing (50) or in a derInhaliervorrichtung separate housing Housed or can be accommodated.

18.

18. System according to claim 16 or 17 in conjunction with Anspruch11, characterized in that the heating device (53,54,60) of the inhaler device is adapted to the operating position located Dia substrate portion (1b) by a conductive by the wrapping (3 ') to heat this substrate portion flowing heating.

19.

19. The system according to one of claims 1 to 15, characterized in that the heating device (30,33,34,35,36,40) of the inhaler device is adapted by thermal or catalytic combustion to generate heat.

20.

20. System according to claim 19, characterized in that dasGehäuse (20) of the inhaler device is adapted to receive a fuel container (41) for a gaseous, liquid or solid fuel.

21.

21. The system of claim 19 or 20, characterized in that is provided as a fuel for the heating device (30,33,34,35,36,40) of the inhaler device is a hydrocarbon, preferably propane or butane.

22.

22. The system according to any one of claims 19 to 21 in connection mitAnspruch 13, characterized in that dieHeizeinrichtung (30,33,34,35,36,40) is adapted to the inhaler device, the air flow (32) by contact of a combustible gas / air mixture heating with a catalyst (33).

23.

23. System according to one of claims 1 to 22, characterized in that the mouthpiece (10) is detachably connected to derInhaliervorrichtung.

24.

24. System according to one of claims 1 to 23, characterized in that the mouthpiece (10) has a length of 10 mm bis 40 mm and a diameter of 6 mm to 12 mm.

25.

25. The system according to any one of claims 1 to 24, characterized in that the mouthpiece (10) has a hollow paper or paperboard core.

26.

26. The system according to any one of claims 1 to 24, characterized in that the mouthpiece (10) is provided as a filter mouthpiece formed, the filter material vorzugsweise Celluloseacetat, paper, Myria and / or polypropylene having einerein- or multi-ply paper wrapper.

27.

27. The system of claim 26, characterized in that das Mundstück (10) have a filter plugs from a plurality of in axialer Richtung successively arranged Teilelementenaufweist, of which preferably one or more axiale Bohrungen.

28.

28. The system according to any one of claims 1 to 27, characterized in that the mouthpiece (10) has one or mehrere Perforationszonen.

29.

29. Inhalation device comprising a housing (20; 50), with a holder (23, 24; 53) von Substratportionen for a composite of a number of on a carrier (5; 6; 7) arranged substrate portions (1), wherein each der Substratportionen furnishings, wherein the inhaler to; (1) includes

within an enclosure (3), comprising a air inlet opening and an Aerosolaustrittsöffnung, aerosol forming material (2), and with einer Heizeinrichtung (53, 54, 60, 30, 33, 34, 35, 36, 40) is that each substrate portion (1) of the composite of substrate portions into a operating position (1a; 1b) is movable and in rough operating position (1a; 1b) can be heated to aerosol formation.

30.

30. An inhaling device according to claim 29, characterized by the features of the inhaler device of any one of claims 12 bis 22nd

31.

having arranged substrate portions (1), each der Substratportionen (1) within an envelope (3) 31. composite of substrate portions, the eingerichtet ist for use with einer Inhalier Vorrichtung according to claim 29 or 30 and a number of on a support (7, 5, 6;) contains), comprising a air inlet opening and a Aerosolaustrittsöffnung, aerosol forming material (2).

32.

32. composite of substrate portions according to claim 31, characterized by features of the composite of any one of claims 2 to Substratportionen aus eleventh

33.

33. mouthpiece, which is adapted for use with a Inhalier Vorrichtung nach claim 29 or 30, wherein das Mundstück (10) in the operating position of a Substratportion mit the aerosol outlet opening of this portion of substrate (1a; 1b) is connected, and which is detachably connectable to der Inhalier Vorrichtung.

34. A nozzle as claimed in claim 33, characterized by Merkmale des mouthpiece of any one of claims 24 to 28th

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DESCRIPTION DE19854012

The invention relates to a system for providing an inhalable aerosol, as well as the components of such a system. This system is particularly suited as a smoking article to provide smoke aerosol for smokers.

When fuming conventional cigarettes, most of the tobacco is not burned during puffs, but in the train pauses. This leads to the formation of the so-called sidestream smoke, which is often perceived by non-smokers as harassing.

To overcome this problem are numerous new smoking article in which no tobacco is burned during the train pauses, been proposed. A common principle of such developments is that not the heat of combustion of tobacco, but other sources of energy to release the smoke aerosol be used. In this way, the generation of sidestream smoke is not only largely avoided, but with a modified temperature control during the trains may also be a preferred release of flavor substances is achieved and the formation of irritating or undesirable by-products be reduced. Frequently used in the proposed smoking articles for aerosol formation instead of tobacco substitute materials such as special foil tobaccos or charged with aroma substances support materials for use.

Thus, a cigarettenförmiger smoking articles is known, in which the heat energy of a smoldering coal member is transferred to a disposed in the interior of the cigarette aluminum capsule containing an aerosol forming material.

In a modification of this smoking article is used as aerosol forming material, a special, high amounts of glycerin impinged sheet tobacco used.

Two above-mentioned smoking articles is common that the combustion gases of the heating element be inhaled with the smoke aerosol, resulting in an increased uptake of carbon monoxide by the smoker. Furthermore, the entire smoking article, in contrast to conventional cigarettes retains its length has to be disposed of after fuming. This leads to an increased production of complex composition residues and related disposal problems. Another disadvantage of the foregoing smoking articles are taste deficiencies in the first and last legs. These result from the fact that when the first trains no sufficient heating of the aerosol former is performed while the aerosol forming material or the heat source are already largely used up at the point of death.

The latter disadvantages can be avoided that in each train a new portion of the aerosol forming material is heated. In one working according to this principle previously known smoking articles a cigarettenförmiger object with filter and tobacco element is placed at the tobacco end in an electronically controlled Abrauchgerät. This heating of the tobacco-containing portion is made at the trains radially successive locations by electric heating elements. This principle requires a complex construction of Abrauchgeräts which must be equipped with several heating elements and a complicated electronic control. Further, the temperature control is critical since a to be consumed or even burning the whole tobacco portion must be prevented securely between the trains.

In another prior art arrangement used on a belt arranged substrate portions for aerosol formation. The substrate portions are brought train for train in contact with an electric heating element. This construction permits only small amounts of substrate, and the use of tobacco as aerosol former is not possible. Furthermore, the winding required for the tape is bulky and requires a complicated feed mechanism.

Object of the present invention is to provide a system for providing an inhalable aerosol which has a simple basic construction and in particular may serve as a smoking article which has a similar taste sensation like conventional cigarettes, in its use, however, between the trains no sidestream smoke is produced.

This object is achieved by a system having the features of claim 1, which has an inhalation with

the features of claim 29 and a composite of substrate portions with the features of claim 31 as well as one of claim 33 is preferably releasable mouthpiece. Advantageous embodiments of the invention result from the dependent claims.

The inventive system for provision of an inhalable aerosol is particularly useful as a smoking article, the operation of which is based on the heating of an aerosol forming material during puffs. A number of preferably cylindrical substrate portions containing aerosol forming material respectively within an enclosure, is located in a preferably linear or circular array on a carrier. Such a composite of substrate portions is smoked in a special inhaler, preferably in each train a new portion of substrate is heated by means of chemical or electrical energy. Through the use of the smoking article the formation of side-stream smoke in the train pauses is avoided.

An average filter cigarette provides the smoker with six to ten trains with approximately the same flavor intensity. The aim of the present invention, namely to provide a similar number taste equivalent trains the smoker, can be achieved with the above-mentioned prior art smoking articles hardly. The invention solves the problem by a new portion of substrate is used instead of used for all trains individual aerosol forming element for each train. Less preferred but also possible to use in each case a substrate serving for two or more trains. Compared to the above-mentioned prior art smoking articles, the system according to the invention thus has the advantages of on the trains constant smoke and offer a simple construction.

In the following the invention will be explained in more detail with reference to embodiments. The drawings show in

Fig. 1a is a perspective view of a substrate portion of a composite of substrate portions according to the invention,

Fig. 1b shows a longitudinal section through the substrate portion of FIG. 1a,

Fig. 1c shows a cross section through the substrate portion of FIG. 1a,

FIG. 2a is a perspective view of an interconnection of substrate portions according to the invention, the substrate portions are arranged on a disc-shaped carrier,

Fig. 2b is a perspective view of another embodiment of a composite of substrate portions according to the invention, wherein the substrate portions are arranged on a substantially rigid linear support,

Fig. 2c is a perspective view of another embodiment of an interconnection of substrate portions according to the invention, the substrate portions are arranged on a band-shaped linear support,

FIG. 3a shows a schematic illustration for an indirect heating principle for a substrate portion,

FIG. 3b is a schematic illustration for a direct heating principle for a substrate portion,

FIG. 4a is a front view of an inhaler according to the invention with a arranged on a disc-shaped carrier composite of substrate portions and a mouthpiece used,

Fig. 4b shows a schematic longitudinal section through the system according to Fig. 4a,

FIG. 5a is an end view of another embodiment of an inhaler according to the invention with a arranged in a linear carrier stock of substrate portions and a mouthpiece used, and

Fig. 5b shows a schematic longitudinal section through the system according to Fig. 5a.

A preferred embodiment of a portion of substrate 1 is shown in FIGS. 1A to 1C. The substrate portion 1 has in the embodiment example a cylindrical shape, as shown in FIGS. 1A to 1C visible. It includes an aerosol forming material 2, which is surrounded by a radial (d. H. On the cylinder jacket) arranged enclosure 3.

The aerosol forming material 2 can for. B. of cut leaf tobacco, cut tobacco stems, reconstituted tobacco or of a treated with flavoring substances support material. The use of leaf-and-fin section may also take place in expanded form as such. B. the obtained 29 03 300 DE 31 19 330 and DE 34 14 625 method described in the patents DE by application. Suitable support materials for flavorings can be both organic materials such. As paper, and inorganic such. B. silica apply. Any

mixtures of the above components can be used.

In the preferred embodiment, the material 2 contains a proportion of about 3% to 30% of a volatile polyol, eg. As glycerol or propylene glycol, to enhance the formation of aerosol. Another way to enhance the formation of aerosol, is the use of the aerosol forming materials having a moisture content that is significantly higher than the equilibrium moisture content. Thus, for. As tobacco, the equilibrium moisture content is up to 12% at about 10%, are used having a moisture of 20%. In this case, should be provided by a suitable packaging for the fact that until use no moisture loss.

The casing 3 may be made of paper, plastic or metal foil. Also a multi-layered sheath of the components mentioned is used. Preferably, however, a single-layer wrapper paper or metallkaschiertem paper. In a further preferred embodiment, the casing 3 has a defined electrical conductivity. This can, for. B. are incorporated by the use of materials such as carbonaceous or metallised paper or a plastic film in which conductive particles, can be achieved.

The preparation of the substrate portions 1 can be effected in a simple manner to a conventional Cigarettenstrangmaschine: First, in a format part a continuous strand of tobacco or substitute material is formed; this is surrounded by the fed from a reel in preparation towards wrapping material and glued at the seam. Subsequently, cutting into the desired dimensions. Another way of manufacturing is the extrusion of a suitable aerosol forming material through a round die, followed by wrapping and cutting the extrudate.

Preferably, the diameter of a portion of substrate 1 is in the range of 3 mm to 10 mm and the length ranges from 3 mm to 30 mm. Particular preference is given diameter of 4 mm to 7 mm and lengths from 5 mm to 15 mm.

According to the invention, the obtained substrate portions 1 are combined to form a composite of substrate portions. Should such. B. a smoking article to be created of the smoker returns eight trains, must be connected together using a substrate serving per train eight of these portions to achieve the conventional Cigarette similar handling. Also possible, but less preferred is the use of a substrate serving for several trains.

The connection of the substrate portions 1 can in various ways on any support materials (eg. B. from cardboard or plastic) carried out. Preferred arrangements are shown in FIGS. 2a, 2b and 2c. In the arrangement of Fig. 2a, the substrate portions 1 are circular mounted in the recesses of a

carrier plate 5. A similar arrangement on a linear support 6 shown in FIG. 2b. By applying the substrate portions 1 on a tape-shaped support 7 is obtained, the arrangement shown in Fig. 2c. The band-shaped carrier 7 is also linear, but may be flexible. The substrate 1 may be portions of the respective support 5, 6 or 7 z. For example, be fixed by sticking.

Fuming of such a composite consisting of a plurality of substrate portions of the smoking article is an inhaler device (hereinafter referred to as smoking device) is required in the smoke aerosol is released from the individual substrate portions. Here, two principles of action can be distinguished:

1. Indirect (Fig. 3a): The portion of substrate 1 is passed through during migration from a heated in the flue gas unit. Here this gas, together with air and the released aerosol inhaled by the user to smoke.
- 2 Direct (Fig. 3b): The portion of substrate 1 is heated while the train cold ambient air is sucked through, forming the smoke along with the released aerosol.

One embodiment of a smoking device with indirect heating will be described below with reference to Fig. 4A (front view) and 4b (longitudinal section). To improve clarity, the mechanical means are not shown, for further transport of the substrate portions.

In a housing 20 a support for the mounted on a circular carrier disc 5 substrate portions 1 is performed such that the carrier plate 5 is supported rotatably about a pin 24th This pin 24 may be either part of the smoking device or the substrate portions 1 and the carrier disc 5 having composite of substrate portions. Due to the rotatable mounting of the substrate portions can be brought one after the other one with the aid of the transport means not shown in an operating position (Abrauchposition); the substrate portion located there is designated by 1 a.

A radially symmetrical receiving device 21 is slidably disposed in the axial direction in the housing 20th In Abbruchstellung the receiving device 21 is determined by the force of a coil spring 22 against the substrate portion 1a, which in turn is pressed against a combustor 30th By means of a conical sealing surface 23 is a substantially gas-tight seal between the substrate portion 1 a and the receiving device 21 is achieved. A further transport of the substrate portions 1 on the other hand enables by displacement of the receiving device 21 against the force of the coil spring 22nd

The receiving device 21 is provided to receive a mouthpiece 10 having a bore whose inner diameter corresponds approximately to the outer diameter of the mouthpiece 10th

The combustion chamber 30 is connected through one or more holes 31 with the outside of the

smoking device. This allows air 32 to enter the combustion chamber 30 to allow on the one hand the combustion, on the other hand the pulling through of air through the portion of substrate 1 a. In the combustion chamber there is a catalyst wire or mesh 33, a gas nozzle 34 and an ignition electrode 35th

Furthermore, the housing 20 includes a refillable from the outside with compressed combustible gases gas tank 41 which is connected via a valve 36 to the nozzle 34, and a battery, and controller 40, via the actuated by electrical means, the valve 36 and the ignition electrode 35 will.

The use of the smoke machine proceeds as follows here: First, the circular composite of substrate portions 1 is inserted into the smoking device that the first substrate portion is in the Abrauchposition 1a. A new mouthpiece 10 with a filter is inserted into the bore of the receiving device 21st After releasing a locking of a tight connection between the receiving device 21, the mouthpiece 10, the substrate portion 1 a and the combustion chamber 30 is produced by the force of the coil spring 22nd For removal of a train, a switch is actuated, the trigger 40, the battery-operated control. This causes a temporary opening of the valve 36 so that the combustible gas from the gas tank 41 enters through the nozzle 34 into the combustion chamber 30th Shortly afterwards, a spark is generated by applying a starting voltage to the electrode 35, which causes the gas ignited with access of air through the bore 31 at the catalyst 33rd

The combustion produces a hot gas mixture which can be dragged along with entering through the air holes 31 through the substrate portion 1 a and there releases the smoke aerosol. After removal of the train, the gas supply is interrupted and brought by means of the transport device, the next portion of substrate 1 in Abrauchposition. The smoke machine is now ready for taking the next train. After all substrate portions are smoked, the composite of substrate portions 1 and the mouthpiece 10 are removed and disposed of.

Another embodiment of a smoking device, this time with direct heating, is described below with reference to FIG. 5 (front view) and 5b (longitudinal section). In order to improve the clarity, are the mechanical means not shown, for further transport of the substrate portions.

In a housing 50 a mounting for a composite of substrate portions, the mounted on a linear support portions 6 substrate 1 with an electrically conductive sheath is 3 'which performed such that the carrier 6 is displaceable in its longitudinal direction. By moving the substrate portions can be brought 1 sequentially using the transport device not shown in the operating position (Abrauchposition), in which the 1 b designated portion of substrate is.

A radially symmetrical recording device 51 is slidably disposed in the axial direction in the housing 50th In Abrauchstellung the receiving device 51 is determined by the force of a coil spring 52 against the substrate portion 1 b, which in turn is pressed against a contact 54th By means of a conical sealing surface 53 is a substantially gas-tight seal between the substrate portion 1 b and the receiving device 51 is achieved. A further transport of the substrate portions 1 is however possible by shifting the recording device 51 against the spring force.

The receiving device 51 is provided to receive a mouthpiece 10 having a bore whose inner diameter corresponds approximately to the outer diameter of the mouthpiece 10th

The annular contact 54 is connected via a pipe 55 to the outside of the smoking device. This allows air to be drawn through the substrate 56 Portion 1 b.

Furthermore, the housing 50 contains a battery or a rechargeable accumulator 61 as well as control electronics 60, whose outputs are electrically connected to the receiving device 51 and the contact 54th

The use of this smoke machine proceeds as follows here: First, the composite of substrate portions 1 is inserted into the smoking device that the first substrate portion is in the Abrauchposition 1b. A new filter mouthpiece 10 is inserted into the bore of the receiving device 51st After releasing a locking of a tight and electrically conductive connection between the receiving device 51, the substrate portion 1 b and the contact 54 is produced by the force of the coil spring 52nd For removal of a train, a switch is actuated which triggers the control 60th This causes a temporary flow of current through the heating element serving as conductive sheath 3 'of the substrate portion 1 b, which heats them or heated and the smoke aerosol releases. Through the pipe 55 entering air 56 can now be drawn 10 through the substrate portion 1 b and the mouthpiece. After removal of the train the power is turned off and brought by means of the transport device, the next portion of substrate 1 in Abrauchposition.

The smoke machine is now ready for taking the next train. After all substrate portions are smoked, the composite of the substrate portions 1 and the mouthpiece 10 are removed and disposed of.

For the construction of the mouthpiece 10 all the expert from the cigarette industry known

principles are applicable in principle. In the simplest case the mouthpiece comprises a hollow paper or board roll. Preferably, however, the embodiment as a filter mouthpiece. In this case, a filter material such as cellulose acetate, polypropylene or paper is provided with a single- or multilayer coating. Also, the known multiple filters corresponding construction can be used, in which a plurality of segments arranged one behind the other in axial direction with different properties and joined by an outer sheath. In this case, one or more segments with axial bores can be provided. In all these structures, there remains the possibility of using a zone perforated wrapping or a subsequent perforation of the envelope for. Example with the aid of a laser beam. This may be diluted by adding flows of intake air when the trains of smoke.

Other variants of the system or its components will be readily apparent from the claims.

In the following further examples of the composite of substrate portions and its use in the system are given.

example 1

An American blend tobacco mixture with a content of 30% Burley tobacco 40% expanded Virginia tobacco 20% unexpanded Virginia tobacco and 10% Oriental tobacco was conditioned with 12 wt .-% of an aqueous Casings having a glycerol content of 80 wt .-% sprayed. Subsequently, the tobacco was cut 0.8 mm Cutting width and dried to a moisture content of 12%. 180 kg of this cut tobacco were mixed with 20 kg of expanded ribs cut.

From this mixture, a continuous strand was produced with a diameter of 6 mm and a packing density of 200 mg / ml on a Cigarettenstrangmaschine. As a wrapping material came on the outside aluminum-clad, air-impermeable paper used. The continuous strand is cut into individual portions of 8 mm length.

In each case eight of these individual portions were bonded in the recesses of a circular carrier of cardboard material. This gave 2a shown a composite of substrate portions, as shown in Fig..

The resultant composite of substrate portions was smoked in a smoking device according to FIG.

4b with mouthpiece in eight trains without visible amounts incurred sidestream smoke. The flavor was rated by subjects as evenly and the conventional cigarette equivalent.

example 2

A prepared according to known methods paper sheet tobacco with a content of propylene glycol of 12 wt.-% was cut with a cutting width of 0.8 mm as supplied in Example 1

Cigarettenstrangmaschine and encased therein with a cigarette paper, said cigarette paper having an air permeability of 5 CU had. By cutting the continuous strand was obtained substrate portions having the same dimensions as in Example 1; the tap density was 240 mg / ml. The substrate portions were as connected and smoked in example. 1 A formation of sidestream smoke could not be found. The flavor was rated by subjects as about the trains smoothly and pleasantly.

example 3

A blend of 72% tobacco dust 15% glycerol 10% starch and 3% hydroxypropyl cellulose was extruded on a standard twin screw extruder through a round die with 4 mm inner diameter. Due to the swelling effect to obtain a continuous strand with 6 mm outside diameter. This continuous strand was coated with a thin sheath of carbonaceous paper and cut into individual portions of 10 mm length. Each of these individual portions contained about 40 mg of extruded tobacco material. In each case eight of these individual portions were placed in the grooves of a linear carrier of cardboard material by gluing. This gave 2b a composite of substrate portions, as shown in Fig..

The fuming carried 5b in a smoking device with direct, electrical heating and mouthpiece, as shown in FIG.. It could also be observed no sidestream smoke. The taste was judged to be fully and cigarettenähnlich.



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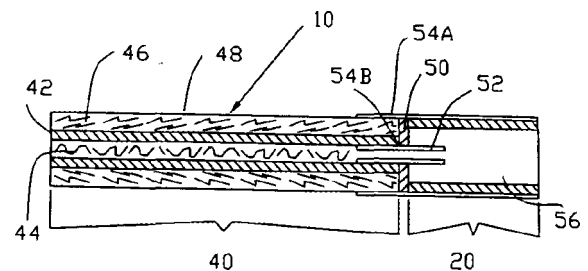
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54 Rauchartikel

57 Ein Rauchartikel (10) weist einen Rauchabschnitt (40) und einen Mundstückabschnitt (20) auf. Aus dem Rauchabschnitt (40) in den Mundstückabschnitt (20) durchgehende Fluide sind auf solche Fluide begrenzt, die aus einem aromatisierenden Material stammen, das in einen zentralen zylindrischen und abbrennbaren Rohr (42) untergebracht ist.



DE 42 00 639 A 1

Die vorliegende Erfindung betrifft einen Rauchartikel. Im besonderen ist die vorliegende Erfindung auf einen Rauchartikel gerichtet, bei dem die aus einem Rauchabschnitt in einen Mundstückabschnitt durchgehenden Fluide auf solche Fluide beschränkt sind, die ein Verbindungsrohr passieren.

Aus US-PS 32 58 015 ist die Verwendung eines rohrförmigen Gliedes mit einem nach außen aufgeweiteten Flansch oder Ring an seinem inneren Ende bekannt. Die Heizmittel umgeben das rohrförmige Glied. Eine äußere Umhüllung berührt die äußere Oberfläche der Heizmittel und den Umfang des Flansches des rohrförmigen Gliedes. Jedoch gibt es zwischen dem Ring und der äußeren Umhüllung keine Abdichtungs-Mittel. In der US-PS 33 56 094 wird erwähnt, daß zwischen der Umhüllung und dem Umfang des Ringes Rauch hindurchleckt. Dabei wird auch erwähnt, daß kleine Rauchanteile von den Heizmitteln bis in den Mund des Rauchers durchgehen, um das Produkt geschmacklich einer Zigarette ähnlicher zu machen.

In beiden Entgegenhaltungen wird nicht offenbart, den Rauch der Heizmittel am Eintreten in den Mund des Rauchers zu hindern.

Bei dem erfindungsgemäßen Rauchartikel wird ein aromatisierendes Material mittels einer Verbrennungsquelle erhitzt, um ein Fluid freizugeben, das von dem Raucher inhaliert wird, ohne Rauch von der Brennstoffquelle zu inhalieren. Im besonderen umfaßt der Rauchartikel gemäß vorliegender Erfindung: einen Mundstückabschnitt; einen Rauchabschnitt mit einem zylindrischen abbrennbaren Rohr, in dem ein aromatisierendes Material vorliegt, ein das abbrennbare Rohr umschreibendes, abbrennbares Brennstoffelement, und ein das Brennstoffelement umschreibendes Umhüllungsmaterial; ferner eine den Rauchabschnitt von dem Mundstückabschnitt trennende Scheibe, in der zentral eine durchgehende Öffnung vorgesehen ist, die mit dem aromatisierenden Material und dem Mundstückabschnitt in Durchfluß-Kommunikation steht, wobei die Scheibe ein Durchfluß-Verbindungsrohr in der erwähnten Öffnung aufnimmt; und Abdichtmittel zumindest an der Verbindungsstelle zwischen der Scheibe und dem Mundstückabschnitt, mit denen eine Strömung von Fluiden über die Verbindungsstelle verhindert wird, ausgenommen die Strömung durch das Durchfluß-Verbindungs-Rohr.

Anhand der Zeichnung, die einen Längsschnitt eines Rauchartikels zeigt, wird der erfindungsgemäße Rauchartikel beschrieben.

In der Fig. der Zeichnung ist ein Rauchartikel 10 erkennbar, der einen Mundstückabschnitt 20 und einen Rauchabschnitt 40 aufweist, die voneinander durch eine Scheibe 50 getrennt sind.

Der Rauchabschnitt 40 enthält ein zylindrisches abbrennbares Rohr 42, ein aromatisierendes Material 44, ein abbrennbares Brennstoffelement 46, und ein Umhüllungsmaterial 48. Das zylindrische abbrennbare Rohr 42 ist hohl und erstreckt sich axial vom stromauf liegenden Ende des Rauchabschnitts 40 bis zum stromab liegenden Ende des Rauchabschnitts 40. Das zylindrische abbrennbare Rohr 42 kann beispielsweise aus folgenden Materialien hergestellt sein: Papier oder Folien. Der optimale Innendurchmesser des zylindrischen abbrennbaren Rohres 42 liegt zwischen etwa 3 und 4 mm. Dieser Innendurchmesser schafft genügend Luftraum, so daß nach der Einbringung des aromatisierenden Materials ein normaler Druckabfall erreicht wird, wie er sich bei einer 3 bis 5 Zoll (7,62 cm bis

12,7 cm) langen Tabaksäule ergäbe. Weiterhin ist bei einer bevorzugten Ausführungsform das Rohr 42 aus einem Bogen aus Aluminiumoxid-Trihydrat mit einer von 0,25 mm bis 0,5 mm aufweisenden Dicke gerollt.

Zusätzlich kann das zylindrische abbrennbare Rohr 42 mit einem Abbrennverzögerer behandelt sein. Beispiele eines solchen Abbrennverzögerers sind z. B. Chlornatrium als ein bevorzugter Abbrennverzögerer. Der Zweck des Abbrennverzögerers ist es unter anderem, die Wahrscheinlichkeit zu verringern, daß der beim Verbrennen des abbrennbaren Brennstoffelementes 26 entstehende Rauch in den Mund des Rauchers gelangt und/oder zu verhindern, daß das aromatisierende Material 44 verbrennt.

Das aromatisierende Material 44 ist im Inneren des zylindrischen abbrennbaren Rohres 42 untergebracht. Im allgemeinen ist das aromatisierende Material 44 ein Material, das bei seiner Erhitzung das gewünschte Aroma für den Raucher freigibt. Besondere Beispiele solcher aromatisierender Materialien umfassen eine solide Mischung in einer gehackten, strangförmigen oder schichtartigen Kondition. Die Mischung ist im allgemeinen aus einer trockenen Sammlung von Tabaken hergestellt, die mit einem Aerosolzerzeuger wie Glycerin oder Glykolen und Wasser kombiniert ist.

Das abbrennbare Brennstoffelement 46 umschreibt das zylindrische abbrennbare Rohr 42. Das Umhüllungsmaterial 48 umschreibt sowohl den Rauchabschnitt 40 als auch den Mundstückabschnitt 20. Sobald der Rauchabschnitt 40 angezündet wird, veranlaßt das Schwelen des abbrennbaren Brennstoffelementes 46 das aromatisierende Material 44 zur Freigabe des gewünschten Aromas. Tabak oder Kohlenstoff sind beispielsweise für das abbrennbare Brennstoffelement 46 verwendbare Materialien.

Der Mundstückabschnitt 20 ist ein hohler Zylinder mit im wesentlichen dem gleichen Durchmesser wie der Rauchabschnitt 40. Beispiele von Materialien, mit denen der Mundstückabschnitt 20 gebildet werden kann, umfassen zu einem Rohr gewickeltes Kraftpapier mit z. B. 0,25 mm Wandstärke oder ein spritzgeformtes thermoplastisches Kunststoffmaterial.

Obwohl dies in der Zeichnung nicht dargestellt ist, könnte am stromab liegenden Ende des Mundstückabschnitts 20 ein Zellulose-Filter-Element angebracht sein, um dem Rauchartikel 10 das Erscheinungsbild einer typischen Zigarette zu verleihen.

Ferner könnte auch ein Mundstück-Umhüllungspapier die äußere Seite des Mundstückabschnitts 20 umschreiben, um das Erscheinungsbild einer typischen Zigarette zu verstärken.

Der Mundstückabschnitt 20 ist vom Rauchabschnitt 40 durch eine Scheibe 50 getrennt, die eine zentral angeordnete Öffnung aufweist. Durch die Öffnung in der Scheibe 50 ragt ein Durchfluß-Verbindungsrohr 52. Dieses stellt eine Durchflußverbindung zwischen dem aromatisierenden Material 44 und dem Mundstückabschnitt 20 her. Die Scheibe 50 kann z. B. aus Papier, aus Folienmaterial oder aus Kunststoff hergestellt sein. Eine bevorzugte Folie ist im allgemeinen ein kaschiertes Kraftpapier (Kraft backed), das beispielsweise 0,127 mm dick ist. Bevorzugtes Kunststoffmaterial ist ein Thermoplast, der zum Spritzverformen geeignet ist. Kunststoff ist ferner ein bevorzugtes Material für diesen Zweck, insbesondere wenn es ein einstückiger Teil eines Kunststoffmundstückabschnitts 20 ist.

Das Durchfluß-Verbindungsrohr 52 kann aus Graphit oder Kohlenstoff hergestellt sein. Bei einer alternativen

Ausführungsform wird das Durchfluß-Verbindungsrohr 52 durch Wickeln mehrerer Lagen eines als Band gegossenen Bogens hergestellt, der aus einer Schlämmung eines Isoliermaterials hergestellt ist. Die Schlämmung kann Pulpe, Natrium-Carboxymethyl-Zellulat-Bindemittel, Glycerin und Wasser enthalten. Das isolierende Material ist beispielsweise Aluminiumoxid-Trihydrat. In der Schlämmung beträgt der Anteil der Pulpe ca. 3 bis 5 Gew.-%, des Bindemittels ca. 10 bis 12, Gew.-%, des Glycerins zwischen etwa 6 und 8 Gew.-% und des Wassers zwischen etwa 85 bis 89 Gew.-%.

Um ein allgemein akzeptierbares und für kommerzielle Nutzungen brauchbares Produkt zu erhalten, sollte das Durchflußverbindungsrohr 52 einen Innendurchmesser von ca. 2,5 mm bis 3,5 mm haben.

Um das Strömen von Rauch aus dem Rauchabschnitt 40 in den Mundstückabschnitt 20 zu verhindern, angenommen die Fluidströmung durch das Durchfluß-Verbindungsrohr 52, sind Abdichtmittel 54A und 54B vorgesehen. Die Abdichtmittel 54A und 54B können z. B. aus hitzeresistentem Epoxid bestehen, das um das Rohr 52 und zwischen dem Rohr 52 und der Öffnung in der Scheibe 50 sowie auch am äußeren Durchmesser der Scheibe 50 und beim Umhüllungsmaterial 48 angebracht wird.

Eine Schmelzkammer 56 ist gewöhnlich in dem Mundstückabschnitt 20 vorgesehen. Die Kammer 56 hält das Gewicht des Rauchartikels und auch den Druckabfall beim Rauchen niedrig. Insbesondere wenn das abbrennbare Rohr 42 und das Verbindungsrohr 52 relativ klein sind, ist die Schmelzkammer 56 vorteilhaft, um den Druckunterschied beim Rauchen auf einem vernünftigen Maß zu halten.

Patentansprüche

1. Rauchartikel, gekennzeichnet durch:

- a) einen Mundstückabschnitt (20);
- b) einen Rauchabschnitt (40), der ein zylindrisches abbrennbares Rohr (42) mit einem darin angeordneten aromatisierenden Material (44); ferner ein das abbrennbare Rohr (42) umschreibendes abbrennbares Brennstoffelement (46); und ein das Brennstoffelement (46) umschreibendes Umhüllungsmaterial (48) aufweist;
- c) eine den Rauchabschnitt (40) vom Mundstückabschnitt (20) trennende Scheibe (50) mit einer zentralen durchgehenden Öffnung, die mit dem aromatisierenden Material (44) und dem Mundstückabschnitt (20) in Durchfluß-Kommunikation steht, wobei die Scheibe (50) in der Öffnung ein Durchfluß-Verbindungsrohr (52) aufnimmt; und
- d) Dichtungsmittel (54A, 54B), die zumindest im Verbindungsbereich zwischen der Scheibe (50) und dem Mundstückabschnitt (20) vorgesehen sind, um einen Strom von Fluiden durch den Verbindungsbereich zu unterbinden, angenommen den Strom von Fluiden durch das Durchfluß-Verbindungsrohr (52).

2. Rauchartikel nach Anspruch 1, dadurch gekennzeichnet, daß das zylindrische abbrennbare Rohr (42) mit einem Abbrennverzögerer behandelt ist, und daß der Abbrennverzögerer z. B. Chlornatrium ist.

3. Rauchartikel nach Anspruch 1, dadurch gekennzeichnet, daß das abbrennbare Brennstoffelement

(46) aus einer Gruppe ausgewählt ist, die aus Tabak oder Kohlenstoff besteht.

4. Rauchartikel nach Anspruch 1, dadurch gekennzeichnet, daß die Dichtungsmittel (54A, 54B) ein hitzeresistentes Epoxid sind.

5. Rauchartikel nach Anspruch 1, dadurch gekennzeichnet, daß die Scheibe (50) aus einer Gruppe von Materialien hergestellt ist, die Papier, Folienmaterial oder Kunststoffmaterial umfaßt.

6. Rauchartikel nach Anspruch 1, dadurch gekennzeichnet, daß das zylindrische abbrennbare Rohr (42) aus einer Gruppe von Materialien hergestellt ist, die Papier oder dünne Folien mit besonderen Material- und Dickenspezifikationen umfassen.

7. Rauchartikel nach Anspruch 1, dadurch gekennzeichnet, daß das Durchfluß-Verbindungsrohr (52) aus Graphit oder Kohlenstoff hergestellt ist.

8. Rauchartikel nach Anspruch 1, dadurch gekennzeichnet, daß das Durchflußverbindungsrohr (52) durch Wickeln mehrerer Lagen eines bandförmig gegossenen Bogens hergestellt ist, der aus einer Aufschlammung eines isolierenden Materials mit Pulpe, Bindemittel, Glycerin und Wasser bestand.

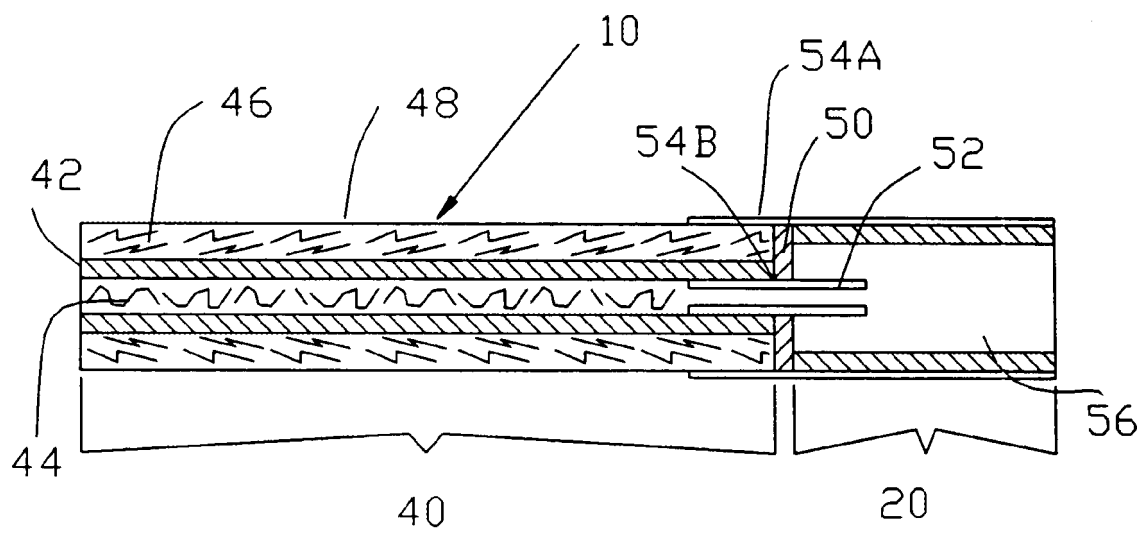
9. Rauchartikel nach Anspruch 8, dadurch gekennzeichnet, daß der Anteil der Pulpe ca. 3 bis 5 Gew.-%, des Bindemittels ca. 10 bis 12 Gew.-%, des Glycerins zwischen ca. 6 bis 8 Gew.-% und des Wassers zwischen ca. 85 bis 89 Gew.-% beträgt.

10. Rauchartikel nach Anspruch 1, dadurch gekennzeichnet, daß das Durchfluß-Verbindungsrohr (52) einen Innendurchmesser von ca. 2,5 bis 3,5 mm aufweist.

11. Rauchartikel nach Anspruch 1, dadurch gekennzeichnet, daß das zylindrische abbrennbare Rohr (42) einen Innendurchmesser von ca. 3 bis 4 mm aufweist.

12. Rauchartikel nach Anspruch 8, dadurch gekennzeichnet, daß das isolierende Material Aluminium-Trihydrat ist.

Hierzu 1 Seite(n) Zeichnungen



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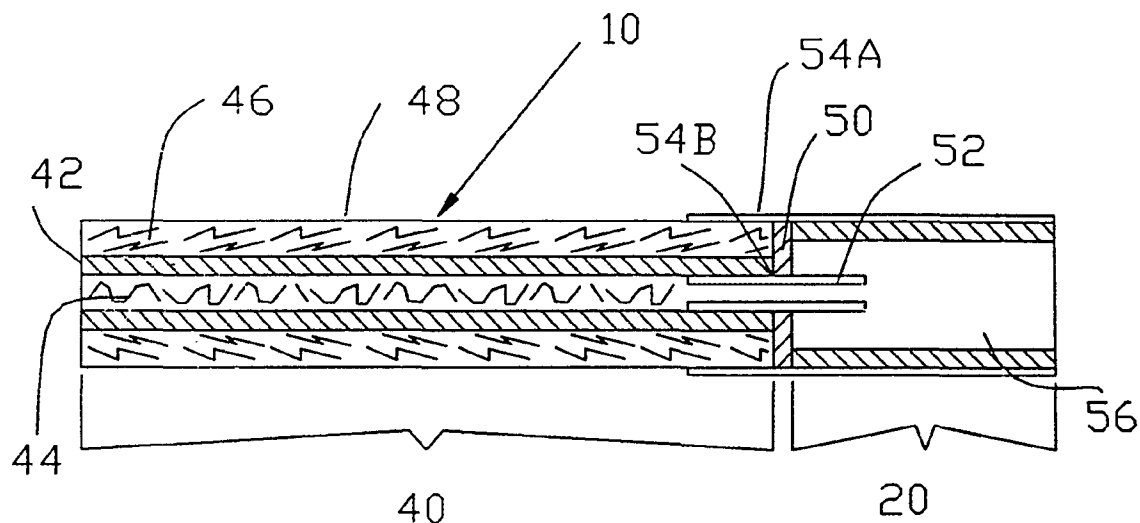
(58) Field of search

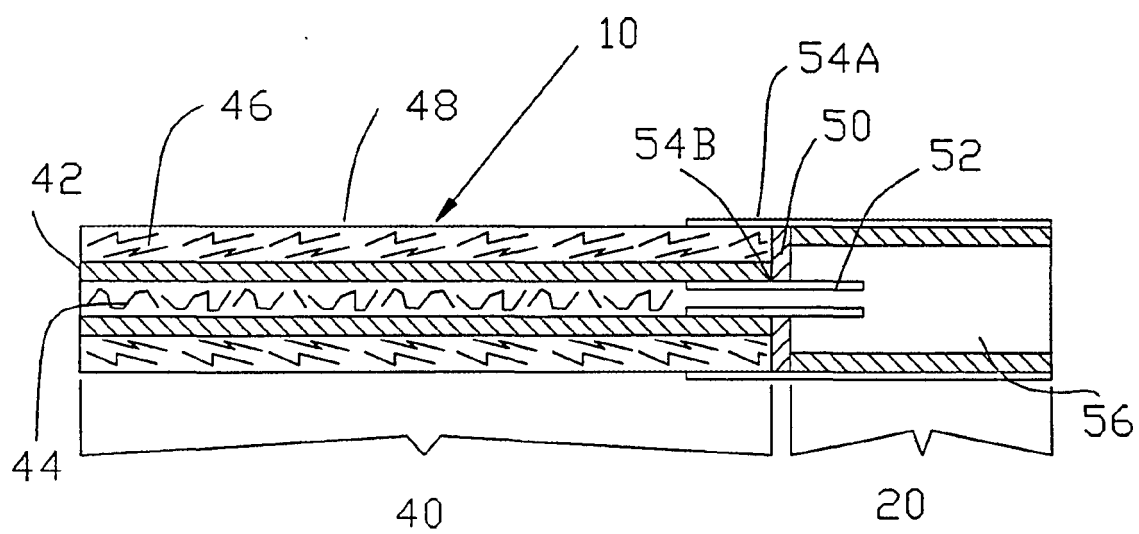
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INT CL⁵ A24D, A24F

(54) **A smoking article**

(57) A smoking article 10 comprising a smoking section 40 and a mouthpiece section 20, separated by a disc 50 with a centrally disposed opening, through which is a flow-through connecting tube 52 providing flow communication between the smoking section 40 and the mouthpiece section 20. The smoking section 40 comprises a cylindrical combustible tube 42 containing a flavouring material 44 and surrounded by a combustible fuel element 46, the tube 52 being in flow-through communication with flavouring material 44.





A Smoking Article

This invention relates to smoking articles. In particular this invention relates to smoking articles wherein a flavouring material is heated by a fuel source to emit a fluid which is to be inhaled by the smoker without inhaling smoke from the fuel source.

The present invention provides a smoking article comprising a mouthpiece section, a smoking section, said smoking section comprising a cylindrical combustible tube having a flavouring material therein, a combustible fuel element circumscribing said combustible tube, a wrapping material circumscribing said fuel element, a disc separating said smoking section from said mouthpiece section, said disc having a centrally disposed opening therethrough in flow-through communication with said flavouring material and said mouthpiece section, said disc receiving a flow-through connecting tube through said opening, and sealing means connecting said disc to said flow-through connecting tube to prevent the flow of fluids from said smoking section to said mouthpiece section except through the flow-through connecting tube.

U.S. Patent No. 3,258,015 ('015), to Ellis, teaches the use of a tubular member with an outwardly flared flange or annulus at its inner end. The heating means surrounds the tubular member. An outer wrapper touches the outside surface of the heating means and the circumference of the flange of the tubular member. However, the invention does not teach sealing means between the annulus and the outer wrapper. In fact, U.S.

Patent No. 3,356,094 ('094), also to Ellis, teaches that in the '015 patent smoke is likely to leak between the wrapper and the circumference of the annulus. Further, the '094 patent teaches passing small amounts of smoke from the heating means into the mouth to make the product more cigarette-like. Therefore, in neither the '015 nor the '094 patent is it taught that the smoke from the heating means should be prevented from entering the smoker's mouth.

A better understanding of the present invention will be had upon reference to the following description in conjunction with the accompanying diagrammatic drawing wherein:

The Figure is a cross-sectional view of the smoking article.

With reference to the Figure, there is shown a smoking article 10. The smoking article 10 contains a mouthpiece section 20 and a smoking section 40 separated by a disc 50.

Smoking section 40 comprises a cylindrical combustible tube 42, a flavouring material 44, a combustible fuel element 46, and a wrapping material 48. Cylindrical combustible tube 42 is hollow and extends axially from the upstream end to downstream end of the smoking section 40. Examples of materials from which cylindrical combustible tube 42 can be constructed are paper or foil. The optimum inside diameter of the cylindrical combustible tube 42 is from about 3mm to 4mm. This provides sufficient air space so that when the

flavourant is added, a normal 3 to 5 inch WG tobacco section pressure drop is realised. Furthermore, in a preferred embodiment, the tube is comprised of a wound alumina trihydrate sheet (2 ply) of from 0.25mm to 0.5mm thickness.

Additionally, cylindrical combustible tube 42 can be treated with a burn retardant. Examples of this burn retardant include, for example, sodium chloride, as one preferred burn retardant. The purposes for the burn retardant are to decrease the chance of smoke from the burning of combustible fuel element 46 from entering the mouth of the smoker and to prevent flavouring material 44 from burning.

Flavouring material 44 is contained within cylindrical combustible tube 42. In general, flavouring material 44 is a material which, when heated, emits the desired flavour to the smoker. Specific examples include flavourful tobaccos as a solid mix in a chopped, stranded, or coating condition. The mix is generally made from a dry collection of tobaccos that is combined with an aerosol generant such as glycerine or glycols and water.

Combustible fuel element 46 circumscribes cylindrical combustible tube 42. Wrapping material 48 circumscribes both smoking section 40 and mouthpiece section 20. When smoking section 40 is ignited, the burning of combustible fuel element 46 causes flavouring material 44 to give off the desired flavour. Tobacco or

carbon are examples of material which can be used for combustible fuel element 46.

Mouthpiece section 20 is shown as a hollow cylinder having approximately the same diameter as smoking section 40. Examples of materials which can be used to construct mouthpiece section 20 include tube wound kraft paper of 0.25mm wall thickness or an injection moulded thermosetting plastic.

While not shown in the drawing, a cellulose filter element can be added to the downstream end of mouthpiece section 20 to give the appearance of a typical cigarette.

In addition, tipping paper may circumscribe the outside of the mouthpiece section 20 to give the appearance of a typical cigarette.

Mouthpiece section 20 and smoking section 40 are separated by a disc 50 with a centrally disposed opening through disc 50. Flow-through connecting tube 52 passes through the opening in disc 50 and provides flow-through communication between flavouring material 44 and mouthpiece section 20. Disc 50 may be constructed of, for example, paper, foil or plastic. A preferred foil is generally a kraft backed foil, for example, 0.005 inch thick. A preferred plastic is a thermosetting type suitable for injection moulding. Plastic is a preferred material, especially as an integral part of a plastic mouthpiece section 20.

Flow-through connecting tube 52 may be constructed of graphite or carbon. An alternative construction would be to construct flow-through connecting tube 52 by

winding multiple plies of a band cast sheet made from a slurry of insulating material with pulp, sodium carboxymethyl cellulate binder, glycerine and water. One example of an insulating material is alumina trihydrate. Preferably, the pulp will be in the range of from about 3 to 5 per cent by weight, the binder will be in the range of from about 10 to 12 per cent by weight, the glycerine will be in the range of from about 6 to 8 per cent by weight and the water will be from about 85 to 89 per cent by weight.

For a generally acceptable product for commercial utilisation, the flow-through connecting tube 52 should have an inside diameter of from about 2.5mm to 3.5mm.

Sealing means 54A and 54B are provided to prevent the flow of smoke from smoking section 40 into mouthpiece section 20 except through flow-through connecting tube 52. Sealing means 54A and 54B may be, for example, heat resistant epoxy. The sealing means 54A and 54B is around and between the connecting tube 52 and the opening in disc 50 and may also be between the outside diameter of disc 50 and wrapping material 48.

A nucleating chamber 56 is generally provided in the mouthpiece section 20. Chamber 56 keeps the total cigarette weight and pressure drop down. In particular, if the combustible tube 42 and connecting tube 52 are relatively small, the nucleating chamber is needed to keep the pressure drop at a reasonable level.

The foregoing detailed description is given primarily for clearness of understanding and no

unnecessary limitations are to be understood therefrom, for modifications can be made by those skilled in the art upon reading this disclosure, and may be made without departing from the spirit of the invention and scope of the appended claims.

CLAIMS

1. A smoking article comprising a mouthpiece section; a smoking section, said smoking section comprising a cylindrical combustible tube having a flavouring material therein, a combustible fuel element circumscribing said combustible tube, a wrapping material circumscribing said fuel element; a disc separating said smoking section from said mouthpiece section, said disc having a centrally disposed opening therethrough in flow-through communication with said flavouring material and said mouthpiece section, said disc receiving a flow-through connecting tube through said opening; and sealing means connecting said disc to said flow-through connecting tube to prevent the flow of fluids from said smoking section to said mouthpiece section except through the flow-through connecting tube.
2. The smoking article of Claim 1 where said cylindrical combustible tube is treated with a burn retardant.
3. The smoking article of Claim 2 where said burn retardant is sodium chloride.
4. The smoking article of Claim 1 where said combustible fuel element is selected from the group consisting of tobacco or carbon.
5. The smoking article of Claim 1 where said sealing means is a heat resistant epoxy.

6. The smoking article of Claim 1 where said disc is made from the group consisting of paper, foil or plastic.
7. The smoking article of Claim 1 where the cylindrical combustible tube is made from the group consisting of paper or thin foil.
8. The smoking article of Claim 1 where the flow-through connecting tube is made from the group consisting of graphite or carbon.
9. The smoking article of Claim 1 where the flow-through connecting tube is made by winding multiple plies of a band cast sheet made from a slurry of insulating material with pulp, binder, glycerine and water.
10. The smoking article of Claim 9 wherein the pulp is from about 3 to 5 weight per cent, the binder is from about 10 to 12 weight per cent, the glycerine is from about 6 to 8 weight per cent, and the water is from about 85 to 89 weight per cent.
11. The smoking article of Claim 1 where said flow-through connecting tube has an inside diameter of from about 2.5mm to about 3.5mm.
12. The smoking article of Claim 1 where said cylindrical combustible tube has an inside diameter of from about 3mm to 4mm.
13. The smoking article of Claim 9 where the insulating material is alumina trihydrate.
14. The smoking article substantially as hereinabove described with reference to the accompanying Figure.

- 4 -

Patents Act 1977
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Relevant Technical fields

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Search Examiner

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Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

9th APRIL 1992

Documents considered relevant following a search in respect of claims 1 TO 14

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
Y	EP 0245732 A2 (REYNOLDS) Figure 1 and page 6 lines 23-42	1, 4
Y	US 3674036 (VEGA) Figures 1 and 3	1, 4
Y	US 3258015 (ELLIS) Figure 5 column 10 lines 29-32	1, 4

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).



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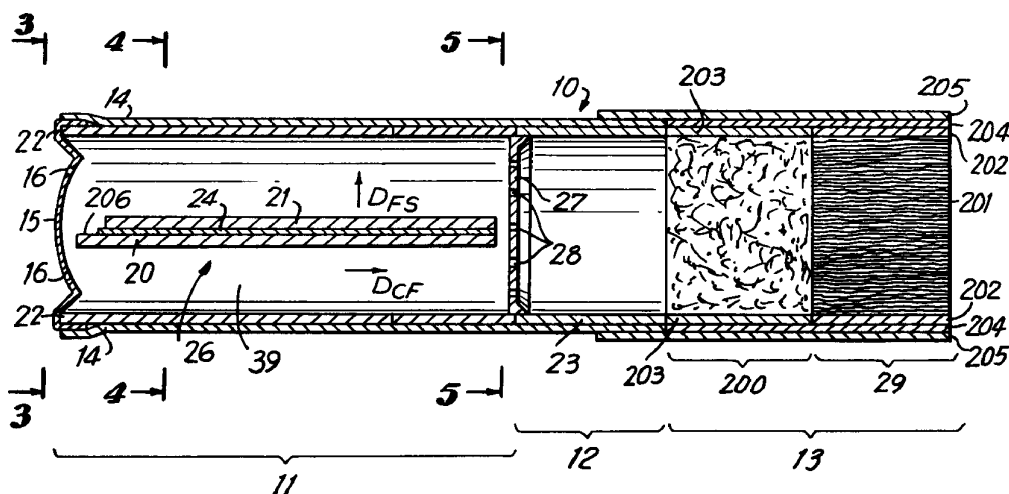
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Thermally-regulated flavor generator.

A flavor generating unit (26) for incorporation into a flavor generating article (10) which delivers to a consumer an inhalable flavor-containing substance. The flavor generating unit includes a distributed heat source (20) and a distributed flavor source (21) in

thermal contact with the distributed heat source. The flavor generating unit can also include an insulating material (24). Furthermore, the distributed flavor source can be composed of one or more individual flavor source components.

FIG. 2



Background of the Invention

This invention relates to flavor generating articles which deliver flavor to the consumer during each individual puff of the article.

A substantial number of previous attempts have been made to produce a flavor generating article in which the quality of flavor delivery resembles that achieved in conventional cigarettes without the generation of sidestream smoke. Accordingly, a wide variety of various design geometries have been tried in an attempt to mimic the quality of flavor delivery in conventional cigarettes. For example, Siegel U.S. Patent No. 2,907,686 describes a smoking article consisting of a charcoal rod and a separate carrier impregnated with flavorants and a synthetic "smoke" forming agent which is heated by the burning charcoal rod. The charcoal rod is coated with a concentrated sugar solution so as to form an impervious layer during burning. It was thought that this layer would contain the gases formed during flavor generating and concentrate the heat thus formed.

Another smoking article, described in US - A - 3,258,015, employs burning tobacco in the form of a conventional cigarette to heat a metallic cylinder containing a source of nicotine, such as reconstituted tobacco or tobacco extract. During flavor generating, the vapors released from the material inside the metal tube mix with air inhaled through an open end of the tube which runs to the burning end of the flavor generating article.

US - A - 3,356,094 describes a similar flavor generating article in which the tube becomes fragile upon heating, so that it would break off and not protrude when the surrounding tobacco had burned away.

Our EP - A - 0 177 355 describes a smoking article which produces a nicotine-containing aerosol by heating, but not burning, a flavor generator. The flavor generator could be fabricated from a substrate material such as alumina, natural clays and the like, or tobacco filler. The flavor generator is impregnated with thermally releasable flavorants, including nicotine, glycerol, menthol and the like. Heating of the flavor generator is provided by hot gases formed as a result of the combustion of a fuel rod of pyrolyzed tobacco or other carbonaceous material.

US - A - 4,714,082 shows a variation of the Hearn et al. article which employs a fuel element. The performance of the article is said to be improved by maximizing heat transfer between the fuel element and the aerosol generator. This is effected by preventing heat loss by insulation, and by enhancing heat transfer between the burning fuel and the flavor generator by a metallic conductor. A spun glass fiber insulator surrounds the fuel

element and aerosol generator assembly.

Our US - A - No. 4,991,606 describes a flavor generating article wherein the flavor bed is positioned relative to the heat source so that heat transfers from the heat source to the flavor bed by radiation and convection. Such a design produces substantially no visible sidestream smoke. Further improvements on such a design can be achieved with the incorporation of improved heat sources. For example, Our EP - A - 0 372 985 describes a heat source made of iron carbide. Such a heat source produces virtually no carbon monoxide upon combustion. Furthermore, our EP - A - 0 430 658 describes a heat source made of metal nitride that produces virtually no carbon monoxide or nitrogen oxide. Thus, flavor generating articles with substantially no visible sidestream smoke and which produce virtually no carbon monoxide or nitrogen oxide can be produced.

Although a wide variety of flavor generating article geometries have been tried, the flavor generating articles described above suffer from a number of design-related drawbacks which have prohibited the flavor generating articles from producing a constant quality of flavor delivery. In the above flavor generating articles, the flavor source is arranged in a geometry where it is concentrated into a single three-dimensional "chamber" with the diameter and length of the chamber approximately the same as the diameter of the flavor generating article. Analogously, the heat source, which is also concentrated into its own individual "chamber," is also arranged with a geometry similar to the flavor source. These two individual "chambers" are then butted against each other so that the heat which is generated in the heat source "chamber" can transfer into the flavor source "chamber." Such a design has inherent disadvantages which have contributed to its inability to mimic the constant quality of flavor delivery obtained in conventional cigarettes.

First, since the "chambers" necessarily have dimensions on the order of the diameter of the flavor generating article, heat that is generated in the heat source must at times be transferred up to distances on the order of twice the diameter of the flavor generating article in order to heat the flavor source material that is most remote from the heat source. Because this distance can be large, the heat transfer properties of the article are inefficient. The large mass of material over which the heat must transfer serves as an unnecessary heat sink. As a result, the heat source of these devices is inefficient since it must generate more heat than a heat source in a structure where heat would not have to be transferred over large distances.

Second, since large heat transfer distances are involved, large transients also exist in the heat transfer properties which result in non-uniformity in

the quality of the individual puffs of the article over its lifetime. Once the heat source generates heat in a localized region of the heat source "chamber," it takes time to be transferred to the flavor source where it can heat it up so as to produce smoke-like vapors and aerosols. As a result, the quality of the first few puffs of such articles is inferior to the quality of the third and fourth. Furthermore, because large heat transfer distances are involved, the transfer of heat from the heat source to the flavor source during a puff is inherently slow and thus results in an inferior quality puff.

Third, because the heat transfer distance varies for each puff of the flavor generating article it is difficult to provide constant flavor delivery over each puff of the flavor generating article. For example, during the ninth and tenth puff, there is a large quantity of "flavor-depleted" flavor source material which serves as an unnecessary heat sink. This results in a degradation in the quality of the puff. Such degradation is an inherent quality of flavor generating articles which have a heat source "chamber" butted against a flavor source "chamber." The regulation of flavor delivery in these type of flavor generating articles is controlled by the smoker. If such a flavor generating article is "puffed" at high volumes, depletion of flavors occurs early -- resulting in inferior quality later puffs.

It would be desirable to be able to provide a flavor generating article which does not produce sidestream smoke but which does not suffer from the inherent design drawbacks exhibited by the articles discussed above.

Summary of the Invention

It is an object of this invention to provide a flavor generating article which produces substantially no visible sidestream smoke and where the delivery of flavor to the consumer during each individual puff of the article can be precisely controlled and regulated.

In accordance with this invention, there is provided a flavor generating article capable of producing a substantially constant quality of flavor delivery from the first to last puff of the article, as is obtained in conventional cigarettes. This ability of the present invention is achieved for the first time because a distributed flavor source is placed in thermal contact with a distributed heat source. Such a design allows for the heat to be directly transferred by conduction and convection from the heat source to the flavor source.

Preferred embodiments have a flavor generating unit which is comprised of a distributed heat source, a distributed flavor source and an optional insulating material. The distributed flavor source is in thermal contact with the distributed heat source.

Because of the distributed nature of the heat and flavor sources and because they are in thermal contact with each other, the present invention allows the quality of the individual puff to be precisely controlled and regulated. Accordingly, the present invention can produce the same flavor delivery, which is constant from puff to puff, as is obtained in conventional cigarettes.

Brief Description of the Drawings

The above and other objects and advantages of the invention will be apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

FIG. 1 is an exploded perspective view of a first preferred embodiment of a flavor generating article according to the present invention;

FIG. 2 is a longitudinal cross-sectional view of the flavor generating article of FIG. 1, taken from line 2-2 of FIG. 1;

FIG. 3 is an end view of the flavor generating article of FIGS. 1 and 2, taken from line 3-3 of FIG. 2;

FIG. 4 is a radial cross-sectional view of the flavor generating article of FIGS. 1-3, taken from line 4-4 of FIG. 2;

FIG. 5 is a radial cross-sectional view of the flavor generating article of FIGS. 1-4, taken from line 5-5 of FIG. 2;

FIG. 6 is an exploded perspective view of the active element of the flavor generating article of FIGS. 1-5;

FIG. 7 is a longitudinal cross-sectional view of the active element of the flavor generating article of FIGS. 1-6 taken from line 7-7 of FIG. 6;

FIG. 8A is a side view of a distributed flavor generating unit with a plurality of individual flavor source components which can be incorporated into the flavor generating article of FIGS. 1-7;

FIG. 8B is a perspective view of the distributed flavor generating unit of FIG. 8A;

FIG. 9 is a conceptual comparison between distributed and non-distributed heat sources of flavor delivery profiles;

FIG. 10A is a side view of a distributed continuous flat heat source with a plurality of individual flavor source components distributed on both sides of the heat source;

FIG. 10B is a side view of an embodiment of a perforated mounting structure of FIG. 10A;

FIG. 10C is a side view of an embodiment of a non-perforated mounting structure of FIG. 10A;

FIG. 11A is a side view of a distributed continuous flat heat source where the width of the flavor

source contact area with the heat source is larger than in the embodiment of FIG. 10A; also included is an associated conceptual depiction of flavor delivery versus time as the combustion front moves down along the distributed heat source in the D_{CF} direction.

FIG. 11B is a side view of a distributed continuous flat heat source where the width of the flavor source contact area with the heat source is smaller than in the embodiments of FIGS. 10A and 11A; also included is an associated conceptual depiction of flavor delivery versus time as the combustion front moves down along the distributed heat source in the D_{CF} direction.

FIG. 12A is a side view of a distributed continuous cylindrical heat source with a plurality of individual flavor source components distributed around the heat source;

FIG. 12B is a side view of a distributed continuous cylindrical heat source with a plurality of individual flavor source components distributed around the heat source and where the width of the flavor source contact area with the heat source is larger than in the embodiment of FIG. 12A;

FIG. 12C is a side view of a distributed continuous cylindrical heat source with a plurality of individual flavor source components distributed around the heat source and where the width of the flavor source contact area with the heat source is smaller than in the embodiments of FIGS. 12A and 12B;

FIG. 13A is a top view of a distributed flat-ladder type of heat source with a plurality of individual flavor source components distributed on the rungs of the ladder;

FIG. 13B is a cross-sectional view of four embodiments (I, II, III, and IV) of the rungs of FIG. 13A taken along line A-A;

FIG. 14A is a side view of a distributed continuous cylindrical heat source with a distributed "mono-layer" flavor source;

FIG. 14B is a radial cross-sectional view of the flavor generating article of FIG. 14A, taken from the line A-A of FIG. 14A; and

FIG. 14C is a radial cross-sectional view of the flavor generating article of FIG. 14A, taken from the line B-B of FIG. 14A.

Detailed Description of the Invention

The basic flavor generating article of the present invention includes a distributed flavor source in thermal contact with a distributed heat source. When the heat source heats the flavor source, flavor-containing substance (i.e., a vapor or aerosol, or mixture thereof, containing flavored vapors or aerosols or other vapors or aerosol compo-

nents) is generated or released from the flavor source and can be drawn in by the consumer. As used herein, "thermal contact" means that the distributed boundaries of the flavor source and heat source are adjacent each other and not necessarily in direct physical contact.

The flavor source can be any material that can be distributed and placed in thermal contact with the distributed heat source of the present invention and which, when heated, releases a flavor-containing substance. Such materials can include as a component tobacco, reconstituted tobacco, tobacco condensates (condensed components of the smoke produced by the combustion of tobacco, leaving flavors and, possibly, nicotine), or tobacco extracts. These materials when heated generate or release a flavor-containing substance (which may include nicotine) which can be drawn in by the consumer. Any of these flavor generating materials can also include an aerosol-forming substance (i.e., aerosol precursor), such as glycerin, propylene glycol, 1,3-butanediol, water or the like. These materials give the "smoker" the perception of inhaling and exhaling "smoke" as in a conventional cigarette where tobacco is burned.

A particularly preferred flavor source material is a composition such as that described in our EP - A - 0 352 107 which describes pelletized tobacco containing an aerosol-forming ingredient and a filler. This composition can be used in the pellet form or, instead of being formed into pellets, could be deposited as a sheet or coating, in conjunction with adhesion agents such as pectins, gums, or cellulose derivatives, such as carboxymethyl cellulose (CMC), or the like. If this sheet or coating-type of flavor source material is used, then the material is applied as a sheet or coating to the heat source. In such a flavor source, the pellets should have a size in the range of approximately 0.1 mm to approximately 0.5 mm. The flavor source material may also be applied to an inert insulating substrate in contact with the heat source, if such an insulating material is used in the flavor generating article design.

The tobacco pellets described above are preferably formed by combining in an extruder: particularized tobacco materials, having a size of from about 20 mesh down to about 400 mesh, preferably, about 150 mesh, an aerosol-forming material (i.e., an aerosol precursor, such as, glycerin, 1,3-butanediol or propylene glycol), that can be widely dispersed among the tobacco particles, and a finely divided filler material, for example, calcium carbonate or alumina, to increase the thermal load to prevent the heat source from raising the temperature of the pellets above their thermal decomposition temperature. The materials are mixed to form a mixture, and the mixture is extruded out a die

typically having a plurality of orifices into spaghetti-like strands of about the same diameter. The extruded strands are cut into lengths, preferably of uniform length. The pellets preferably are uniformly dimensioned and comprise a mixture of about 15% to about 95% tobacco material, about 5% to about 35% aerosol precursor, and about 0% to about 50% filler material.

Another preferred flavor source material is a gel-based composition such as that described in our copending European application No. 92 302 592.8, which describes a gel-based flavor source containing glycerin (as an aerosol-forming ingredient), tobacco particles, and a gelling agent (to supply structural rigidity to the flavor source). When used in the present invention, instead of being formed into a one-piece central cylinder from which a plurality of vanes radiate outward in a spoke-like fashion, the gel-based composition would be formed into a "sheet" or some other distributed shape so that it can be positioned in thermal contact with the distributed heat sources of the present invention.

Other flavor source materials are also contemplated by this invention. For example, the flavor source could be a reconstituted tobacco sheet made from a combination of tobacco dust with a binder or the like. Furthermore, the flavor source could also be a material that can be "sprayed" onto the heat source or onto the inert insulating substrate in contact with the heat source. In this later type of process the flavor source material is sprayed on while it is in a liquid-like state and then is allowed to dry or harden so that it adheres to the flavor generating unit. What ever type of flavor source is employed in the flavor generating article of the present invention, the only restriction on the flavor source is that it must be able to be placed in thermal contact with the heat source.

In some embodiments of the present invention, as discussed below, the flavor source material is divided into individual components, each representing one puff of the flavor generating article. In such designs it is possible to mimic a conventional cigarette by providing the number of components of flavor source material equal to an average number of puffs per cigarette, e.g., eight to ten puffs. Although the flavor generating article does not decrease in length like a conventional cigarette as it is consumed, it is possible to make the flavor generating article in varying lengths, with a different numbers of puffs.

As discussed above, the flavor source can be any material that can be placed in thermal contact with the distributed heat source and which, when heated, releases a flavor-containing substance for inhalation by the "smoker". Analogously, the heat source of this invention can be any material that

can be formed into a distributed shape and which would undergo an exothermic reaction to liberate heat so as to enable the flavor generating material to release flavor-containing substances.

Preferably, the heat source should combust to produce substantially no carbon monoxide or nitrogen oxides. Preferred materials for the heat source include carbon, metal carbides, metal nitrides, metal oxides and metals. More preferable materials are carbon, non-stoichiometric metal nitrides, metal oxides, or mixtures thereof. Most preferably, the heat source comprises materials made according to the methods of any one or more of our EP-A-0 352 108, 0 372 985, 0 430 658, 0 467 658, 0 494 784 and European Application No. 92 304 310.3 filed July 19, 1991.

Any method capable of forming the heat source into the desired distributed shape may be used. Preferred methods of manufacture include, but are not limited to, slip casting, injection molding, die compaction and extrusion. Those skilled in the art will understand that a particular desired distributed shape may require a particular method of manufacture. The heat sources may be prepared at the desired size and shape or alternatively, they may be cut, shaped or otherwise produced from a larger piece of material. Furthermore, precursors to the desired heat source materials listed above may be formed into the desired shape and then converted, in situ, to the desired materials.

In addition to the distributed heat source and the distributed flavor source, the flavor generating units of the present invention may optionally include, as discussed below, an insulator material or substance. Its purpose is to further regulate the generation and conduction of heat reaching the flavor source. A thermal insulation material, as employed herein, is any substance or configuration of materials that resists the flow of heat. Preferably, the insulation material or substance should have a low density so that it does not absorb too much heat and act as a heat sink. Alternatively, the insulation material or substance can be porous in order to avoid the absorption of heat. The insulation materials of the present invention do not stop heat flow, but simply retard it to a rate that suits a particular design requirement. These materials include, preferably, ceramics and more preferably, alumina. A most preferred insulating material is calcium carbonate. Any method capable of forming the insulating material into a shape so that it can be brought into thermal contact with the distributed heat source may be used. Those skilled in the art will understand that a particular desired heat source shape may require a particular method of manufacturing the insulating material.

Those skilled in the art will understand that when a particular embodiment of the present inven-

tion requires that the flavor source is directly adhered to the heat source (or to an insulating material) that any adhesion technique suitable for use in the art of flavor generating articles can be employed. The only requirement on the adhesion technique is that the adhesive must be able to bring the flavor source in intimate contact to the heat source (or the insulating material). Of course, preferably, the heat transport properties of the adhesive should be taken into account when the flavor generating article is designed.

With the above discussion of the fabrication of the distributed heat and flavor source materials and the optional insulating materials, the general theory of operation of the flavor generating article in which they are incorporated into will now be discussed. Furthermore, the advantages of the new design of the present invention over previous designs will also be discussed.

The flavor generating articles of the present invention include a flavor generating unit. This unit is labelled 26 in the embodiment of FIGS. 1-7 and 226 in the embodiment of FIGS. 8A-8B. The flavor generating units in these embodiments include a distributed heat source (20 in FIGS. 1-7 and 220 in FIGS. 8A-8B), a distributed flavor source (21 in FIGS. 1-7 and 221 in FIGS. 8A-8B), and an optional insulating material (24 in FIGS. 1-7 and 224 in FIGS. 8A-8B). Upon combustion of the distributed heat source, heat is generated and is then partially transferred through the insulating material (24, 224) to the distributed flavor source (21, 221) where flavor-containing substance is generated and released for consumption by the smoker.

In the present invention, because the heat source is distributed, the heat transfer properties of the flavor generating article can be regulated and controlled so as to improve the flavor delivery characteristics in each individual puff of the article in comparison to flavor generating articles which employ a non-distributed flavor "bed" that is physically separated from a non-distributed heat source chamber.

Furthermore, in the present invention, the heat that is produced in a localized region of the distributed heat source undergoes transport in at least two distinct spacial directions. Such multi-dimensional heat transport, in contrast to uni-dimensional transport, allows the flavor source of the present invention to be heated quicker, more directly and more controllably than flavor generating articles without such "distributed" heat sources. The ability to employ multi-dimensional transport is a direct result of the distributed nature of the flavor generating units of the present invention.

In contrast to previous flavor generating article designs, the present invention utilizes heat transfer in two distinct directions. In one of these directions

the combustion front of the heat source propagates down along the heat source (i.e., down along the distributed length of the source). This direction is labelled " D_{CF} " in FIGS. 1-7 and 8A-8B. The length of time that the combustion front takes to propagate down the distributed heat source determines the useful lifetime of the flavor generating article. In a second direction distinct from the combustion front direction, heat that is generated in a localized region of the distributed heat source is transported to the distributed flavor source, which is in thermal contact with the distributed heat source. This direction is labelled " D_{FS} " in FIGS. 1-7 and 8A-8B.

The beneficial aspects of the present invention are achieved because the distance of separation between the combustion front in the heat source and the flavor source can be small, fixed, and the same for each individual puff of the flavor generating article. This is in contrast to flavor generating articles which employ a non-distributed flavor "bed" which is physically separate from a non-distributed heat source. In such non-distributed designs, the distance of separation between the localized region of the heat source that is undergoing combustion for a given puff and the localized region of the flavor bed that is generating flavor for that puff is large, not fixed, and not the same for each individual puff of the flavor generating article. The distance of separation is referred to as "large" because sandwiched in between the combustion front of the heat source and the flavor bed are two types of "extraneous" material which are not needed for generating the flavor in a given puff of the flavor generating article.

The first type of "extraneous" material is heat source material which has not undergone combustion because the combustion front of the heat source, for all but the last few puffs of the flavor generating article, has not propagated throughout the source. There will be more volume and mass of this type of material during the early puffs of the flavor generating article. Because this type of material has not undergone combustion for the majority of puffs of the flavor generating article, and because it is positioned in between the combustion front of the heat source and the flavor bed, it is an unnecessary heat sink. In order to heat up the flavor bed to a given temperature so that it can emit flavor-containing substance, this extraneous region in the flavor generating article must also be heated up with no beneficial results. Consequentially, the heat output of the heat source must be larger than would otherwise be required. This disadvantage exists in a non-distributed design because the heat transport characteristics of the flavor generating article are uni-dimensional since D_{CF} and D_{FS} are in the same direction.

With the distributed heat source design of the present invention, where D_{CF} and D_{FS} are in two distinct directions, the unnecessary non-combusted heat source material, which existed in the non-distributed designs, has been eliminated. In distributed designs, a distributed flavor source is placed in thermal contact with a distributed heat source. As such, the distance of separation between the combustion front of the heat source and the localized region of the flavor bed that is at a sufficient temperature to emit flavor-generating substance is generally small, fixed, and constant for each individual puff of the flavor generating article. Because of such design, the heat transfer mechanism that is used to heat the flavor source can be predominately conductive. In contrast, in non-distributed designs, convective heat transfer plays a dominant role in heating the flavor source since the distance of separations are necessarily larger.

The second type of "extraneous" material that is sandwiched in between the combustion front of the heat source and the flavor bed, in non-distributed designs, is flavor source material that has been "depleted" of flavor. This type of material is flavor source material which has been heated for so long that its capability to further emit flavor-containing substance has been reduced to a point where it is not significantly contributing to total volume of flavor and aerosol that the consumer is flavor generating. Such material will exist close to the heat source and will increase in volume with each puff as the flavor generating substance is depleted. As was the case with the extraneous non-combusted heat source material discussed above, this depleted flavor source is also positioned in between the combustion front of the heat source and the localized regions in the flavor bed that are emitting flavor-containing substance. As such, it is also an unnecessary heat sink. In order to heat up "un-depleted" flavor source material to a given temperature so that it can emit significant amounts of flavor-containing substance, this extraneous material in the flavor generating article must also be heated up for no beneficial reasons. Consequently, the heat output of the heat source must be larger than would otherwise be required. As discussed above, this disadvantage exists in non-distributed designs because the heat transport characteristics of the flavor generating article are uni-dimensional since D_{CF} and D_{FS} are in the same direction. In contrast to the extraneous material associated with the heat source, there will be more of the second type of extraneous material during the later puffs of the flavor generating article. This second type of extraneous material is responsible for the degradation in quality during the last few puffs of the article.

The fact that there is extraneous material (i.e., non-combusted heat source material and depleted flavor source material) which acts as an unnecessary heat sink is not as much of a problem as the fact that the volume and mass of it is not constant over the lifetime of the flavor generating article. The amount of extraneous material, in non-distributed designs, varies from the first puff of the flavor generating article to the fifth puff and further to the last puff. As a result, the relative delivery of flavor to the consumer varies from the first to the fifth to the last puff of the flavor generating article. In contrast, with the distributed design of the present invention, the amount of material in between the heat source and the flavor source can be fixed and constant for each individual puff. This fundamental difference between distributed and non-distributed heat sources is conceptually depicted in FIG. 9 where the flavor delivery profiles from distributed and non-distributed heat sources are compared. As seen in FIG. 9, the flavor delivery to the consumer with non-distributed heat sources varies from puff to puff, in contrast to distributed heat sources where the distributed flavor source is put in thermal contact with the distributed heat source. As discussed above, the source of the flavor delivery variation in non-distributed designs is due to the non-constant extraneous material which exists in between the combustion front of the heat source and the flavor source and which acts as an unnecessary heat sink. The rise in relative delivery depicted in FIG. 9 during the first few puffs of the non-distributed design, as discussed above, is associated with extraneous heat source material. In contrast, the fall-off in relative delivery depicted in FIG. 9 during the last few puffs of the non-distributed design is associated with the extraneous "depleted" flavor source material.

Because of the distributed nature of the heat sources of the present invention, the flavor delivery for each individual puff of the flavor generating article can be precisely controlled. The insulating material included in the flavor generating units of the present invention assists in allowing for precise control over the heat transfer characteristics of the flavor generating article. The insulating material is chosen as a design parameter.

For example, if it is desired to produce a particular puff of smoke which is "rich" or has "full flavor" as in conventional flavor generating articles, then the insulator material should be chosen so that the flavor source is exposed to a temperature which would allow the tobacco elements of the flavor source to undergo extensive pyrolysis. In general, in the present invention, exposing the flavor source to high temperatures can be accomplished in two (2) alternate ways depending upon the heat source material properties. If the heat

source is at a temperature much higher than that needed to produce the necessary extensive pyrolysis in the flavor source, then a thick insulator with a low thermal conductivity can be inserted in between the heat source and the flavor source. Alternately, if the heat source is not at such high temperatures, but only at a temperature which is only close to the pyrolysis temperature of the flavor source, then it would be necessary to couple most of the heat that is generated in the heat source directly to the flavor source. This can be accomplished by choosing a very thin insulator with high thermal conductivity or possibly even eliminating the insulator material altogether by positioning the flavor source in direct physical contact with the heat source. With either of the above alternatives, it is seen that the production of a "rich" or "full flavor" smoke can be achieved by varying the design parameters of the flavor generating unit. These parameters include, among others, the temperature of the heat source and the thickness and thermal conductivity of an insulating material positioned in between the heat source and the flavor source, if at all included in the design of the flavor generating unit.

As a second example, if it is desired to produce a smoke which is "lean," then the insulator material should be chosen so that the flavor source is not exposed to a temperature which would allow the tobacco elements of the flavor source to undergo extensive pyrolysis. In general, in the present invention, limiting the exposure of the flavor source to a low temperature can also be accomplished in two (2) alternate ways depending upon the heat source properties. If the heat source is at a temperature much higher than the combustion temperature of the flavor source, then a thick insulator with a low thermal conductivity should be inserted in between the heat source and the flavor source. Alternatively, if the heat source is not at such high temperatures, but only at a temperature which is close to or lower than the extensive pyrolysis temperature of the flavor source, then most of the heat that is generated in the heat source can be coupled directly to the flavor source without extensive pyrolysis of the flavor source. As a result, it is possible to choose a very thin insulator with high thermal conductivity or possibly even eliminating the insulator material altogether by positioning the flavor source in direct physical contact with the heat source. With either of the above alternatives, it is seen that the production of a "lean" smoke can be achieved by varying the design parameters of the flavor generating unit.

Above it was discussed how either a "rich" or a "lean" smoke could be achieved by the present invention. Of course, a quality of smoke in between these extremes is also achieved with the present

invention by varying the design parameters of the flavor generating unit. Furthermore, another advantage of the distributed nature of the flavor generating unit of the present invention is that a single flavor generating article can be "programmed" to have various qualities of puffs (i.e., both "rich" and "lean" puffs). An example of this type of embodiment can be explained with reference to FIGS. 8A and 8B. The embodiment of FIGS. 8A and 8B can be programmed to have the first five puffs of the flavor generating unit generate a "rich" smoke while the last four puffs could generate a "lean" smoke. This can be accomplished in various ways. First, the thickness of the insulator under the first five individual flavor source components can be small while the thickness under the last four components can be large. Second, the thermal conductivity of the insulator under the first five individual flavor source components can be large while the conductivity under the last four components can be small. Third, the combustion temperature of the heat source itself can be designed to be non-uniform down the distributed length of the source. For example, the heat source could be designed to have a high combustion temperature under the first five individual flavor source components while under the last four components the combustion temperature could be designed to be small. As discussed below with respect to another embodiment of the present invention, a fourth possibility for producing a high heat source temperature under the first five individual flavor source components and a lower one under the last four would be to incorporate a second insulator material under the back side of the heat source underneath the first five components.

The above discussion explains how the quality of the first five puffs of the flavor generating article could be "programmed" to be different than the last four in FIGS. 8A and 8B by changes in the design and geometry of the flavor generating unit. Of course the flavor generating unit could also be "programmed" so that the quality of each individual puff is different than the other puffs, if desired.

The preferred embodiments will now be discussed in detail in order to elaborate on the features of the present invention. It should be understood that these embodiments should not be interpreted to limit the present invention in any way.

A first preferred embodiment of a flavor generating article according to the present invention is shown in FIGS. 1-7. Flavor generating article 10 consists of an active element 11 and an optional expansion chamber tube 12, overwrapped by cigarette wrapping paper 14, and a filter element 13 attached by tipping paper 205. Wrapping paper 14 preferably is a cigarette paper treated to minimize thermal degradation, such as a magnesium oxide,

or other suitable refractory type, cigarette paper. As discussed in more detail below, active element 11 includes a distributed flavor generating unit 26 which includes a distributed heat source 20 and a distributed flavor source 21 which releases flavored vapors and gases when heated. Optionally, distributed flavor generating unit 23 includes an insulating material 24 to further control the heat transfer characteristics of the distributed flavor generating unit 26, as discussed in detail below. The vapors generated from flavor source 21 form an aerosol and pass into an optional expansion chamber tube 12 and mouthpiece element 13, and then into the mouth of a "smoker."

In the embodiment of FIGS. 1-7, distributed heat source 20 is substantially rectangular and flat in shape. Preferably, distributed heat source 20 has dimensions of width and length so that flavor generating article 10 has dimensions comparable to the diameter and length of a conventional flavor generating article, such as a cigarette. As such, its preferred dimensions should be about 50 mm long, about 7.4 mm wide, and about 2 mm thick. Distributed heat source 20 can be fabricated using any of the heat source materials and methods described in detail above.

In the embodiment of FIGS. 1-7, flavor source 21 is also substantially rectangular and flat in shape. Its width is comparable to the width of heat source 20 but has a length that is shorter than heat source 20 so as to offset heat source 20 from the flavor source 21. This "offset" exposes an area 206 of heat source 20 so that flavor source 21 does not combust upon lighting of flavor generating article 10. Flavor source 21 can be fabricated using any of the flavor source materials and methods described in detail above.

Given sufficient oxygen, as discussed in more detail below, heat source 20 will burn to produce mostly carbon dioxide. As also discussed below, radiant energy reflector sleeve 22 of active element 11 is substantially non-combustible, and does not burn during flavor generating of article 10. Further, article 10 is constructed in such a way that flavor source 21 is in thermal contact with distributed heat source 20 so that the temperature that flavor source 21 is exposed to is controlled by the design, geometry, and positioning of distributed heat source 20, flavor source 21 and, if included, insulator material 24. By controlling the design, geometry and positioning of these three elements, along with their position relative to radiant energy reflector sleeve 22, the heat transfer characteristics of distributed flavor generator unit 26 can be precisely controlled. As a result, the transfer of heat from heat source 20 into flavor source 21 can be regulated so that the temperature which flavor source 21 achieves can also be precisely con-

trolled. As such, the design and geometry of distributed flavor generator unit 26 can be chosen so that flavor source 21 undergoes either pyrolysis or combustion.

Turning to the details of the construction of article 10 in FIGS. 1-7, active element 11 is housed in an inner radiant energy reflector sleeve 22.

Distributed flavor generator unit 26 is held within inner sleeve 22 along its distributed length. Optional expansion chamber tube 12 with its inner sleeve 23 adds to the length of article 10 and thus article 10 has the appearance of an ordinary cigarette. Wrapper 14 holds active element 11 and expansion chamber tube 12 together. Preferably, cigarette wrapping paper 14 will have sufficient porosity to allow air to be admitted through paper 14 and radiant energy reflector sleeve 22 to support combustion of heat source 20.

Alternatively, paper 14 may be perforated, such as by laser perforation, in the region of radiant energy reflector sleeve 22 which surrounds heat source 20.

Preferably, aluminum insert 27, fitted in between active region 11 and expansion chamber tube 12, leaves only a plurality of orifices 28 for the passage of the hot vapors. Passage of hot vapors through plurality of orifices 28 causes the vapors to increase their velocity and then expand into expansion chamber tube 12. Expansion of the vapors and gases into the expansion chamber causes cooling of the saturated vapors to form a stable aerosol, thereby minimizing condensation on segments 29 and 200, increasing the delivery of aerosol to the "smoker." The degree of expansion, and therefore of cooling, may be controlled by varying the size and density of orifices 28 and the volume of expansion chamber 12. Aluminum insert 27 also serves as a heat sink so that radiated and convective heat from heat source 20 does not cause over heating/combustion of the tobacco filler in segment 200, if present, or the cellulose acetate filter plug 201.

Mouthpiece element 13 may be a hollow tube or may include segment 29. Mouthpiece element 13 preferably includes two segments 29 and 200. Segment 29 is a cellulose acetate filter plug 201 wrapped in plug wrap 202. Segment 200 is a rod of tobacco filler, wrapped in plug wrap 203, which, in addition to further cooling the aerosol and providing some filtration, may impart additional tobacco taste. The tobacco filler in segment 200 is preferably cut at the standard thirty (30) cuts per inch, but may be coarser to minimize filtration. For example, the tobacco filler may be cut at about fifteen (15) cuts per inch. The two segments 29 and 200 of mouthpiece element 13 are jointly overwrapped by plug wrap 204, and the entire mouthpiece element 13 is attached to the remainder of article 10 by tipping paper 205.

Returning to the structure of active element 11, heat-side space 39 is provided so that there is sufficient air flow to distributed heat source 20 to allow for sustained combustion and so that the amount of heat which is conducted to flavor source 21 is sufficient so as to allow flavor source 21 to achieve its desired temperature. For the former reason, radiant energy reflector sleeve 22 is perforated so as to allow air to pass through it. preferably, the open area and permeability of radiant energy reflector sleeve 22 should be large enough so that the permeability of air and oxygen through the composite of wrapping paper 14 and radiant energy reflector sleeve 22 is limited and controlled by the permeability of wrapping paper 14. Under these conditions, it would be mainly the permeability of wrapping paper 14 that would determine the mass burn rate of distributed heat source 20. In the alternative, if the open area and permeability of radiant energy reflector sleeve 22 is not so large, then the permeability of the combination of sleeve 22 and wrapping paper 14 would be a function of the individual permeabilities of sleeve 22 and wrapping paper 14 and would not be limited by permeability of wrapping paper 14.

Which ever air permeability design is chosen, it is desirable for article 10 to provide about ten (10) puffs under FTC conditions (i.e., a two-second, thirty-five milliliter puff taken once a minute). If the mass burn rate of distributed heat source 20 is too high, each puff taken by a "smoker" will deliver added flavor because the amount of heat reaching distributed flavor source 21 will be enhanced. This enhancement occurs as a result of distributed heat source 20 emitting heat over a broader area than with smaller mass burn rates. As a result of this broader area of emission of heat, distributed flavor source 21 will also generate flavor over a broader area. Since more of heat source 20 is consumed in each puff, heat source 20 may be consumed in fewer than ten (10) puffs. Similarly, if the mass burn rate is too low, more than ten (10) puffs will be available, but each of these puffs will deliver less flavor because the flavor in the flavor source, at the burn front, will be depleted. In addition, if the mass burn rate is too low, heat source 20 may extinguish before the "smoker" is ready to take another puff.

In order to minimize radiative heat loss from article 10, all inner surfaces of active element 11 should preferably have the ability to reflect heat so that the inner walls of active element 11 do not absorb large amounts of heat and heat up. For example, radiant energy reflector sleeve 22 can be made from metallized paper. More preferably, as seen in FIGS. 6 and 7, radiant energy reflector sleeve 22 is made up of a paper layer 70 and inner foil layer 71. Foil layer 71 reflects heat radiated by

heat source 20 to keep it hot and thus to ensure that it does not cool down below its ignition temperature and become extinguished.

Paper layer 70 may be made by spiral winding a paper strip or using other well-known techniques of paper tube making. Preferably, however, paper layer 70 and foil layer 71 are passed together through a garniture, similar to that used in the making of conventional cigarettes, which forms them into a tube. In that preferred embodiment, the edges of paper layer 70 is either porous or perforated, so that the required permeability, referred to above, can be achieved. Foil layer 71 is preferably made by taking a standard 1 to 10 mil aluminum foil, embossing it to provide raised holes, and then calendaring it to flatten the holes so that the perforated foil is more nearly smooth. Although calendaring closes up the holes somewhat, the desired permeability can be achieved by taking this effect into account when the foil is embossed.

Although foil layer 71 reflects a substantial portion of the heat produced by heat source 20, some of the heat may be absorbed and therefore will be conducted through foil layer 71 to paper layer 70. For that reason, the paper used in paper layer 70 preferably is modified to prevent combustion so that it does not ignite when article 10 is "smoked." Furthermore, if desired, paper layer 70 can also include (not shown in figures) up to three layers of a paper treated to reduce thermal degradation, such as magnesium oxide, or other suitable refractory type, cigarette paper.

In a most preferred embodiment, in order to minimize radiative heat loss from article 10, radiant energy reflector sleeve 22 can be comprised of a single perforated aluminum sleeve. Its inside walls should be reflectorized so that its ability to reflect heat is maximized.

Air chamber 12 includes air chamber sleeve 23 which preferably is not perforated. It can be constructed out of heavy paper or the same material which radiant energy reflector sleeve 22 is made of. Since the inner walls of air chamber sleeve 23 are not exposed directly to heat source 20, it is less critical that air chamber sleeve 23 has to be designed with thermal degradation considerations in mind, in contrast to radiant energy reflector sleeve 23.

Finally, active element 11 is provided with a reflective end cap 15 which clips into radiant energy reflector sleeve 22 but is covered by wrapper 14. Cap 15 has one or more opening 16 which allow air into active element 11. Opening 16 preferably is located at the periphery of cap 15. In the preferred embodiment, there are six equiangular spaced openings 16 each having a diameter of eighty (80) mils. Cap 15 increases the reflection of radiation back into active element 11, and also

keeps heat source 20 from falling out of article 10 if it somehow becomes loose. This is important when it is considered that heat source 20 smolders at a high temperature between puffs, and is even hotter during puffs. Cap 15 also keeps in any ash that may form during burning of heat source 20.

It is preferred that article 10 have an outer diameter of about 7.9 mm, similar to a conventional cigarette. Heat source 20 preferably has a width of about 7.4 mm and a length of about 40 mm, while active element 11 preferably has an overall length of about 50 mm. Mouthpiece element 13 preferably has a length of 21 mm, divided between a 10 mm cellulose acetate filter portion segment 29 and an 11 mm tobacco rod portion segment 200. Expansion chamber tube 12 preferably is about 29 mm long, so that article 10 overall is about 100 mm long, which is comparable to a conventional "long-size" cigarette.

The embodiment of FIGS. 1-7 has a distributed flavor generating unit 26 with a single continuous distributed flavor source 21 which sits on top of a single continuous distributed insulator material 24, if such a material is included in the design of article 10. However, in another preferred embodiment, the distributed flavor source can be comprised of a plurality of individual flavor source components. In such an embodiment each individual charge represents one puff of the article. This type of preferred embodiment is illustrated in FIGS. 8A and 8B where the distributed flavor generating unit 226 is comprised of single continuous distributed heat source 220, single continuous distributed insulator material 224 of width W_{IN} and a plurality of individual flavor source components 221 with a contact width of W_{CA} . This embodiment also has an "offset" area 299 on the ignition end of heat source 220 so that the first flavor source charge 221 closest to the ignition end of distributed flavor generating unit 226 does combust upon lighting of flavor generating article 10.

Another preferred embodiment of a flavor generating article according to the present invention is shown in FIG. 10A. The figure only shows a portion of a flavor generating article, active element 311. Such active element could be incorporated into the flavor generating article depicted in FIGS. 1-7 above, which were described in detail. One would simply have to replace active element 11 of FIGS. 1-7 with active element 311 of FIG. 10A.

Active element 311 includes distributed continuous flat heat source 320, distributed flavor source 321, flavor source holder 331 and perforated sleeve 322. In the embodiment of FIG. 10A, distributed heat source 320 is substantially rectangular in shape as in heat source 21 of FIGS. 1-7. Preferably, distributed heat source 320 has dimensions of width and length so that the flavor generat-

ing article in which it is incorporated has dimensions comparable to the diameter and length of a conventional flavor generating article, such as a cigarette. Its preferred dimensions should be about 50 mm long, about 7.4 mm wide, and about 2 mm thick. Distributed heat source 320 can be fabricated using any of the heat source materials and methods described in detail above.

In the present embodiment, distributed flavor source 321 is comprised of a plurality of individual flavor source components. These individual components can exist on one side of heat source 320, as was the case for the embodiment depicted in FIGS. 8A-8B, or can exist on both sides of distributed heat source 321, as depicted in FIG. 10A. The flavor source material that the individual components are composed of can be chosen from any of the flavor source materials described in detail above, but preferably the components are composed of pelletized tobacco, as discussed above.

The individual flavor source components are held in place by flavor source holder 331. FIG. 10A depicts a plurality of "air gaps" 324 in between heat source 320 and flavor source holder 331. These air gaps serve the same purpose that the insulator 24 serves in the embodiment of FIGS. 1-7. The function of the insulating air gap is to control and regulate the heat transfer properties of the flavor generating unit of the flavor generating article. As discussed in detail above, larger insulator thicknesses (i.e., larger air gaps) reduce the temperature that the flavor source is exposed to, and consequently reduce the potential for combustion of the tobacco elements in the flavor source. In the embodiment of FIG. 10A the size of the air gap (i.e., the thickness of the insulator substance) can be reduced to zero by simply allowing flavor source material 321 to come into direct contact with heat source 320. This type of design can be achieved by simply eliminating that portion of flavor source material holder 331 that exists adjacent to the insulating air gap 324.

FIGS. 10B and 10C show two possible embodiments of flavor source holder 331 where the size of the insulating air gap is zero (i.e., flavor source material is in direct physical contact with the heat source). FIG. 10B shows an embodiment with perforations in side wall 332 of flavor source holder 331B. FIG. 10C shows an embodiment without perforations in side wall 333 of flavor source holder 331C. Both figures include perforated sleeve 322 which preferably has a permeability so large that when the sleeve is incorporated into a flavor generating article similar to that in FIGS. 1-7, the permeability of the outer wrapping paper (14 in FIGS. 1-7) will limit the permeability of the composite structure. The presence or absence of perforations in flavor source holder 321 will influence

flavor delivery to the consumer. The density of perforations should be chosen so that flavor delivery is optimized, depending upon the specific geometry and materials of which active element 311 are composed. Since the perforation density will also influence the mass burn rate of heat source 320, the specific optimized density will also depend upon the structure of heat source 320. One of ordinary skill in the art would adjust the perforation density of flavor source holder 331 in the same manner that the permeability is adjusted in the composite wrapping paper and outer sleeve in other forms of flavor generating articles.

Flavor source holder 331 and perforated sleeve 322 can be formed of thermally stable paper treated to minimize thermal degradation as discussed above with respect to the embodiment depicted in FIGS. 1-7, or more preferably, can be formed from aluminum preferably about 1 to 2 mils thick.

In the present embodiment, the width of the contact area of the flavor source holder (labelled W_{CA} in FIG. 10A) facing heat source 320 can also be varied in addition to the "air gap" between the heat source and flavor source. This aspect of the present invention is depicted in FIGS. 11A and 11B, where embodiments with a large and a small contact area, respectively, are shown. Included in FIGS. 11A and 11B are conceptual flavor delivery profiles associated with the flavor generating units. In the FIG. 11A embodiment, a flavor source holder with a larger width of contact area, W_{CA} , than in FIG. 10A is shown. In the FIG. 11B embodiment of the present invention, the width of contact area has been reduced to a point where the pellets of the flavor source do not come into direct physical contact with the distributed heat source. As a result of reducing the contact area, extensive pyrolysis of the flavor source pellets closest to the heat source is less likely in the design of FIG. 11B in comparison to the designs of FIGS. 10A-10C and 11A. Because of this effect, reducing the width of the contact area serves the same purpose as inserting an insulator in between the flavor source and heat source: to control and regulate the heat transfer properties of the flavor generating unit and to reduce the temperature that the majority of the flavor source material is exposed to.

A second aspect of the effect of varying the width of the contact area of the present invention is that it allows the quantity of flavor delivered to the consumer in a single puff to be precisely controlled. This added benefit of the present invention is conceptually depicted underneath the embodiments of the flavor generating units in FIGS. 11A and 11B, where delivery of flavor to the consumer is plotted against time as the combustion front moves down along the distributed heat source in the D_{CF} direction. For smaller contact areas (i.e.,

smaller contact times), as shown in FIG. 11B, the total delivery of flavor (the integrated area under the relative flavor delivery curves) is smaller than with larger contact areas (i.e., larger contact times), as shown in FIG. 11A.

It should be pointed out that this type of individual puff control discussed herein is not possible in non-distributed designs where the heat transport characteristics of the flavor generating article are uni-dimensional since D_{CF} and D_{FS} , as discussed above, are in the same direction.

FIGS. 10A, 11A and 11B show how the design of the flavor source holder can be varied in an embodiment of a flavor generating article of the present invention with a distributed continuous flat heat source. In a further embodiment of the present invention, the distributed heat source can be cylindrical. Such an embodiment is shown in FIGS. 12A-12C, where, analogously with FIGS. 10A, 11A and 11B, the width of the contact area, W_{CA} , is also varied. The inner radius of cylindrical heat source 420 should be designed in the same manner that the heat source of the other embodiments of the present invention are designed. As discussed above, the inner heat space 439 should be large enough so that sufficient oxygen is present inside cylindrical heat source 420 so that the heat source does not extinguish in between puffs. Furthermore, it should not be so large that the propagation of the combustion front down heat source 420 is too fast.

Further embodiments of the present invention are shown in FIGS. 13A and 13B where flat-ladder-type of distributed heat sources are depicted. In this embodiment, active element 511 includes distributed flat-ladder heat source 520 and perforated sleeve 522. Flat-ladder heat source includes left leg 520B and right leg 520A. These two legs are connected by rung 520STP. FIG. 13B depicts four embodiments (I, II, III and IV) of the cross section of rung 520STP along line A-A of FIG. 13A. In embodiment I of FIG. 13B, rung 520STP includes left leg 520B and right leg 520A which are connected by heat source rung 520C. Preferably, these three components comprise a one-piece heat source, as opposed to a heat source where parts 520B, 520A and 520C are attached together after fabrication of the individual parts. Included on one side of heat source rung 520C is individual flavor source charge 521.

In embodiment II of FIG. 13B, heat source rung 520C is bounded on one side with individual flavor source charge 521 and on the opposite side with individual insulator material 524 of width W_{IN} . The insulator material serves the same purpose of regulating and controlling the heat transport properties of the flavor generating unit as did the insulator material in FIGS. 1-8 and the "air gap", in the discussion surrounding FIGS. 10-12 above.

In embodiment III of FIG. 13B, heat source rung 520C is bounded on both sides with flavor source material: on the top side of the rung is individual flavor source charged 521A, while on the opposite side is individual flavor source charge 521B.

In embodiment IV of FIG. 13B, heat source rung 520C includes individual flavor source charge 521 which is separated from the rung by individual insulator material 524 of width W_{IN} .

Another embodiment of the present invention is shown in FIGS. 14A-14C. This embodiment includes distributed cylindrical heat source 620, distributed mono-layer flavor source 621, flavor source holder 631 and perforated sleeve 622. Distributed flavor source 621 is in thermal contact with distributed cylindrical heat source 620. An air gap 624 of width W_{IN} between heat source 620 and flavor source 621 serves the purpose of an insulator so as to control and regulate the transfer of heat to flavor source 621 from heat source 620. FIG. 14B is a cross section of FIG. 14A at A-A, whereas FIG. 14C is a cross section of FIG. 14A at B-B. As can be seen from the cross-section, flavor source 621 comprises a thin mono-layer of flavor source pellets where the distance of separation between perforated sleeve 622 and insulating air gap 624 is small. Such a thin layer results in extremely efficient heat transfer from the heat source to the outer edge 621E of flavor source 621 and therefore a higher quality puff.

The following specific example is intended to illustrate an embodiment of the present invention.

Example I

A 7 mm wide, 60 mm long, 0.30mm thick carbon heat source was coated with a calcium carbonate paste. The paste was prepared by mixing 2% CMC (carboxymethyl cellulose), 40% CaCO_3 , and 58% water. The paste was coated and after drying was 0.38 mm thick and 3 mm in width along the length of the carbon heat source. A tobacco mixture composed of 6.2% glycerin, 1.2% pectin, 2.4% wheat starch, 31.5% tobacco and 58.5% water was coated over the CaCO_3 surface and dried. The laminated structure was ignited and the heat transfer to the tobacco was sufficient for generation of an aerosol without combustion of the tobacco.

One skilled in the art will appreciate that the present invention can be practiced by other than the described embodiments and examples, which are presented for purposes of illustration only.

For example, with a continuous, cylindrical and hollow heat source, as shown at 420 in Figs. 12 A-C, the distributed flavor source may be a continuous cylindrical and monolayer flavor source.

Claims

1. A flavor generating unit for incorporation into a flavor generating article, comprising a combustible heat source (20 etc) and a flavor source (26 etc) disposed in heat transfer relationship with the heat source, characterized in that: the heat source is a distributed heat source and the flavor source (21 etc) is a distributed flavor source in thermal contact with the distributed heat source, such that after initial generation of heat at a first end of the heat source a combustion front propagates in a first direction (D_{CF}) towards a second end of the heat source and heat is transferred to the flavor source in a second direction (D_{FS}) distinct from the first direction.
2. The flavor generating unit of claim 1 wherein the distributed heat source (220, 320, 420) is continuous and flat.
3. The flavor generating unit of claim 2 wherein the distributed heat source (20) and distributed flavor source (21) are both continuous and flat and wherein the flavor source is in intimate physical contact with the heat source along a flat side extending in the first direction.
4. The flavor generating unit of claim 1 wherein the distributed heat source (420) is continuous, cylindrical and hollow.
5. The flavor generating unit of claim 4 wherein the distributed heat source is (420) is continuous, cylindrical and hollow and wherein the distributed flavor source is a continuous, cylindrical and monolayer flavor source.
6. The flavor generating unit of claim 1, 2 or 4 wherein the distributed flavor source comprises one or more individual flavor source components (221, 321, 421, 521).
7. The flavor generating unit of claim 6 wherein each individual flavor source (321) component comprises a contact area adjacent to the heat source (320) which regulates the heat transfer properties of the flavor generating unit.
8. The flavor generating unit of claim 6 or 7 wherein the distributed heat source (520) has a flat-ladder conformation and wherein the individual flavor source components (521) are positioned on the individual rungs (520C) of the ladder.

9. The flavor generator of claim 6, 7 or 8 wherein the individual flavor source components (221, 321, 421, 521) each generate flavor-containing substance corresponding to substantially a single puff of the flavor generating article. 5
10. The flavor generating unit of any preceding claim, further comprising an insulating substance (24, 224, 324, 524) in thermal contact with the distributed heat source (20, 220, 320, 520), which regulates the heat transfer characteristics of the flavor generating unit. 10
11. The flavor generating unit of claim 2 comprising a distributed heat source (20), a distributed flavor source (21) and an insulating substance (24) which are all continuous and flat, wherein the distributed flavor source is in intimate physical contact with one flat side of the insulating substance and the distributed heat source is in intimate physical contact with the second flat side of the insulating substance. 15 20
12. The flavor generating unit of any preceding claim wherein the distributed flavor source (21 etc) comprises pelletized tobacco containing an aerosol-forming ingredient and a filler. 25
13. A flavor generating article having an end for reception by the mouth and having at its distal end, remote from but in fluid communication with the mouth end, a flavor generating unit according to any preceding claim. 30

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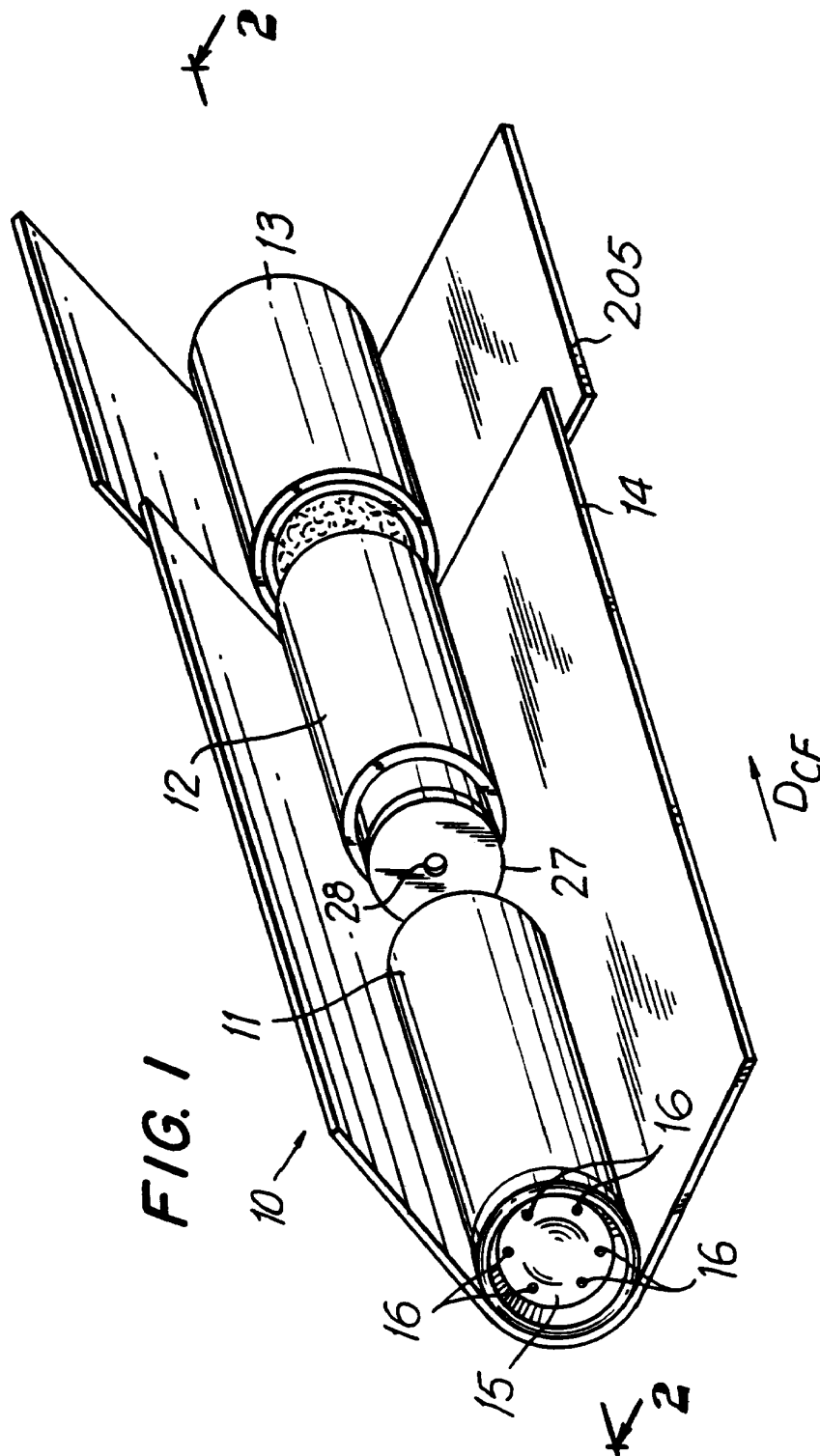
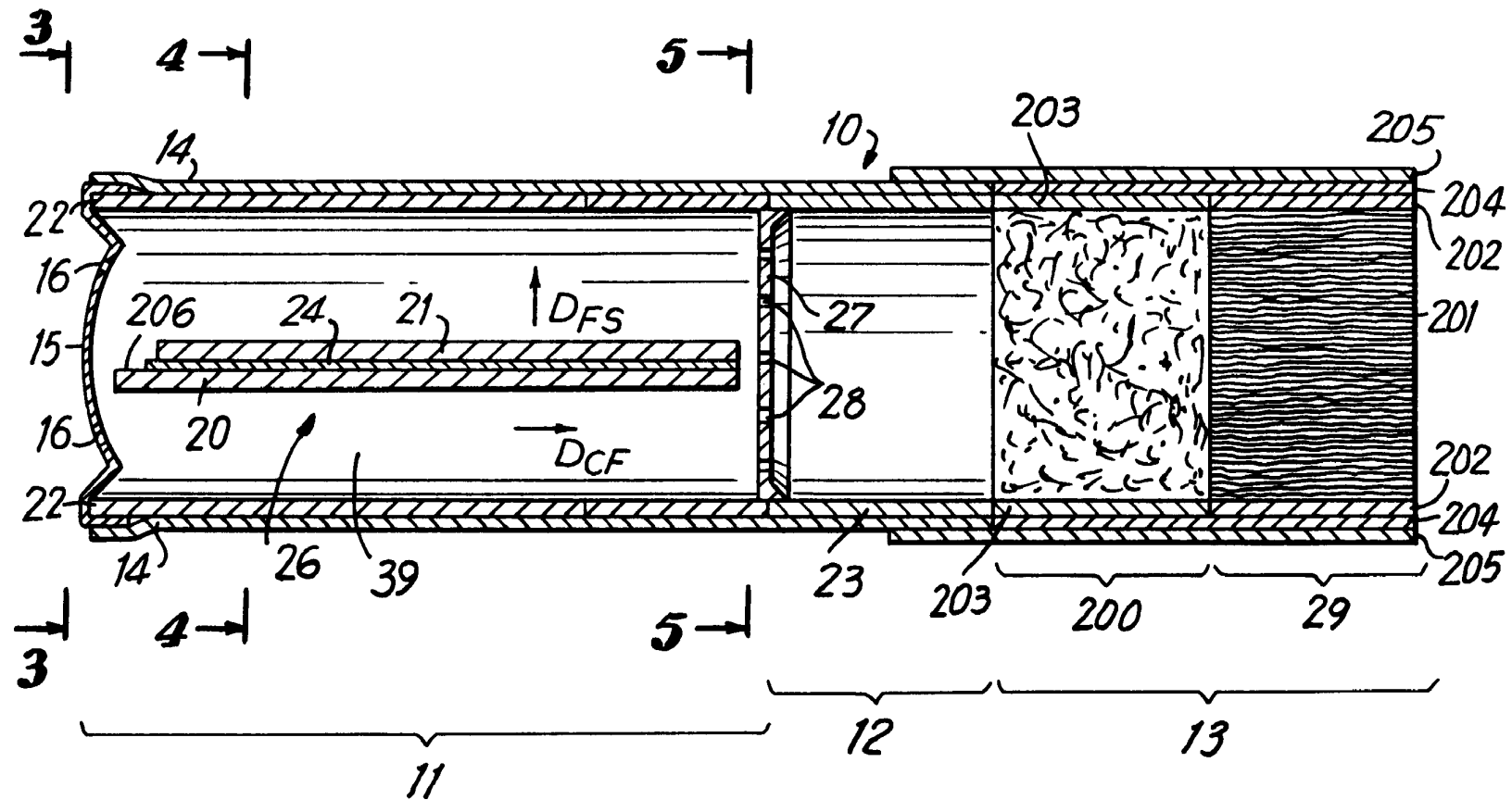


FIG. 2



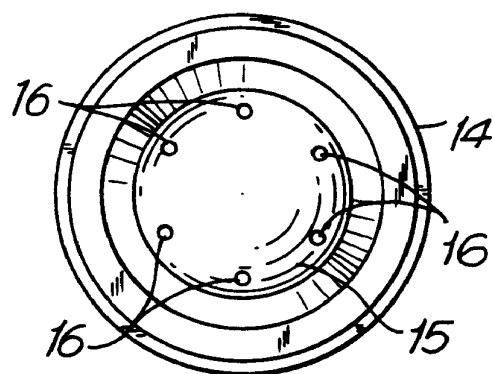


FIG. 3

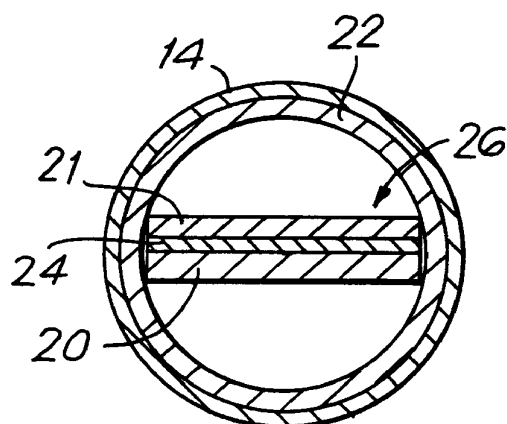


FIG. 4

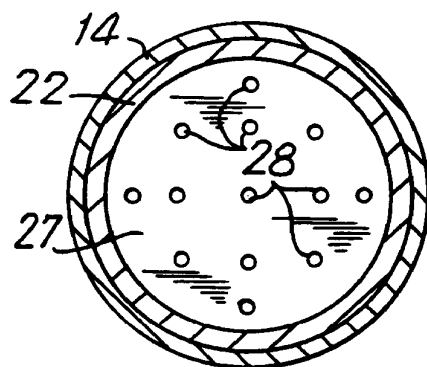


FIG. 5

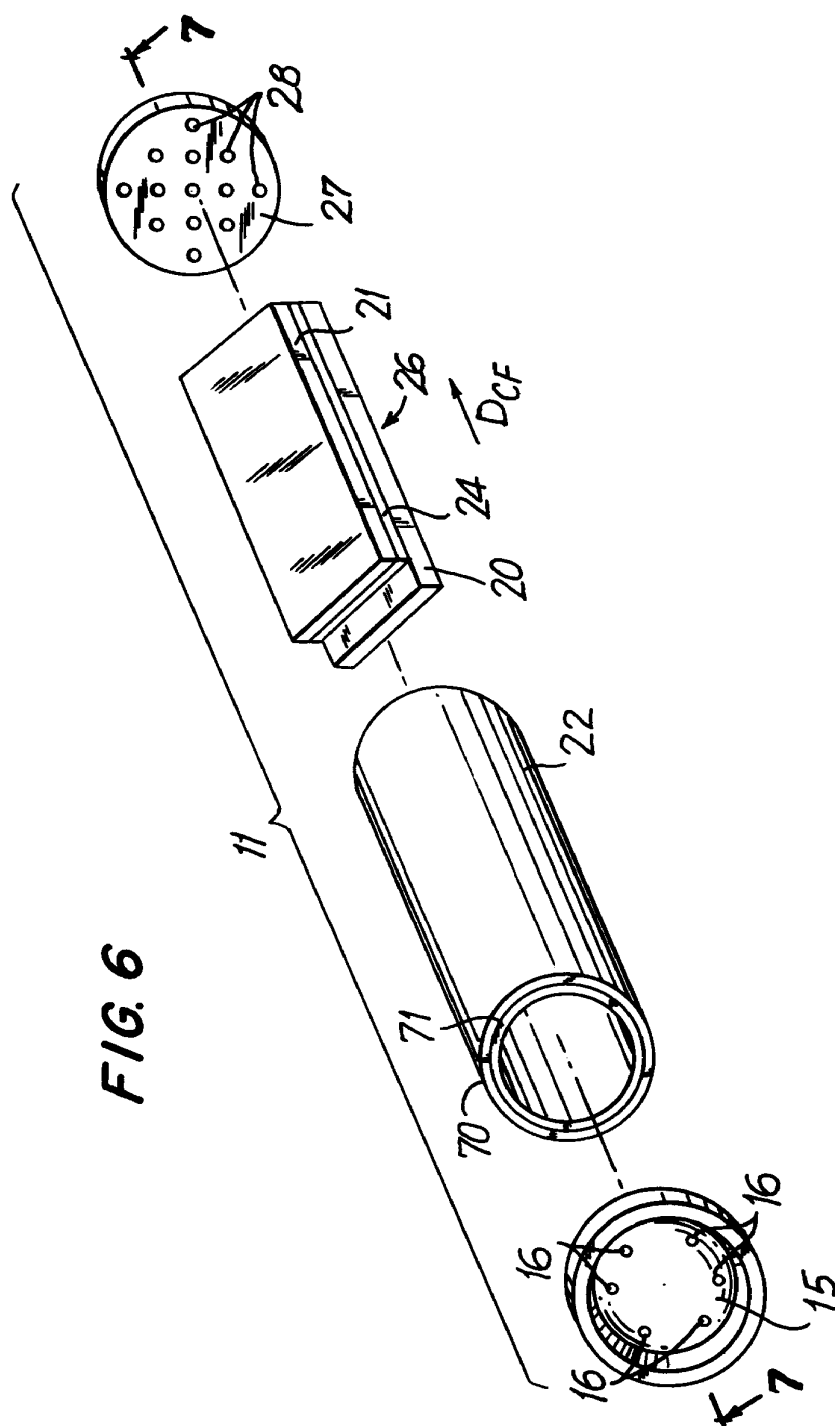
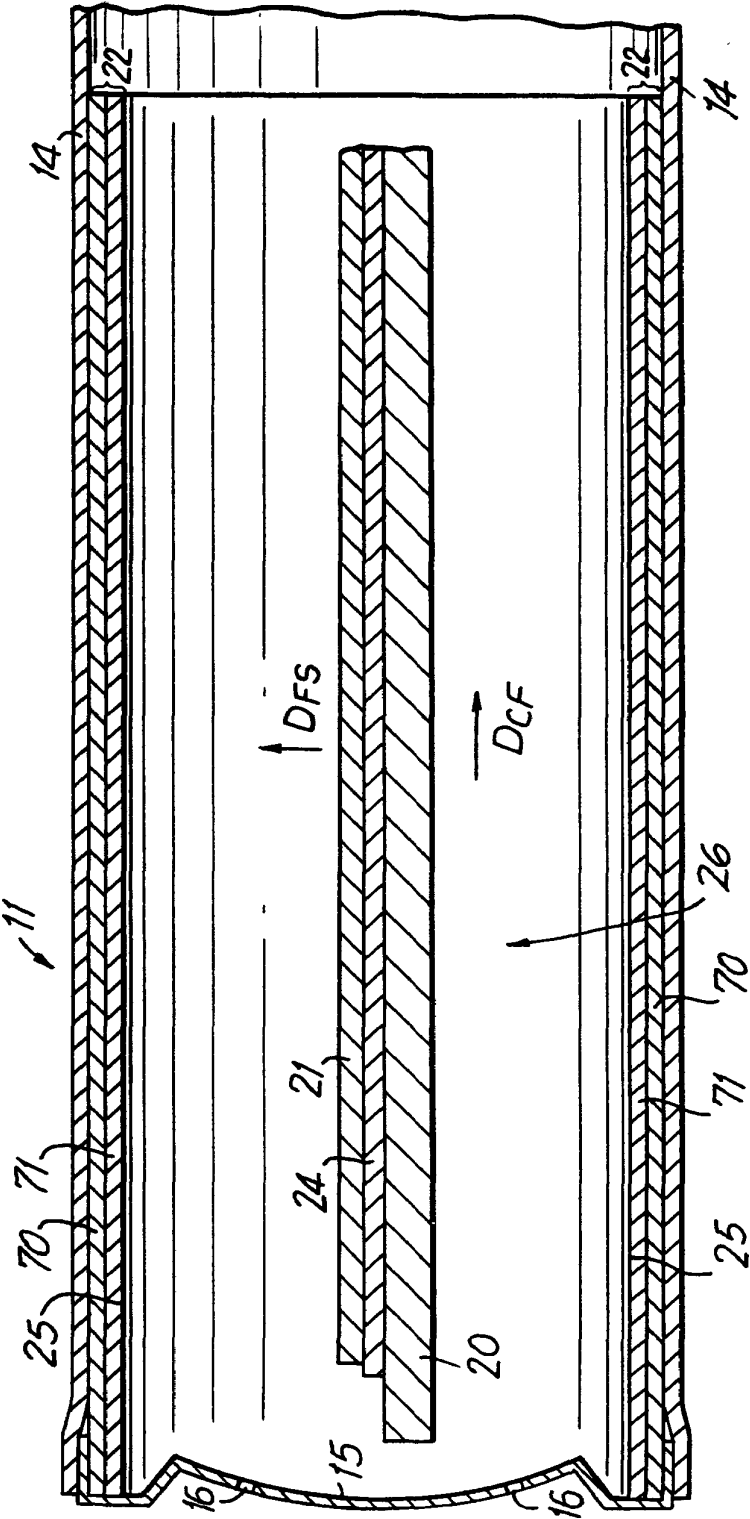


FIG. 7



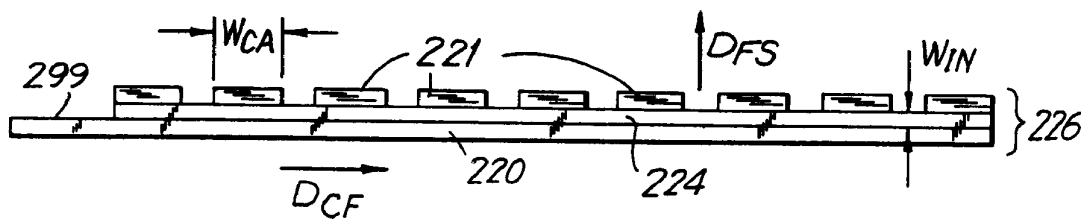


FIG. 8A

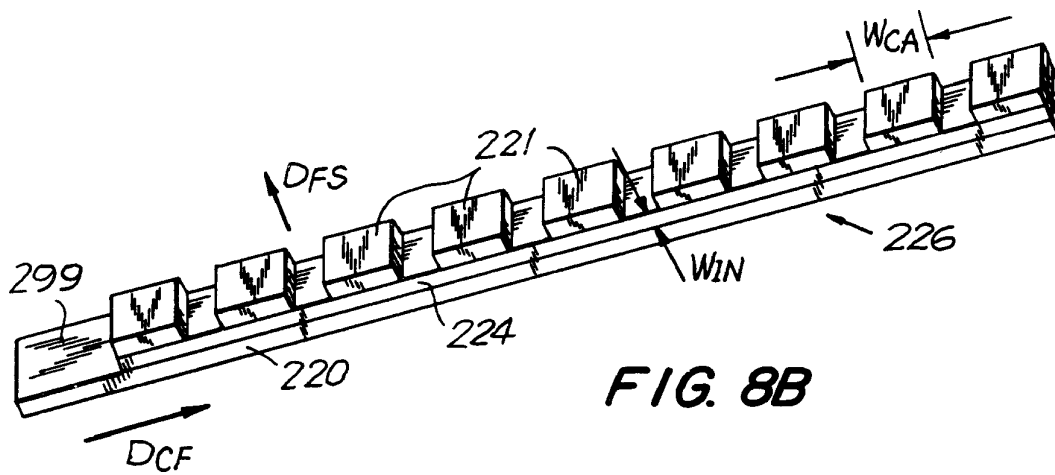
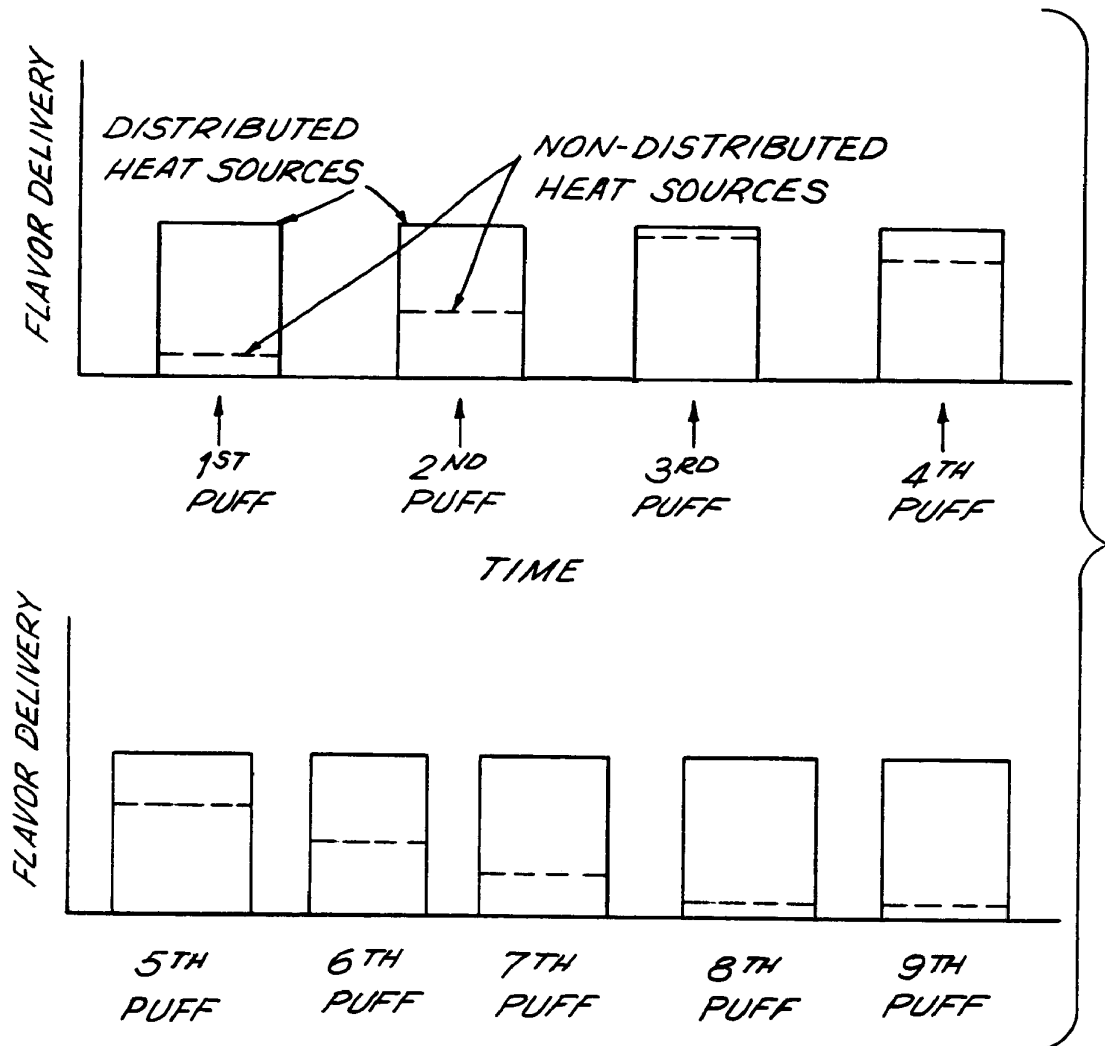


FIG. 8B

FIG. 9



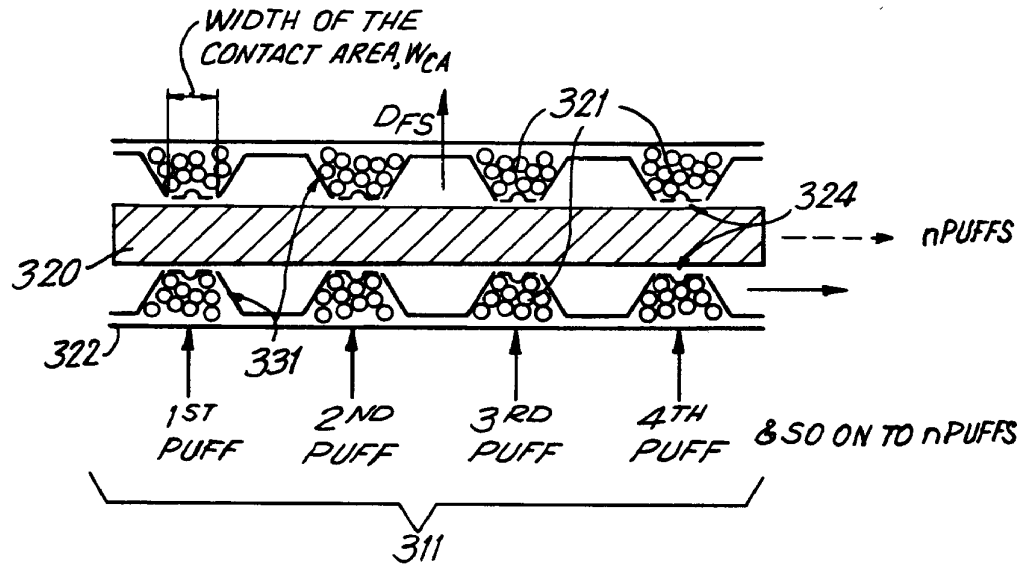


FIG. 10A

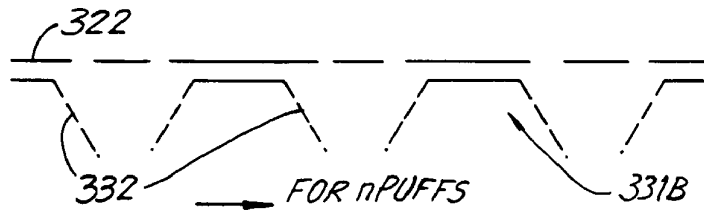


FIG. 10B

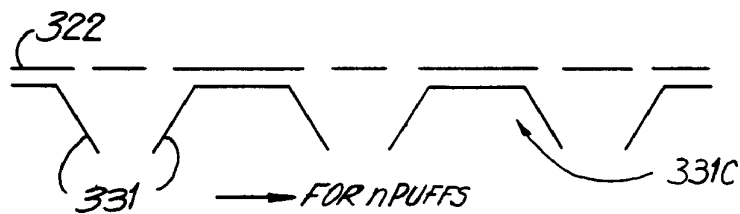


FIG. 10C

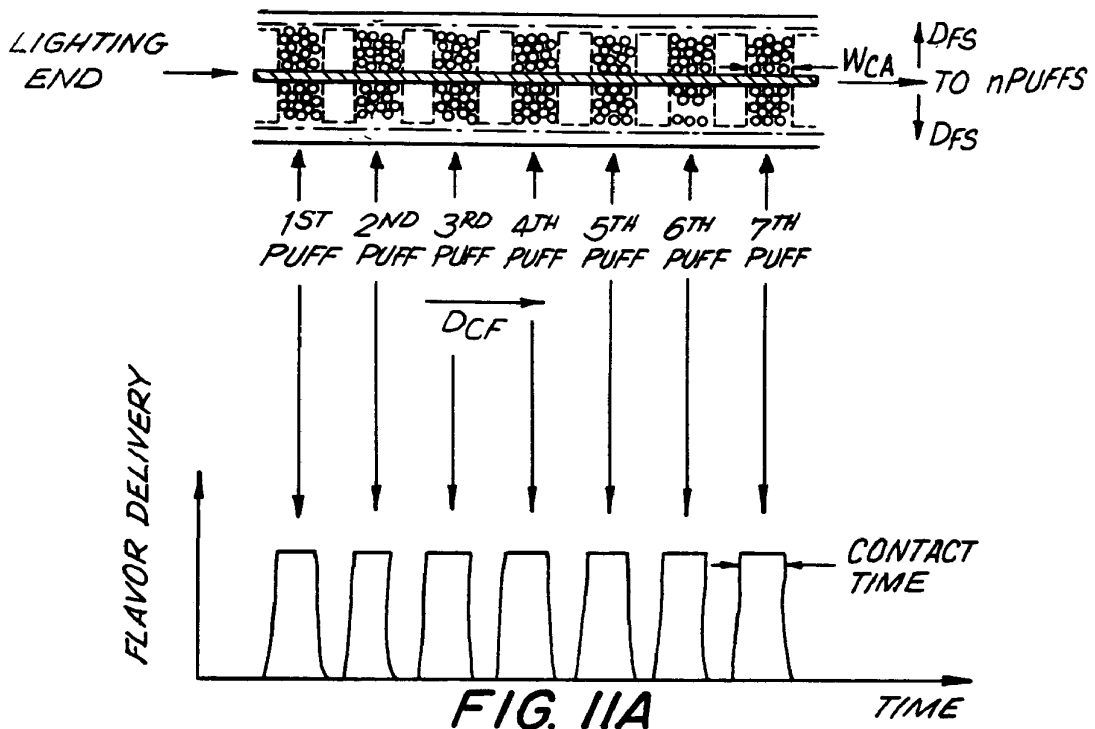
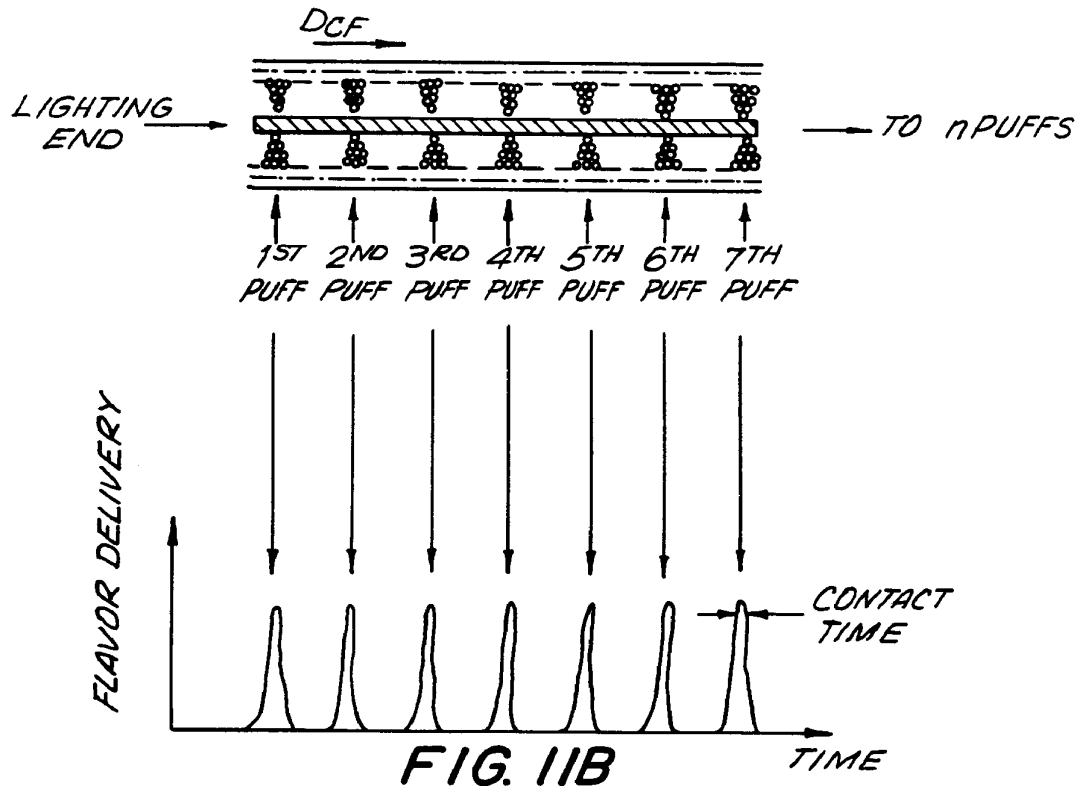


FIG. 12A

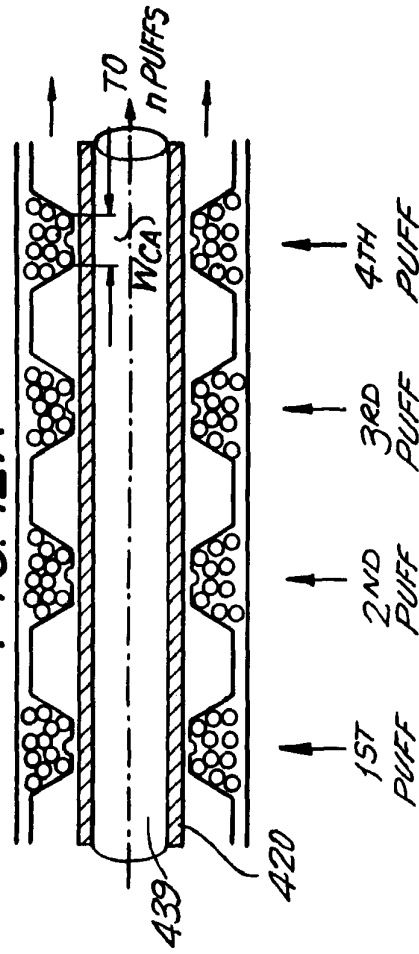


FIG. 12B

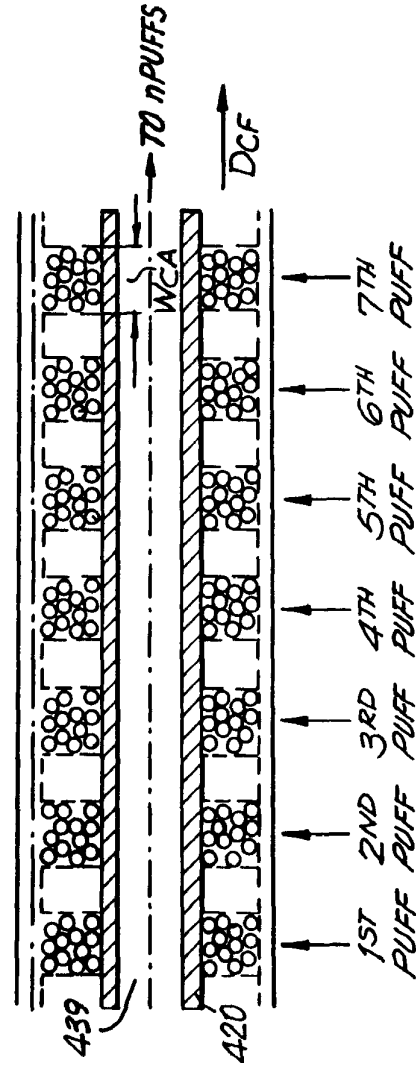
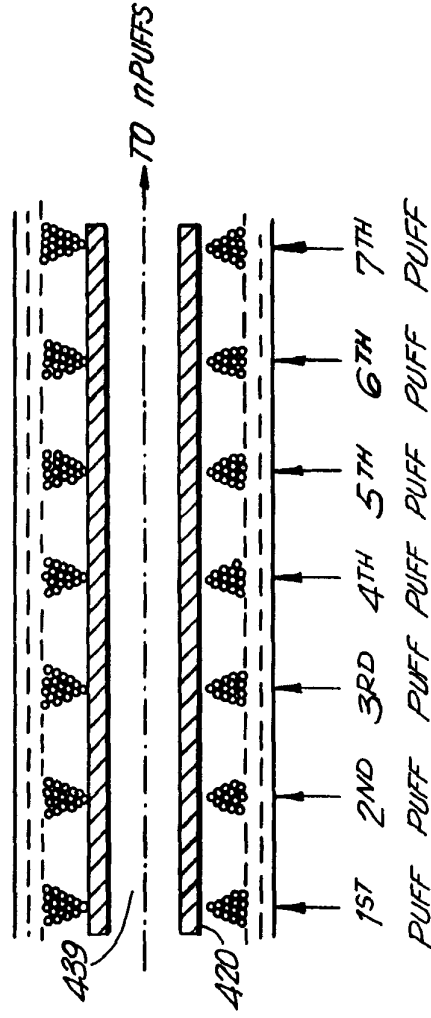
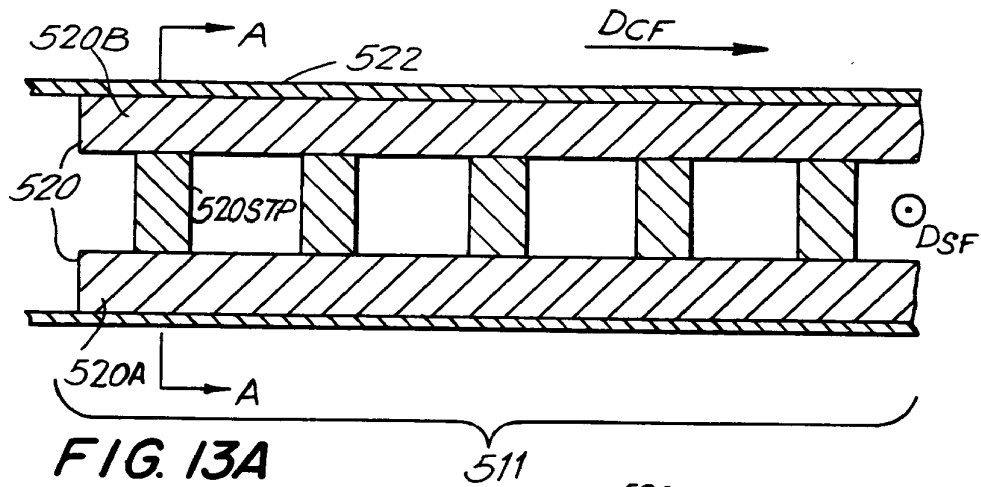
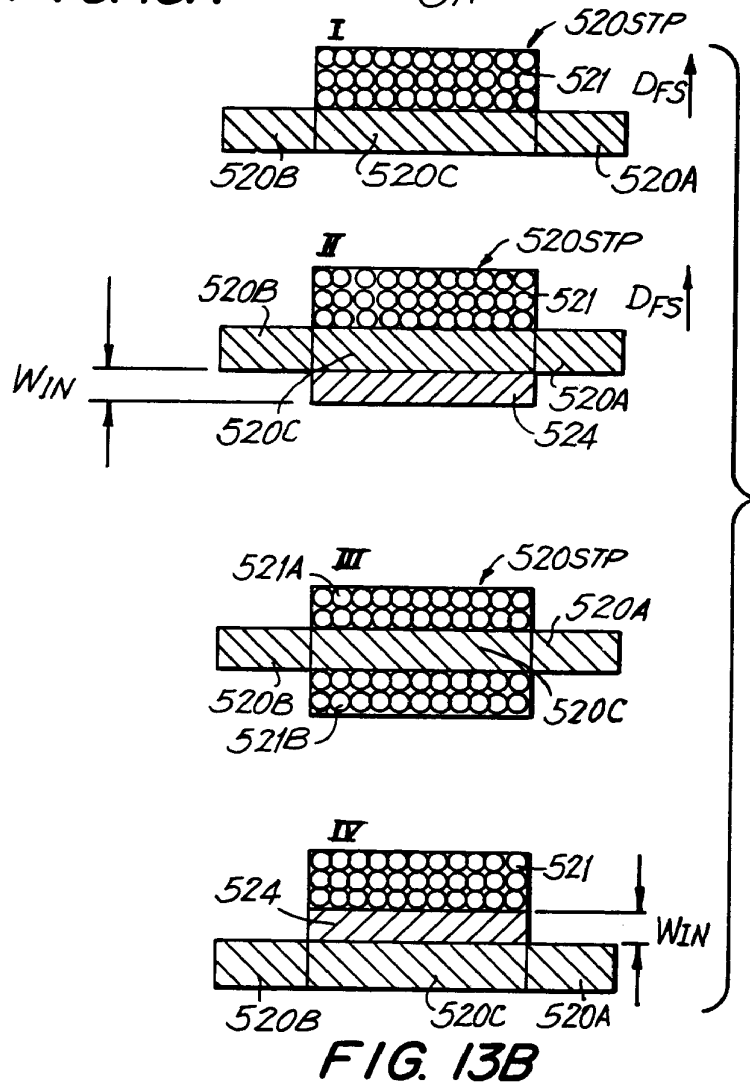


FIG. 12C





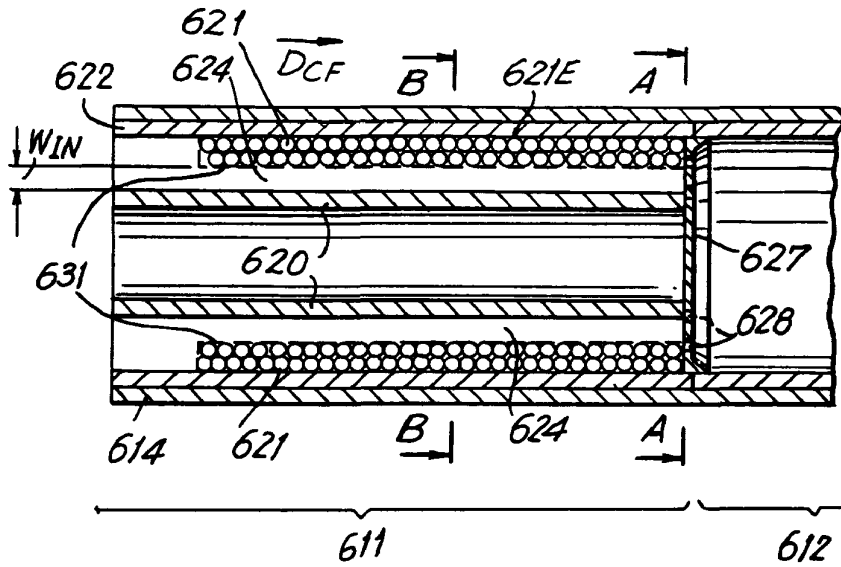


FIG. 14A

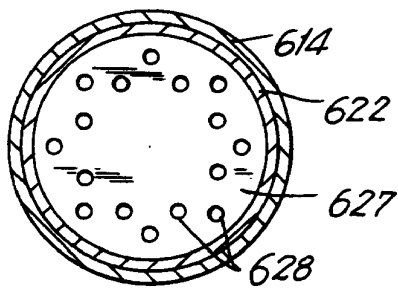


FIG. 14B

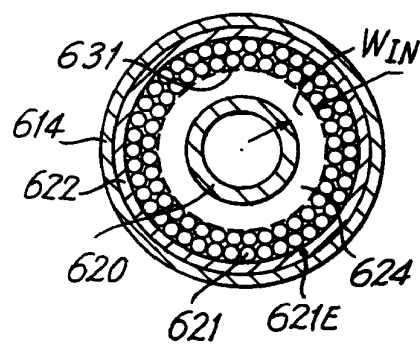


FIG. 14C



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 30 7710

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-A-3 910 899 (B.A.T. CIGARETTENFABRIKEN GMBH) * the whole document *	1,4,10,13	A24F47/00
X	EP-A-0 264 195 (IMPERIAL TOBACCO LIMITED) * the whole document *	1,4,13	
X	EP-A-0 245 732 (R.J. REYNOLDS TOBACCO COMPANY) * page 6, line 23 - page 8, line 18; figure 1 *	1,4	
A	FR-A-1 388 144 (BATTELLE MEMORIAL INSTITUTE) * page 5, left column, line 48 - right column, line 3; figure 8 *	6,7,9	
A	EP-A-0 430 566 (PHILIP MORRIS PRODUCTS INC.) * abstract; figure 2 *	6,7,9	
A	EP-A-0 405 190 (R.J. REYNOLDS TOBACCO COMPANY)		TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	GB-A-2 229 349 (BROWN & WILLIAMSON TOBACCO CORPORATION)		A24F A24B

The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 30 NOVEMBER 1992	Examiner RIEGEL R.E.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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Publication number: **0 535 695 A2**

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Smoking article with carbon monoxide oxidation catalyst.

The present invention relates to a cigarette-like smoking article which is capable of producing substantial quantities of aerosol, both initially and over the useful life of the product, without significant thermal degradation of the aerosol former and without the presence of substantial pyrolysis or incomplete combustion products or sidestream aerosol.

Embodiments of the present smoking article comprise a combustible fuel element, a physically separate CO oxidation catalyst attached adjacent to the fuel element, a physically separate aerosol-generating means including an aerosol forming material attached adjacent to the catalyst in conductive heat exchange relationship with the fuel element, and a means for delivering the generated aerosol to the user.

The articles of the present invention provide the user with the taste, feel, and aroma associated with the smoking of conventional cigarettes without burning tobacco. The CO oxidation catalyst substantially decreases the level of CO inhaled by the user of such an article, by oxidizing the CO created by the burning fuel element to CO₂.

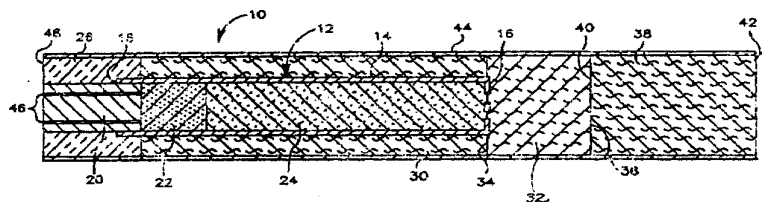


FIG. 1

EP 0 535 695 A2

Background of the Invention

The present invention relates generally to smoking articles, and more particularly, but not by way of limitation, to smoking articles comprising means for oxidation of CO.

Smoking articles have been disclosed which employ an aerosol-producing apparatus to simulate tobacco smoke. Generally, such articles comprise a small, high density combustible fuel element in conjunction with a physically separate aerosol-generating means. Generally, a heat conducting member is utilized, such as a metal conductor, which contacts both the fuel element and aerosol-generating means to transfer heat from the burning fuel element to the aerosol-generating means.

A problem with these articles is the high level of carbon monoxide which exists in the aerosol. This large amount of carbon monoxide is a result of incomplete combustion, which is caused by the burning carbonaceous fuel element. The level of carbon monoxide in the smoke of cigarettes and cigarette substitutes is a known concern in the tobacco industry.

Summary of the Invention

It is an object of this invention to provide a product, such as, for example, a smoking article which is capable of producing substantial quantities of aerosol, both initially and over the useful life of the product, while also producing significantly reduced quantities of carbon monoxide.

It is a further object of this invention to reduce potential health hazards in smoking.

In accordance with this invention there is provided an apparatus for producing aerosol comprising a combustible fuel element, a quantity of CO oxidation catalyst, and aerosol-generating means. In accordance with another aspect of this invention there is provided a cigarette-type smoking article comprising a combustible fuel element, a quantity of CO oxidation catalyst, aerosol-generating means, and means for delivering the generated aerosol to the user.

The present invention is described in greater detail in the accompanying drawings and in the detailed description of the invention which follow.

Brief Description of the Drawings

Figure 1 is a longitudinal cross-sectional view of a smoking article constructed in accordance with the invention.

Figure 2 is an enlarged, partial left side elevation view of the smoking article of Figure 1 more clearly illustrating the preferred fuel element passageway configurations.

Figure 3 is an elevation view similar to Figure 2 illustrating a second fuel element passageway configuration.

Figure 4 is an elevation view similar to Figure 2 illustrating a third fuel element passageway configuration.

Figure 5 is a longitudinal cross-sectional view of a smoking article constructed in accordance with a second embodiment of the invention.

Figure 6 is a longitudinal cross-sectional view of a smoking article constructed in accordance with a third embodiment of the invention.

Figure 7 is an enlarged partial longitudinal cross-sectional view more clearly illustrating the aerosol-production assembly employed in the embodiments of Figure 1, Figure 5 and Figure 6.

Figure 8 is an enlarged elevation view taken along line 8-8 of Figure 7.

Figure 9 is an enlarged longitudinal cross-sectional view of an alternative form of metallic containers suitable for use in the assembly of Figure 7.

Figure 10 is a cross-sectional view taken along line 10-10 of Figure 9.

Figure 11 is an enlarged partial longitudinal cross-sectional view illustrating an alternative form of aerosol-production assembly suitable for employment in the embodiments of Figure 1 and Figure 5.

Figure 12 is an enlarged cross-sectional view taken along line 12-12 of Figure 11.

Figure 13 is an enlarged elevation view taken along line 13-13 of Figure 11.

Figure 14 is an enlarged longitudinal cross-sectional view of an alternative form of metallic catalyst container suitable for use in the assembly of Figure 11.

Figure 15 is a cross-sectional view taken along line 15-15 of Figure 14.

Detailed Description of the Invention

Referring now to the drawings, and to Figure 1 in particular, there is illustrated a cigarette-like smoking article 10 constructed in accordance with one embodiment of the present invention. The smoking article 10 includes an aerosol production assembly 12 comprising a heat-conductive tubular metal container 14 having a partially closed, perforated first end portion 16 and an open second end portion 18, a combustible fuel element 20 fixedly secured in the second end portion 18, a quantity of CO oxidation catalyst 22 disposed within the metal container 14 adjacent to the fuel element 20, and a quantity of aerosol-generating material 24 disposed within the metal container 14 intermediate the first end portion 16 and the catalyst 22.

A CO oxidation catalyst can be any catalyst capable of the oxidation of carbon monoxide to carbon dioxide by reaction with oxygen. The process for oxidizing a carbon monoxide containing gas can be carried out at any suitable temperature and pressure conditions and any suitable volume ratio of CO and O₂.

The periphery of the fuel element 20 is surrounded by a porous jacket of resilient heat insulating fibers 26, such as glass fibers. The portion of the tubular metal container 14 containing the catalyst 22 and aerosol-generating material 24 is surrounded by a jacket of tobacco-containing material 30. At the first end portion 16 of the container 14 is situated a tobacco paper filter 32 having a first end 34 contacting the first end portion 16 and the tobacco 30 and an opposite second end portion 36. At the second end portion 36 of the tobacco paper filter 32, a porous filter element 38 having a first end portion 40 contacting the second end portion 36 and having an opposite second end portion 42 defining the terminal or mouth-end of the smoking article 10. The entire length of the smoking article 10 is overwrapped with one or more layers of a suitable combustible wrapper 44 such as, for example, cigarette paper.

Preferably, the fuel element 20 is provided with one or more longitudinally extending passageways 46. The passageways 46 provide means for controlling transfer of heat from the fuel element 20 to the aerosol-generating material 24, which is important both in terms of transferring enough heat to produce sufficient aerosol and in terms of avoiding the transfer of so much heat that the aerosol-generating material 24 is degraded. Generally the passageways 46 provide porosity and increase early heat transfer to the aerosol-generating material 24 by increasing the amount of hot gases which reach the aerosol-generating material 24. The passageways 46 also tend to control the rate of burning of the fuel element 20.

Generally, a large number of passageways 46, e.g. about 5 to 9 or more, especially with a relatively close spacing between the passageways such that the passages grow together, at least at the lighting end 48 of the fuel element 20, during burning and produce high convective heat transfer which leads to high aerosol delivery from aerosol-generating material 24. A large number of passageways 46 also generally helps assure ease of lighting of the fuel element 20. Figure 2, Figure 3, and Figure 4 show several suitable alternative configurations for such passageways 46.

The most preferred fuel elements 20 useful in practicing this invention are carbonaceous materials (i.e. materials primarily comprising carbon). Combustible fuel elements 20 constructed of carbonaceous materials are particularly advantageous because they produce minimal ash, and have high heat generating capacity.

A preferred combustible fuel element 20 is formed of a pressed or extruded mass of carbon prepared from a powdered carbon and binder, by conventional pressure forming or extrusion techniques. Suitable non-activated carbons for pressure forming are prepared from pyrolyzed cotton or pyrolyzed papers, such as non-talc containing grades of Grande Prairie Canadian Kraft Paper, available from the Buckeye Cellulose Corporation of Memphis, Tennessee. A suitable activated carbon for combustible fuel elements 20 is sold under the designation PCB-G, and another suitable non-activated carbon is sold under the designation PXC, both of which are available from Calgon Carbon Corporation, Pittsburgh, Pennsylvania.

A suitable carbonaceous fuel can be prepared by admixing from about 50 to about 90 weight-%, most preferably from 80 to 95 weight-%, of the carbonaceous material based on the total weight of carbonaceous material and binder with from about 1 to about 50 weight-%, most preferably from 5 to 20 weight-%, of a suitable binder based on the total weight of carbonaceous material and binder with sufficient water to make a paste having a stiff dough-like consistency. Minor amounts, e.g. up to about 35 weight-%, preferably from about 10 to about 20 weight-%, based on the total weight of carbonaceous material and binder, of tobacco, tobacco extract, and the like can be added to the paste with additional water, if necessary, to maintain a stiff dough-like consistency.

The paste is then extruded, using any suitable extrusion apparatus such as a conventional ram or piston type extruder, into the desired shape with the desired number and configuration of passageways, and dried, preferably at a temperature in the range of from about 90 °C to about 100 °C to reduce the moisture content to about 2% to 7% by weight based on the total weight of paste. Alternatively, the passageways can be formed using conventional drilling techniques.

In general, the combustible fuel elements 20 which are employed in practicing the invention are less than about 20 millimeters long. Preferably, the element 20 is about 15 millimeters or less, more preferably about 10 millimeters or less in length. Advantageously, the diameter of the fuel element 20 is about 8 millimeters or less, preferably between about 3 and 7 millimeters, and more preferably between about 4 to 6 millimeters. The density of the carbonaceous material forming the fuel elements 20 ranges generally from about 0.5 g/cc to about 1.5 g/cc as measured, e.g., by mercury displacement. Preferably, the density is greater than 0.7 g/cc, more preferably greater than 0.8 g/cc. The length and diameter of the fuel element 20, the density of the carbonaceous material from which it is formed, and the passageway patterns are selected to achieve a desired burning time for the fuel element 20. In most cases, a high density carbonaceous material is desired because it helps to ensure that the fuel element will burn long enough to simulate the burning time of a conventional cigarette and that it will provide sufficient heat energy to generate the required amount of aerosol from the aerosol-generating material 24.

Upon lighting the smoking article 10, the fuel element 20 burns, generating the heat used to volatilize the components of the aerosol-generating material 24. These thus volatilized components comprise the aerosol and are then drawn through the mouth-end 42 of the smoking article 10, especially during puffing, and into the users mouth, in a manner akin to the smoking of a conventional cigarette.

The aerosol-generating material 24 preferably includes one or more thermally stable components which carry one or more aerosol-forming substances. As used herein, a "thermally stable" material is defined as one capable of withstanding the high, albeit controlled, temperatures, e.g., generally from about 350 °C to about 600 °C, which may eventually exist near the burning fuel element 20, without significant decomposition or burning. The use of such thermally stable material is believed to help maintain the simple "smoke" chemistry of the aerosol.

Suitable aerosol-forming substances include polyhydric alcohols and mixtures of polyhydric alcohols. Preferred aerosol-forming substances are selected from the group consisting of glycerin, triethylene glycol, propylene glycol, and mixtures of any two or more thereof.

One particularly preferred aerosol-generating material 24 comprises a thermally stable alumina substrate containing sprayed, dried tobacco extract, and one or more tobacco flavored modifiers, such as levulinic acid, one or more flavoring materials, and one or more aerosol forming substances, such as glycerin. An especially useful alumina substrate is available from the Davison Chemical Division of W.R. Grace and Co. under the designation SMR-14-1896. Before use, this alumina is sintered at elevated temperatures, e.g. greater than 1000 °C, washed, and dried. In certain preferred embodiments, this alumina substrate can be mixed with densified tobacco particles, which particles may also be impregnated with an aerosol forming substance.

A significant improvement or advantage of the smoking article 10 over other similar smoking articles exists in the placement of the CO oxidation catalyst 22 between the combustible fuel element 20 and the aerosol-generating material 24. The CO oxidation catalyst 22 removes carbon monoxide produced by the burning carbonaceous material in the combustible fuel element 20. Such a removal results in a reduction in the amount of carbon monoxide inhaled by the user of the smoking article 10.

Non-limiting examples of suitable, effective CO oxidation catalysts are: CuO-MnO₂ catalysts such as, for example, catalysts sold under the trademark Hopcalite and available from Mine Safety Appliances; alumina or magnesia-supported Pt and/or Pd catalyst (preferably also containing iron oxide, described in U.S. Patent 4,818,745, the disclosure of which is hereby incorporated of reference); compositions comprising a ceramic honeycomb support, tin dioxide Pt and/or Pd, and optionally other copromoters (described in U.S. Patent 4,830,844, the disclosure of which is hereby incorporated of reference); titania or zirconia-supported platinum and iron oxide containing catalyst materials (optionally containing a ceramic honeycomb support which is coated with titania or zirconia); hydrotalcite-supported platinum/iron oxide; compositions comprising Pt and Fe-oxide on hydrotalcite; compositions comprising Pt and Fe-oxide on vanadium oxide; compositions which contain silver metal or oxide, manganese oxide, and an oxide of cobalt or iron; and many of the commercially available catalyst compositions used for purifying exhaust gases from combustion engines, and used in CO₂ lasers (for recombining CO and O₂).

The CO oxidation catalyst materials used in the apparatus of this invention can have any suitable shape such as cylindrical, ring-shaped, honeycomb-shaped and the like. The materials can be of any suitable size, for instance a particle diameter of about 0.01 inches to about 0.1 inches for bead-shaped particles. The surface area of these catalyst materials generally is in the range of from about 10 to about 300 m²/g, preferably about 150 to about 250 m²/g. The shape, size, surface structure and area and other structural parameters of the catalyst particles can be selected by those having ordinary skill in the art so as to provide maximum conversion of CO to CO₂ and minimum resistance to the flow of the combustion gas exiting from the burning fuel element.

Preferably, the CO oxidation catalyst 22 and aerosol-generating material 24 are enclosed within a heat-conductive tubular metal container 14. The heat-conductive material preferably employed in constructing the preferred container is typically a metallic tube, strip, or foil, such as aluminum, which can vary in thickness from less than about 0.01 millimeters to about 0.1 millimeters, or more. The thickness and/or type of conducting material can be varied (e.g. other metals, or the material sold under the trademark Grafoil and available from Union Carbide) to achieve virtually any desired degree of heat transfer.

The fuel element heat insulating fibers 26 employed in practicing the invention are preferably formed into a porous resilient jacket from one or more layers of heat insulating material. Advantageously, this jacket is at least about 0.5 mm thick, preferably at least about 1 mm thick, more preferably between about 1.5 to 2 mm thick. Generally, the jacket extends over more than about half, if not all of the length of the fuel element 20.

The currently preferred heat insulating fibers 26 are ceramic fibers and glass fibers. Two suitable glass fibers are available from the Manning Paper Company of Troy, New York, under the designations, Manniglas 1000 and Manniglas 1200. When possible, glass fiber materials having a low softening point, e.g., below about 650 °C, are preferred. The preferred glass fibers include materials produced by Owens-Corning of Toledo, Ohio under the designations 6432 and 6537.

The CO oxidation catalyst 22 and aerosol-generating material 24, or at least a portion thereof, are circumscribed by a jacket of tobacco-containing material 30 through which gases and vapors may pass during smoking of the article. During smoking, hot vapors are swept through the tobacco to extract the volatile components from the tobacco, without combustion or substantial pyrolysis. Thus, the user receives an aerosol which contains the tastes and flavors of natural tobacco without the numerous combustion products produced by a conventional cigarette.

The jacket of tobacco-containing material 30 employed around the aerosol-generating material 24 may contain any tobacco available to the skilled artisan, such as Burley, Flue-Cured, Turkish, reconstituted tobacco, extruded tobacco mixtures, tobacco-containing sheets, and the like.

Advantageously, a blend of tobacco can be used to contribute a greater variety of flavors. The jacket of tobacco-containing material 30 can also include conventional tobacco additives, such as fillers, casings, reinforcing agents, humectants, and the like. Flavor agents can likewise be added to the jacket of tobacco-containing material 30, as well as flavor modifying agents.

The porous filter element 38 can be formed of any suitable material which can satisfactorily filter particulate or other forms of solids as well as liquids from combustion gases passing therethrough while passing filtered gases through the second end portion 42 of the filter element 38. It is presently preferred to construct the filter element 38 from polypropylene fibers in, for example, the form of non-woven fabric. Such filters can also include low efficiency cellulose acetate filters and hollow or baffled plastic filters, such as those made of polypropylene. Such filters do not appreciably interfere with the aerosol delivery. The embodiment of the invention in Figure 1 utilizes a filter comprised of two components. The first component is disposed adjacent the aerosol-generating material 24 and is comprised of a tobacco paper filter 32. The second component is disposed adjacent the tobacco paper filter 32 and is comprised of a porous filter element 38, preferably comprising polypropylene.

The entire length of the article, or any portion thereof, may be overwrapped with one or more layers of a suitable wrapper 44 such as cigarette paper, tobacco leaf, or tobacco paper. Generally, the wrapper 44 at the lighting end of the fuel element 48 should not openly flame during burning of the fuel element 20. In addition, the wrapper 44 should have controllable smolder properties and should produce a gray, cigarette-like or cigar-like ash.

In addition to the components described in Figure 1, the embodiment of smoking article 10A illustrated in Figure 5 also contains a second portion of CO oxidation catalyst 50 disposed between the heat conducting tubular metal container 14 and the wrapper 44. The second portion of CO oxidation catalyst 50 circumscribes either a portion of the fuel element 20 or a portion of the heat conducting tubular metal container 14, or a portion of both. The second portion of CO oxidation catalyst 50 is positioned between the heat insulating fibers 26 that surround the fuel element 20, and the jacket of tobacco-containing material 30 that surrounds the heat-conductive tubular metal container 14. The purpose of the second portion of CO oxidation catalyst 50 is to remove or substantially remove carbon monoxide from the vapor stream that passes around the heat-conductive tubular metal container 14 through the jacket of tobacco-containing material 30 to the first end portion 16 of the tubular metal container 14 by inducing the oxidation of CO to CO₂.

The embodiment of smoking article 10B illustrated in Figure 6 also includes, in addition to the elements depicted in Figure 5, a slightly modified aerosol production assembly 12A which differs from the aerosol production assembly 12 by additionally including an elongated heat-conductive member 52 that is in direct

heat-conductive contact with both the fuel element 20 and at least a portion of the aerosol-generating material 24. The heat-conductive member 52 is generally comprised of a thin metallic wire. The wire is preferably comprised of copper. The wire can be of any suitable length and diameter for effectively transferring heat from the fuel element 20 to at least a portion of the aerosol-generating material 24. The wire preferably has a diameter of about 0.05 cm. The wire is preferably about 2.0 cm or less in length. More preferably, the wire is about 1.0 cm in length. The heat-conductive member 52 is anchored in the center hole of the fuel element 20 and extends axially through the center of the heat-conductive tubular metal container 14. The heat-conductive member 52 reaches completely through the CO oxidation catalyst 22 and extends into the aerosol-generating material 24.

The purpose of such a heat-conductive member 52 is to promote more effective transfer of heat from the burning tip of the fuel element 20 to the aerosol-generating material 24. This is necessary because the CO oxidation catalyst 22 inside the heat-conductive tubular metal container 14 can act as a heat sink, delaying the warmup of the aerosol-generating material 24 which in turn delays the appearance or generation of aerosol. Additionally, the heat-conductive member 52 heats up the CO oxidation catalyst 22 more quickly, resulting in better conversion of carbon monoxide to carbon dioxide during the initial puffs from the cigarette-like smoking article 10B.

Figure 7 more clearly illustrates the configuration for the aerosol production assembly 12 comprising the heat-conductive tubular metal container 14 having a partially closed perforate first end portion 16 and the open second end portion 18, the combustible fuel element 20 fixedly secured in the second end portion 18, the quantity of CO oxidation catalyst 22 disposed within the metal container 14 adjacent the fuel element 20, and the quantity of aerosol-generating material 24 disposed within the metal container 14 intermediate the first end portion 16 thereof and the CO oxidation catalyst 22. The metal container 14 is cylindrically shaped with the open second end portion 18 adjacent to the fuel element 20. Preferably, several slot-like openings 54 are provided in the closed perforate first end portion 16 of the metal container 14. A preferred configuration for such slot-like openings 54 is shown in Figure 8. The purpose of these slot-like openings 54 is to allow the aerosol created to escape from the metal container 14.

While the metal container 14 could be of any suitable length and material thickness, generally, the thickness of the metal container 14 ranges from about 0.01 mm or less to about 0.1 mm or more, and ranges from about 10 mm or less to about 50 mm or more in length. Preferably, the metal container 14 ranges in length from about 20 mm to about 40 mm, more preferably from about 25 to about 35 mm. Advantageously, the diameter of metal container 14 is about 8 mm or less, preferably between about 3 and 7 mm, and more preferably between about 4 to 6 mm.

Generally, the diameter of the heat-conductive metal container 14 and the fuel element 20 are such that one end of the fuel element 20 will fit tightly within the open second end portion 18 of the metal container 14. Generally, the heat-conductive metal container 14 extends over no more than about one half the length of the fuel element 20. Preferably, the heat-conductive metal container 14 overlaps or otherwise contacts no more than about the rear 5 mm of the fuel element. This contact is sufficient to hold the fuel element 14 in place while not substantially interfering with the burning of the fuel element 14.

In Figure 9 and Figure 10, a slightly modified version of the heat-conductive metal container 14 is shown as is designated by the reference character 14A. This embodiment contains a plurality of circumferentially spaced pin-like holes 15 formed in the metal container 14A along a circumferential line near the juncture of the combustible fuel element 20 and the CO oxidation catalyst 22 to be disposed therein. The purpose of the holes 15 is to increase the amount of oxygen available to the CO oxidation catalyst 22. A higher oxygen concentration will increase the carbon monoxide conversion to carbon dioxide that can be obtained.

Generally the pin-like holes 15 are of such size and number so as to allow a sufficient amount of oxygen to reach the catalyst in order to provide a maximum conversion of carbon monoxide to carbon dioxide. While the pin-like holes 15 can be of any suitable number, generally there are about 8 pin-like holes 15 formed in the metal container 14A. Generally, the pin-like holes 15 are evenly spaced around the circumference of the metal container element 14A. Preferably, the pin-like holes 15 are positioned so that they circumscribe the juncture between the fuel element 20 and the CO oxidation catalyst 22 disposed within the metal container element 14A. Preferably, this position is about 5 mm from the open end of the metal container element 14A. While the pin-like holes 15 can be of any suitable size, generally the pin-like holes 15 are less than about 1 mm in diameter. Preferably, the pin-like holes 15 are less than about 0.5 mm in diameter.

Figure 11 illustrates an alternate configuration for the aerosol production assembly which is designated by the reference character 12B. This aerosol production assembly 12B is characterized by physically separate container elements. The CO oxidation catalyst 22 is contained within a heat-conductive catalyst

container element 56, while the aerosol-generating material 24 is contained within a heat-conductive aerosol-generating material container element 58.

Generally, the catalyst container element 56 is cylindrically shaped with an open end adjacent to the fuel element 20 and closed at the other perforated end. Generally, several slot-like openings 60 are provided in the perforate closed end of the catalyst container element 56 as shown in Figure 12. The purpose of these slot-like openings 60 is to allow the flow of hot gases and vapors from the fuel element 20 to the aerosol-generating material 24.

While the catalyst container element 56 can be of any suitable length and material thickness, generally, the thickness of the catalyst container element 56 ranges from about 0.01 mm or less to about 0.1 mm, or more, and is less than about 30 mm in length. Preferably, the catalyst container element 56 is about 20 mm or less, more preferably about 15 mm or less in length. Advantageously, the diameter of the catalyst container element 56 is about 8 mm or less, preferably, from about 3 mm to about 7 mm, and more preferably from about 4 mm to about 6 mm.

Generally, the diameters of the catalyst container element 56 and the fuel element 20 are such that one end of the fuel element 20 will fit tightly within the open end of the catalyst container element 56. Generally, the catalyst container element 56 extends over no more than about one half the length of the fuel element 20. Preferably, the catalyst container element 56 overlaps or contacts no more than about the rear 5 mm of the fuel element 20. This will allow the catalyst container element 56 to hold the fuel element 20 securely while not interfering substantially with the burning of the fuel element 20.

Generally, the aerosol-generating material container element 58 is cylindrically shaped with an opened end adjacent to the closed perforate end of the catalyst container element 56 and closed at the other perforated end. Preferably, several slot-like openings 62 are provided in the perforate closed end of the aerosol-generating material container element 58 as shown in Figure 12. The purpose of these slot-like openings 62 is to allow the aerosol created to escape from the aerosol-generating material container element 58.

While the aerosol-generating material container element 58 could be of any suitable length and material thickness, generally the thickness of the aerosol-generating material container element 58 ranges from about 0.01 mm or less to about 0.1 mm, or more, and the element ranges from about 10 mm to about 50 mm in length. Preferably, the aerosol-generating material container element 58 is about 40 mm or less, more preferably about 30 mm or less in length. Advantageously, the diameter of the container element 58 is about 8 mm or less, preferably, from about 3 mm to about 7 mm, and more preferably from about 4 mm to about 6 mm. Generally, the diameter of the aerosol-generating material container element 58 and the catalyst container element 56 are such that the closed end of the catalyst container element 56 will fit tightly within the open end of the aerosol-generating material container element 58. Generally, the aerosol-generating material container element 58 extends over a sufficient portion of the catalyst container element 56 so that the catalyst container element 56 is securely held adjacent to the aerosol-generating material container element 58.

In Figure 14 and Figure 15, a slightly modified version of heat-conducting catalyst container element 56 is shown and is designated by the reference character 56A. This embodiment contains a plurality of circumferentially spaced pin-like holes 64 formed in the catalyst container element 56A along a circumferential line near the juncture of the combustible fuel element 20 and the CO oxidation catalyst 22 to be disposed therein. The purpose of the holes 64 is to increase the amount of oxygen available to the CO oxidation catalyst 22. A higher oxygen concentration will increase the carbon monoxide conversion to carbon dioxide that can be obtained.

Generally, the pin-like holes 64 are of such size and number so as to allow a sufficient amount of oxygen to reach the catalyst in order to provide a maximum conversion of carbon monoxide to carbon dioxide. While the pin-like holes 64 can be of any suitable number, generally there are about 8 pin-like holes 64 formed in the catalyst container element 56A. Generally, the pin-like holes 64 are evenly spaced around the circumference of the catalyst container element 56A. Preferably, the pin-like holes 64 are positioned so that they circumscribe the juncture between the fuel element 20 and the CO oxidation catalyst 22 disposed within the catalyst container element 56A. Preferably, this position is about 5 mm from the open end of the catalyst container element 56A. While the pin-like holes 64 can be of any suitable size, generally the pin-like holes 64 are less than about 1 mm in diameter. Preferably, the pin-like holes 64 are less than about 0.5 mm in diameter.

The aerosol produced by the articles constructed in accordance with the present invention is chemically simple, consisting essentially of air, water, oxides of carbon, the aerosol former, any desired flavors or other desired volatile materials, and trace amounts of other materials.

The wet total particulate matter (WTPM) produced by articles of this invention has no measurable mutagenic activity as measured by the Ames Test, i.e., there is no significant dose response relationship between the WTPM produced by articles of the present invention and the number of revertants occurring in standard test microorganisms exposed to such products. According to the proponents of the Ames Test, a significant dose dependant response indicates the presence of mutagenic materials in the products tested. See Ames et al, Mutation Research, 31:347-364 (1975); Nagas et al, Mutation Research, 42:335 (1977).

A further benefit from the present invention is a relative lack of ash produced during use in comparison to ash from a conventional cigarette. As the carbon fuel element is burned, it is essentially converted to oxides of carbon, with relatively little ash generation, and thus there is no need to dispose of ashes while using the article.

Another important benefit from the various embodiments of the present invention is the decrease in carbon monoxide produced in comparison to that produced by other known cigarette-like smoking articles.

Preferred embodiments of this invention are capable of delivering at least 0.6 milligrams of aerosol, measured as wet total particulate matter (WTPM), in the first three puffs, when smoked under FTC smoking conditions, which consist of a 35 cc puff volume of 2 seconds duration, separated by 58 seconds of smolder. More preferably, embodiments of the invention are capable of delivering 1.5 milligrams or more of aerosol in the first three puffs. Most preferably, embodiments of the invention are capable of delivering 3.0 milligrams or more of aerosol in the first three puffs when smoked under FTC smoking conditions. Moreover, preferred embodiments of the invention deliver an average of at least about 0.8 milligrams of WTPM per puff for at least about 6 puffs, preferably at least about 10 puffs under FTC smoking conditions. More preferably, preferred embodiments deliver 20 to 30 milligrams, or more, of WTPM over at least 10 puffs, under FTC smoking conditions.

A presently preferred smoking article of the present invention also delivers very low levels of carbon monoxide, preferably less than about 10 milligrams total CO delivery over the life of the smoking article, more preferably, less than about 5 milligrams total CO delivery (e.g., about 0.01-4.5 milligrams), most preferably less than about 3 milligrams total CO delivery (e.g., about 0.1-2 milligrams).

As used herein, and only for the purposes of this application, "aerosol" is defined to include vapors, gases, particles, and the like, both visible and invisible, and especially those components perceived by the user to be "smoke-like", generated by action of the heat from the burning fuel element upon substances contained within the aerosol-generating means, or elsewhere in the article. As so defined, the term "aerosol" also includes volatile flavoring agents and/or pharmacologically or physiologically active agents, irrespective of whether they produce a visible aerosol.

As used herein, the term "conductive heat exchange relationship" is defined as a physical arrangement of the aerosol-generating means and the fuel element whereby heat is transferred by conduction from the burning fuel element to the aerosol-generating means substantially throughout the burning period of the fuel element. Conductive heat exchange relationships can be achieved by locating the aerosol-generating means in close proximity to the burning portion of the fuel element, and/or by utilizing a conductive member to transfer heat from the burning fuel to the aerosol-generating means. Preferably, both methods of providing conductive heat transfer are used.

Advantages of the cigarette-like smoking article of the present invention will be further illustrated with reference to the following examples which aid in the understanding of the present invention, but which are not to be construed as limitations thereof.

Example I

In this example the preparation and properties of several CO oxidation catalysts are described. These catalysts were tested in the smoking article of this invention, as is described in subsequent examples.

A CuO-MnO₂ catalyst was prepared in R&D laboratories of Phillips Petroleum Company in Bartlesville, Oklahoma as follows: To 150 ml of water (having been heated to 75 °C) were added 20.7 g of MnSO₄ • H₂O and 6.2 g of CuSO₄ • 5 H₂O. Upon complete dissolution of the copper and manganese sulfates, air was bubbled through the solution at a fast rate. Then 40 ml of an aqueous 25 weight-% NaOH solution was added with stirring to the solution of copper and manganese sulfates. A coprecipitate of copper oxides/hydroxides and manganese oxides/hydroxides was formed, which was filtered, washed with water, air dried and then heated for 3 hours at 200 °C in an oven. A brown, dry solid was obtained, which is labeled Lab CuO-MnO₂ catalyst. Its composition is shown in Table 1.

Several commercial CuO-MnO₂ catalysts were obtained from Callery Chemical Co. These materials are labeled "Callery A", Callery B", and "Callery C". These CuO-MnO₂ contain approximately 60 weight-% MnO₂ and about 40% CuO (as per disclosure in J. Am. Chem. Soc. 43, 1921, page 1982). The exact

compositions of the above-described CuO-MnO₂ catalysts are shown in Table 1.

Table 1

Element	Lab CuO-MnO ₂ Catalyst	Callery A CuO-MnO ₂ Catalyst	Callery B CuO-MnO ₂ Catalyst	Callery C CuO-MnO ₂ Catalyst
Ag	64 ppm	70 ppm	88 ppm	88 ppm
Ba	14 ppm	12 ppm	14 ppm	27 ppm
Ca	2440 ppm	200 ppm	3690 ppm	1440 ppm
Co	42 ppm	---	23 ppm	---
Cr	125 ppm	123 ppm	132 ppm	151 ppm
Cu	11.4%	11.8%	15.0%	12.9%
Fe	741 ppm	576 ppm	893 ppm	825 ppm
K	1.9%	2.3%	1.8%	2.7%
Mn	55.1%	50.4%	48.0%	48.9%
Mo	319 ppm	297 ppm	319 ppm	378 ppm
Na	6040 ppm	3250 ppm	2770 ppm	5560 ppm
Ni	430 ppm	538 ppm	115 ppm	118 ppm
Pb	730 ppm	821 ppm	744 ppm	508 ppm
Sr	10 ppm	11 ppm	36 ppm	18 ppm
Ti	452 ppm	---	13 ppm	---
V	42 ppm	33 ppm	58 ppm	92 ppm
(Note: "%" means weight percent; "ppm" means parts by weight per million parts by weight of CuO-MnO ₂ catalyst)				

An Ag-Mn-Co oxide catalyst (1:3:8 atomic ratio) was prepared in the following manner. A solution as prepared by dissolving 127.1 g Na₂CO₃ in 500 ml H₂O. When fully dissolved, 12.6 g KMnO₄ were then added to the solution and dissolved. This solution was stirred while a second solution was slowly added, comprised of 8.5 g AgNO₃, 28.0 g 50% Mn(NO₃)₂ solution, and 113.4 g Cu(NO₃)₂•6H₂O dissolved in 500 ml H₂O. The mixture was stirred, filtered, and washed in 1 liter of H₂O containing 30 g NH₄NO₃ in order to remove the Na and K from the sample. This mixture was then washed in a like manner an additional three times using distilled water. The sample was dried at 110 °C for 3 hours, and then calcined at 400 °C for 20 hours. The resulting material was ground and sieved to 8-10 mesh. This catalyst is labeled Ag-Mn-Co oxide catalyst.

A titania-supported catalyst with platinum metal and iron oxide as promoters was prepared by impregnating titania (provided by Degussa Corporation, Teterboro, New Jersey) with an aqueous solution containing both Pt(NH₃)₄(NO₃)₂ and Fe(NO₃)₂•9H₂O. Concentrations of Pt and Fe in the solution and the weight ratio of the solution to titania were chosen such as to obtain a final catalyst loading of about 1 weight-% Pt and about 0.5 weight-% Fe. The Pt/Fe-impregnated titania was dried at about 125 °C, calcined in air for several hours at 350 °C, and heated in a stream of hydrogen gas at about 200-300 °C for several hours. This catalyst is labeled 1% Pt, .5% Fe/TiO₂.

Several other Pt/Fe/TiO₂ catalysts were prepared substantially in accordance with the above-described procedure except that Pt and Fe loadings were different. These promoter loadings will be identified when tests are described in the examples below.

Example II

This example illustrates the carbon monoxide output for the preferred smoking articles of the present invention. These articles were substantially those illustrated in Figure 1. For the tests in this example, the articles were prepared by modifying the RJR Premier smokeless cigarette.

The Premier unmodified cigarette was comprised of a carbonaceous fuel element in direct contact with an aerosol-generating material. The aerosol-generating material was enclosed within a metal container having a length of approximately 30 mm and a diameter of approximately 5 mm. The carbonaceous fuel element was of approximately 10 mm in length and 5 mm in diameter, with longitudinal channels or passageways running through the length of the element. The fuel element was inserted into the open end of the aerosol-generating material container.

The fuel element was circumscribed by a layer of heat-insulating glass fiber of approximately 1.5 mm in thickness. The aerosol-generating material container was circumscribed by a layer of tobacco of approximately 1.5 mm in thickness. The mouthpiece end of the aerosol-generating material container was adjacent to a filter consisting of a cigarette paper filter adjacent to a nonwoven polypropylene filter. The entire article was wrapped in cigarette paper, and it had the overall size and appearance of a conventional cigarette.

The Premier cigarette was modified by removing a portion of the aerosol-generating material from its container and replacing it with a CO oxidation catalyst at the fuel element end of the container. This modification was accomplished by cutting through the outer paper and tobacco one inch from the cigarette tip. The canister was then opened at the partially perforated end 16. All the aerosol-generating material was then removed from the canister. The desired amount of CO oxidation catalyst was loaded into the canister so as to be in direct contact with the fuel source. The remaining space in the canister was refilled with the aerosol-generating material, and the perforated end of the canister was then reclosed.

For testing, tygon® polymer tubing was fitted directly onto the exposed end of the metal container. Smoke was drawn through the tubing, through a particulate filter and into the cylinder of a smoking machine. The particulate filter was utilized to remove H₂O, glycerine and particulates prior to the gas chromatograph sampling. The smoke was then exhaled from the cylinder into an HP 3890 gas chromatograph. Finally the smoke passed through an Anarad AR 400 Series infrared CO analyzer and then to vent.

According to FTC smoking conditions, a "standard puff" consists of a 35 cc draw in 2 seconds, with one minute rest between puffs. Because the tygon® tubing in this experiment was fitted directly onto the exposed end of the metal container rather than to the mouth-end of the smoking article, no air was drawn around the outside of the container during the test. There was approximately 30% bypass around the container in the unmodified Premier cigarette. For this reason, the 35 cc/2 sec. standard puff was adjusted to 25 cc/2 sec. for the canister only experiments. The results are shown in Table 2. The values shown in Table 2, as well as the values shown in all subsequent tables, are the average values for three runs.

Table 2

Run	Catalyst	CO/CO ₂ ⁽¹⁾	Total mg CO ⁽²⁾
1	No catalyst	0.96	14.4
2	1% Pt, .5% Fe/TiO ₂ (100 mg)	0.37	7.7
3	LAB CuMnO ₂ (100 mg)	0.01	2.8
4	CALLERY A CuMnO ₂ (100 mg)	0.14	5.4
5	CALLERY B CuMnO ₂ (100 mg)	0.01	2.3
6	CALLERY B CuMnO ₂ (80 mg)	0.11	4.0
7	CALLERY B CuMnO ₂ (50 mg)	0.27	7.2
8	CALLERY C CuMnO ₂ (100 mg)	0.06	4.2

Notes: (1) "CO/CO₂" in this and subsequent Tables means molecular ratio of CO to CO₂ in the filtered smoke, taken on the third puff.

(2) "Total mg CO" in this and subsequent Tables means the total amount (in milligrams) of CO produced during one entire test using one Premier cigarette until complete exhaustion of the fuel source.

The CO/CO₂ ratio is used as a measure of the completeness of the combustion to CO₂. Test results in Table 2 clearly demonstrate the CO reducing effect of the tested catalysts (Runs 2-8) when compared to the unmodified Premier cigarette canister (Run 1). The CuO-MnO₂ catalysts (Runs 3-8) were generally more effective than the Pt/Fe/TiO₂ catalyst (Run 2).

Example III

The articles utilized in this example were substantially those described in Figure 1. The articles were prepared and tested in the same manner as those in Example II. Additionally, however, some of the articles were provided with eight pin-like holes in the outer surface of the container, as shown in Figure 14 and Figure 15. The holes were made with the sharp point of a #1 insect pin. The purpose of the holes was to provide additional oxygen to the catalyst in the container for more complete combustion of the carbon monoxide to carbon dioxide. Table 3 shows the carbon monoxide output for the articles with holes in the container, as compared to articles without such holes.

Table 3

Run	Test Description	O/C	CO/CO ₂	Total mg CO
9	No catalyst, no holes	2.1	0.96	14.4
10	1% Pt, 0.5% Fe/TiO ₂ (100 mg), no holes	2.1	0.37	7.7
11	1% Pt, 0.5% Fe/TiO ₂ (100 mg), 8 holes	2.8	0.03	2.5
12	Lab CuO/MnO ₂ (100 mg), no holes	2.3	0.01	2.8
13	Lab CuO/MnO ₂ (100 mg), 8 holes	2.8	0.01	2.1

The O/C ratio clearly shows the holes are effective for increasing the amount of oxygen available for combustion of the carbon fuel. The additional oxygen significantly increases the CO removal by the noble metal type catalysts, such as the 1% Pt, 0.5% Fe/TiO₂ catalyst. The additional oxygen only slightly effects the CO removal by the CuO/MnO₂ catalysts.

Example IV

The articles used in this example were substantially identical to those described in Figure 1. The articles were prepared and tested in the same manner as those in Example III, with 8 holes in the metal container to provide additional oxygen for the reaction. The effects of using 100 mg of catalyst with different promoter levels were investigated in an effort to reduce the cost of the catalyst while maintaining a high activity. Data with various Pt and Fe weight percentages on TiO₂ support are given in Table 4.

Table 4

Run		% Pt	% Fe	Total O/C Ratio	Total mg CO
14	Blank	no	catalyst	2.7	13.4
15	Group 1	1.0	0.5	2.7	2.5
16		0.5	0.25	2.8	4.7
17		0.3	0.15	2.8	9.5
18	Group 2	0.5	0.0	2.7	11.2
19		0.5	0.25	2.8	4.7
20		0.5	0.5	3.0	6.6
21		0.5	1.0	2.8	9.7
22	Group 3	0.3	0.0	2.5	12.1
23		0.3	0.15	2.8	9.5
24		0.3	1.5	2.9	12.4

In the utilization of the preferred smoking articles of the present invention, carbon monoxide passes to the user by flow around the outside of the metal container as well as flow through the metal container. Test results in Group I of Table IV demonstrate that as the Pt level decreases, the CO conversion decreases. Test results in Groups 2 and 3 demonstrate that the addition of a small amount of Fe (Runs 18, 19, 22 and 23) results in a substantial increase in the CO conversion over the same catalyst without Fe (Run 14). Furthermore, these results show that too much Fe can have a detrimental effect on the activity of a low level Pt catalyst (Runs 19-21, 23 and 24).

Example V

This example illustrates the additional benefit that is incurred when catalyst is positioned outside the metal container as well as inside the metal container. Additionally, this example illustrates that the positioning of the catalyst inside the metal container in close proximity to the aerosol-generating material for a substantial period of time will not result in a reduction of the catalyst activity. The articles utilized in this example were substantially those described in Figure 5. The articles were prepared by modifying the RJR Premier smokeless cigarette. The cigarette was modified by removing a portion of the aerosol-generating material from its container and replacing it with a CO oxidation catalyst at the fuel element end of the

container, as described in Example II. Additionally, a portion of catalyst was placed outside the metal container so that it circumscribed a portion of the container near the fuel element, as shown in Figure 5. This was accomplished by removing a portion of the tobacco adjacent to the glass fiber jacket that surrounds the fuel element and replacing it with catalyst so that the catalyst was positioned between the glass fiber jacket and the tobacco jacket of the cigarette.

In order for this experiment to account for air flow around the outside of the canister as well as through the inside, the cigarette was completely reassembled, and tygon® tubing was fitted to the mouth end of the cigarette. Standard FTC smoking conditions were employed, i.e. a 35 ml puff of 2 seconds duration, once every minute. The amount of catalyst inside and outside the metal container was varied. Additionally, the effect of aging on the newly prepared cigarettes was tested. The results are shown in Table 5.

Table 5

Run	Test Description	O/C	CO/CO ₂	Total mg CO
25	no catalyst (unmodified Premier)	3.2	0.92	13.0
	Lab CuO-MnO ₂ catalyst			
26	100 mg inside canister, none outside	4.3	0.10	5.3
27	100 mg inside canister, 50 mg outside	4.2	0.03	3.0
28	80 mg inside canister, 50 mg outside	3.2	0.06	5.8
	Aging tests for Lab CuO-MnO ₂ catalyst: 100 mg inside, 50 mg outside			
29	aged for 24 hrs before testing	3.6	0.02	3.4
30	aged for 48 hrs	4.6	0.02	3.1
31	aged for 120 hrs	3.4	0.02	3.6
32	aged for 48 hrs at 50°C	4.5	0.02	2.7

Addition of catalyst outside the metal container decreased the total carbon monoxide (Run 27). Test results on aging of the cigarettes from Table 5 show that aging up to 120 hours had no detrimental effect on the catalyst performance.

Example VI

The articles utilized in this example were substantially those described in Figure 6. The articles were prepared by modifying the RJR Premier smokeless cigarette. The cigarette was modified by removing a portion of the aerosol-generating material from its container and replacing it with a CO oxidation catalyst at the fuel element end of the container, as described in Example II. Also, in all articles, 50 mg of 28-48 mesh Callery CuO-MnO₂ B catalyst were placed outside the container, as described in Example V. Additionally, a short piece of 0.020 inch diameter copper wire was anchored in the center hole of the carbon fuel element extending axially through the center of the container. The length of the wire reached completely through the catalyst bed and extended into the aerosol-generating material.

The cigarettes were completely reassembled and tygon® tubing fitted to the mouth end of the cigarettes. Standard FTC smoking conditions were employed, i.e. a 35 ml puff of 2 seconds duration, once every minute. The amount of catalyst inside the container was varied from 25 to 100 mg. Control tests without the copper wire were run for each trial for comparison.

The amount of aerosol emitted from the cigarette was recorded by carefully watching the clear tygon® tube attached to the mouthpiece of the cigarette. A numerical value for the amount of aerosol was designated for each puff on a scale from 0.0 to 1.0 (in increments of 0.25), where 0.0 is for no aerosol, 0.5 is for moderate aerosol, and 1.0 is for full aerosol. Of course, these numerical assignments for the amount of aerosol are subjective and imprecise. Nevertheless, this gives a useful (though approximate) method of quantifying the amount of aerosol. As before, the total mg of CO is determined for each cigarette using the IR CO meter. The tabulated aerosol and total mg CO data for all trials are given in Table 6 and Table 7. Puff #1 designates the puff that is utilized to light the cigarette. Puffs #9 and #10 show no aerosol because

the fuel source has completely burned.

Table 6

	No Catalyst	100 mg Catalyst	75 mg Catalyst	50 mg Catalyst	25 mg Catalyst
Total mg CO	12.15	2.62	2.79	4.80	7.72
Puff #	Aerosol				
0	0.00	0.00	0.00	0.00	0.00
1	0.50	0.00	0.00	0.25	0.33
2	1.00	0.33	0.42	0.75	0.75
3	1.00	0.50	0.67	1.00	1.00
4	1.00	1.00	0.92	1.00	1.00
5	1.00	0.75	1.00	1.00	1.00
6	1.00	0.58	0.83	1.00	1.00
7	0.50	0.50	0.67	0.75	0.66
8	0.00	0.16	0.33	0.16	0.00
9	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00

Table 7

	No Catalyst No Wire	100 mg Catalyst 2.0 cm Wire	75 mg Catalyst 2.0 cm Wire	50 mg Catalyst 2.0 cm Wire	25 mg Catalyst 1.0 cm Wire	25 mg Catalyst 2.0 cm Wire
Total Mg CO	12.15	2.28	2.10	2.70	4.86	5.39
Puff #	Aerosol					
0	0.00	0.00	0.00	0.00	0.00	0.00
1	0.50	0.16	0.25	0.13	0.25	0.42
2	1.00	0.66	0.58	0.38	0.72	0.92
3	1.00	0.91	1.00	0.88	0.92	1.00
4	1.00	1.00	1.00	1.00	1.00	1.00
5	1.00	0.83	1.00	0.96	1.00	1.00
6	1.00	0.66	0.91	0.79	0.88	0.83
7	0.50	0.42	0.58	0.50	0.50	0.17
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00

Test results in Table 6 show the effect of varying the amount of catalyst inside the container in the absence of a copper wire. This data illustrates that adding catalyst inside the container reduces the amount of aerosol produced, especially during the initial puffs. Test results in Table 7 show the effect of varying the amount of catalyst inside the container with the addition of the copper wire described above. Comparing the wire and no-wire data shows that the addition of the copper wire increased the observed aerosol in all cases except the 50 mg case. Additionally, comparison of the wire and no-wire data shows that the addition of the copper wire increased the CO conversion rate in all cases. The increased CO conversion is apparently due to the copper wire heating up the catalyst more quickly, resulting in better conversion of CO during the initial puffs than is observed in the absence of the copper wire.

Example VII

The articles utilized in this example were substantially those illustrated in Figure 5. The articles were prepared by modifying the RJR Premier smokeless cigarette as described in Example V. The portion of the catalyst placed outside the metal container comprised 50 mg of the Ag-Mn-CO oxide catalyst described in Example I. The portion of the catalyst placed inside the metal container comprised 100 mg of the Ag-Mn-CO oxide catalyst described in Example I. Standard FTC smoking conditions were employed, i.e. a 35 ml puff of 2 seconds duration, once every minute. Also, unmodified Premier cigarettes were tested for comparison. The results are shown in Table 8.

Table 8

Run	Test Description	O/C	CO/CO ₂	Total mg CO
32	No catalyst (unmodified Premier)	3.2	0.92	13.0
33	Ag-Mn-Co Oxide Catalyst 100 mg inside container, 50 mg outside	4.0	0.3	6.1

The results of Table 8 clearly indicate that the addition of the Ag-Mn-CO oxide catalyst significantly increases the CO conversion for the Premier cigarette.

Reasonable variations, modifications and adaptations for various usages and conditions can be made within the scope of the disclosure and the appended claims, without departing from the scope of this invention.

Claims

- Apparatus for producing aerosol, which comprises:
 - a combustible fuel element;
 - a quantity of CO oxidation catalyst having a first end portion and an opposite second end portion and disposed with the first end portion thereof adjacent said fuel element;
 - aerosol-generating means including an aerosol-forming substance and disposed adjacent the second end portion of said catalyst for forming an aerosol in response to the application of heat thereto; and
 - heat-conductive means interconnecting said combustible fuel element and said aerosol-generating means for transferring heat from said combustible fuel element to said aerosol-generating means.
- Apparatus in accordance with claim 1,
 - wherein said CO oxidation catalyst comprises CuO and MnO₂;
 - or wherein said CO oxidation catalyst comprises titania-supported platinum and iron oxide;
 - or wherein said CO oxidation catalyst comprises a silver-manganese-cobalt oxide.
- Apparatus in accordance with claim 1, wherein said CO oxidation catalyst is selected from the group consisting of a CuO and MnO₂ catalyst, a titania-supported platinum and iron oxide catalyst, and a silver-manganese-cobalt oxide catalyst and combinations of any two or more thereof.
- A cigarette-type smoking article comprising:
 - a combustible hollow tube having a first end portion, an opposite second end portion and an intermediate portion;
 - filter means disposed within said hollow tube adjacent the second end portion thereof;
 - apparatus for producing aerosol disposed within said hollow tube intermediate the first end portion thereof and said filter means, said apparatus comprising
 - a combustible fuel element;
 - a quantity of CO oxidation catalyst, in particular one as defined in one of the preceding claims, having a first end portion and an opposite second end portion and disposed with the first end portion thereof adjacent said fuel elements;
 - aerosol-generating means including an aerosol-forming substance adjacent the second end portion of said catalyst for forming an aerosol in response to application of heat thereto;
 - heat-conducting means interconnecting said combustible fuel element and said aerosol-generating means for conducting heat from said combustible fuel element to said aerosol-generating means; and
 - said combustible fuel element being disposed within the first end portion of said hollow tube and said

aerosol-generating means being disposed within said hollow tube adjacent said filter means.

5. A smoking article in accordance with claim 4 wherein said hollow tube and said apparatus for producing aerosol defines an annular space therebetween and wherein said smoking article further comprises:
 5 a quantity of tobacco disposed within said annular space adjacent said catalyst and said aerosol-generating means; and
 a quantity of porous heat insulation material disposed within said annular space adjacent said combustible fuel element.
- 10 6. A smoking article in accordance with claim 4 or 5 wherein said heating conducting means comprises:
 an elongated metallic member having a first end portion and an opposite second end portion with the first end portion thereof in heat-conductive contact with at least a portion of said combustible fuel element and with the second end portion thereof in heat-conductive contact with at least a portion of said aerosol-generating means, more particularly wherein said elongated member extends through said
 15 quantity of CO oxidation catalyst.
7. A smoking article of one of claims 4-6 wherein the fuel element comprises combustible carbon.
8. A smoking article of one claims 4-7 wherein the aerosol-generating means comprises glycerin-
 20 impregnated alumina particles.
9. A smoking article in accordance with one of claims 4-8 further comprising a heat-conductive metal container which encloses at least a first portion of the CO oxidation catalyst and at least a portion of the aerosol-generating means.
 25
10. A smoking article in accordance with one of claims 4-9 wherein said heat-conductive container is provided with a plurality of pin-like holes through the surface of said heat-conductive container so as to circumscribe said CO oxidation catalyst enclosed within said heat-conductive metal container.
- 30 11. A smoking article in accordance with one of claims 4-10 further comprising a first heat-conductive metal container having a first end portion, an opposite second end portion, and an intermediate portion wherein said CO oxidation catalyst is enclosed within said first heat-conductive metal container, and a second heat-conductive metal container having a first end portion adjacent to said second end portion of said first heat-conductive metal container, an opposite second end portion and an intermediate
 35 portion, wherein said aerosol-generating means is enclosed within said second heat-conductive metal container.
12. A smoking article in accordance with one of claims 4-11 wherein said hollow tube and said apparatus for producing aerosol defines an annular space therebetween and wherein said smoking article further
 40 comprises:
 a quantity of tobacco disposed within said annular space adjacent said catalyst and said aerosol-generating means;
 a quantity of porous heat insulation material disposed said annular space adjacent said combustible fuel element; and
 45 a second portion of CO oxidation catalyst within said annular space between said quantity of tobacco and said quantity of porous heat insulation material so as to circumscribe at least a portion of said heat-conductive metal container.
13. A smoking article in accordance with one of claims 4-12 wherein said elongated member comprises a
 50 thin metallic wire, preferably wherein said thin metallic wire has a diameter not greater than 0.020 inches.

55

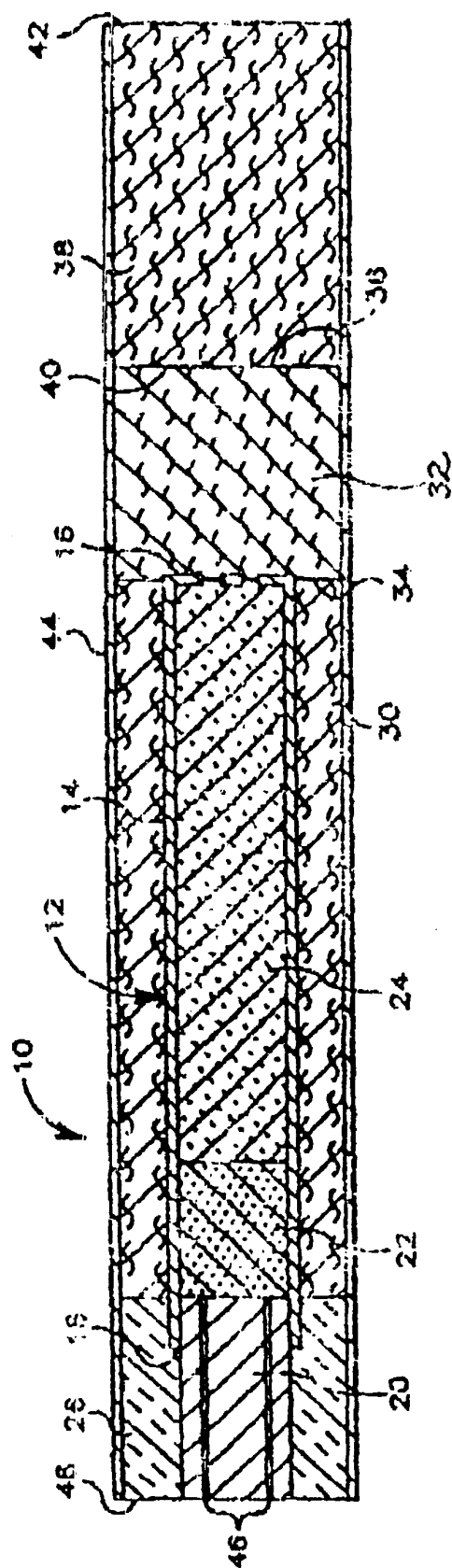


FIG. 1

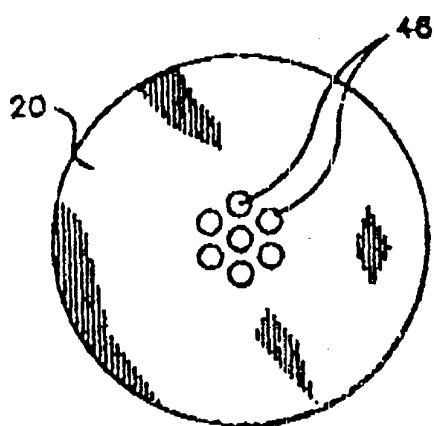


FIG. 2

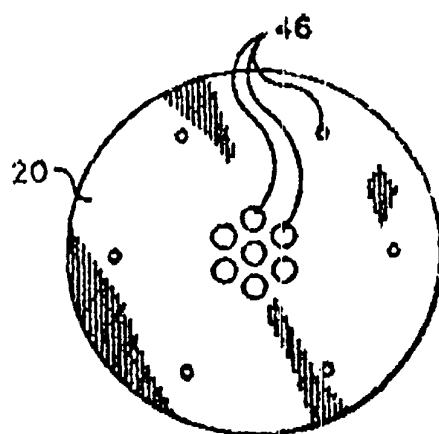


FIG. 3

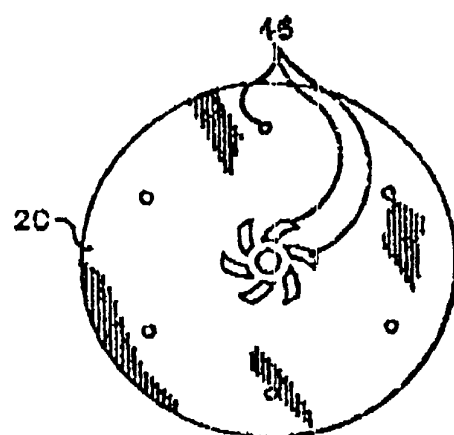


FIG. 4

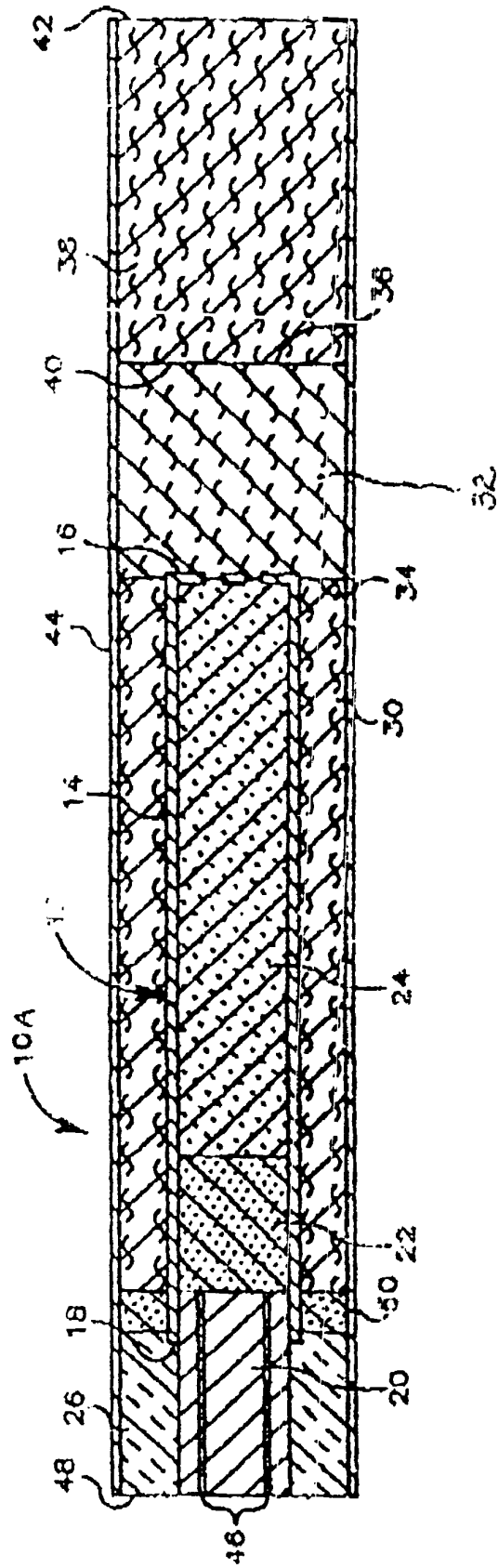


FIG. 5

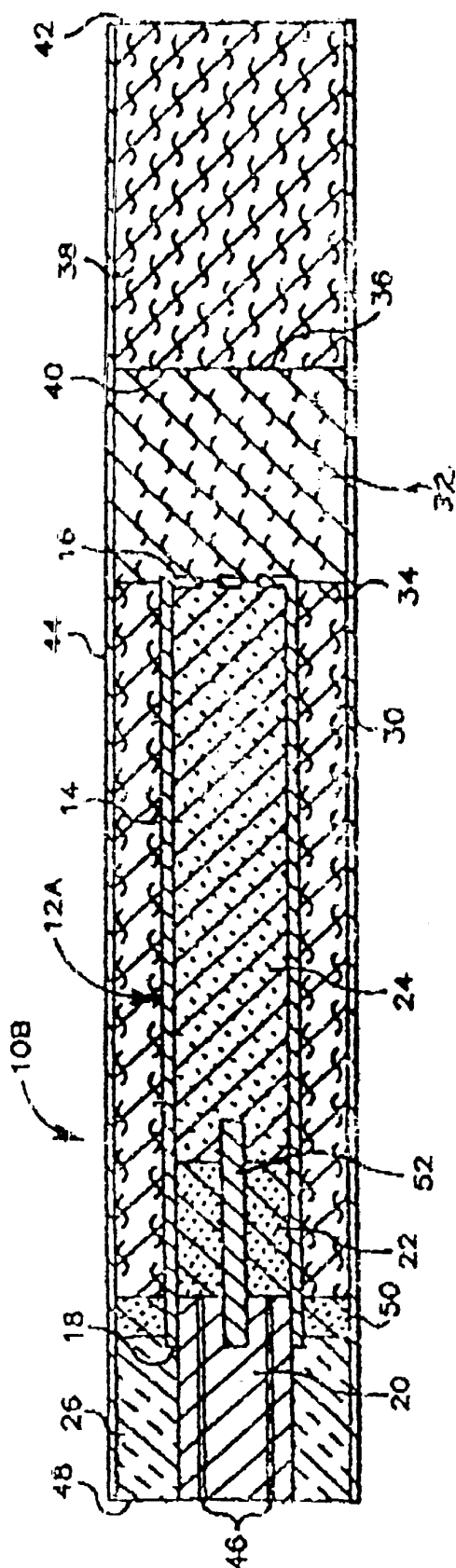


FIG. 6

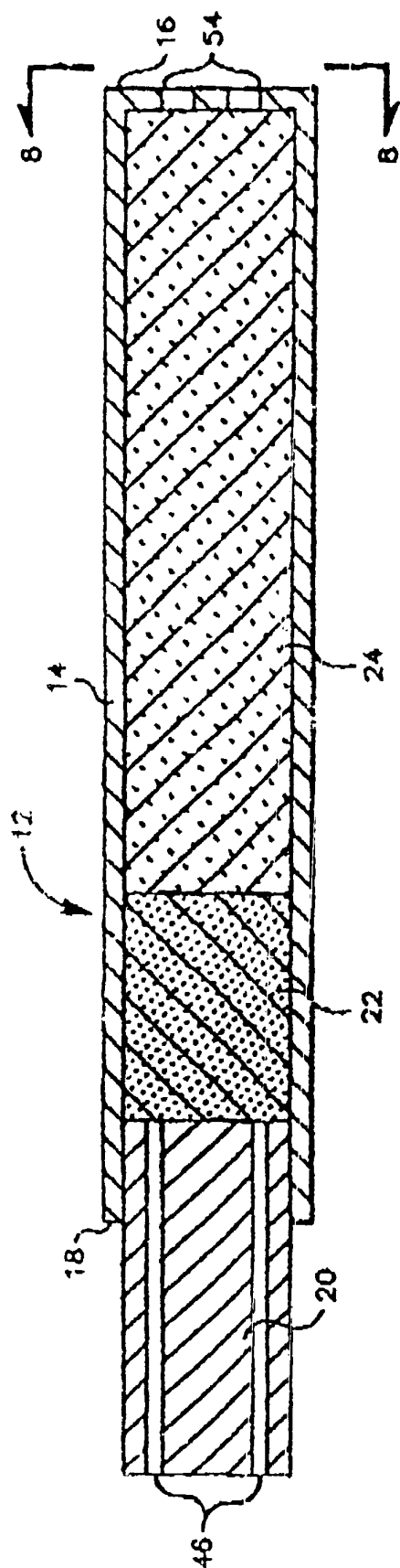


FIG. 7

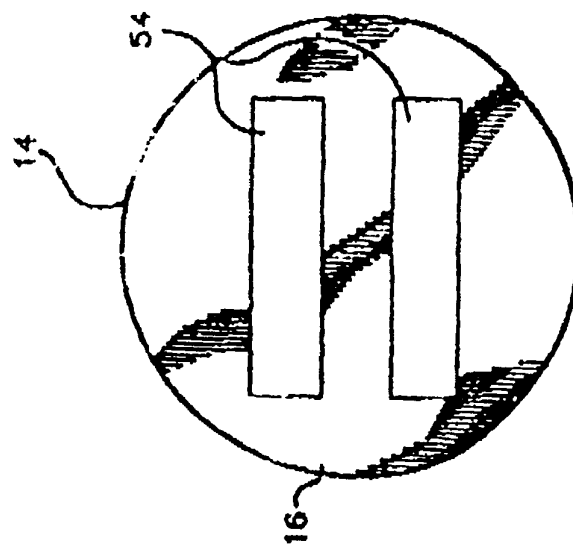
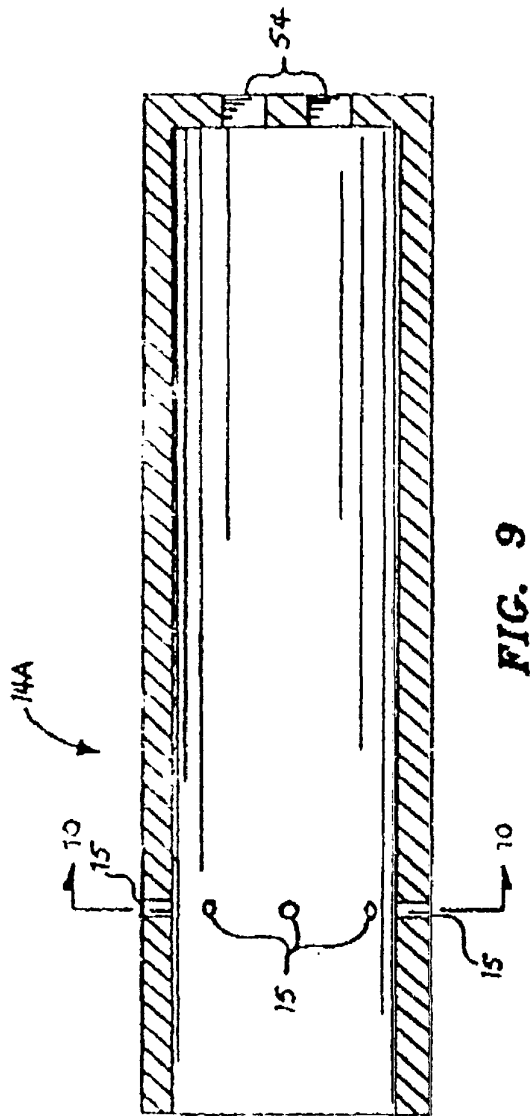
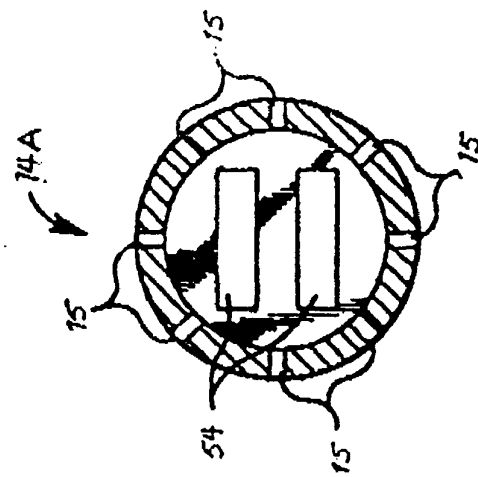


FIG. 8



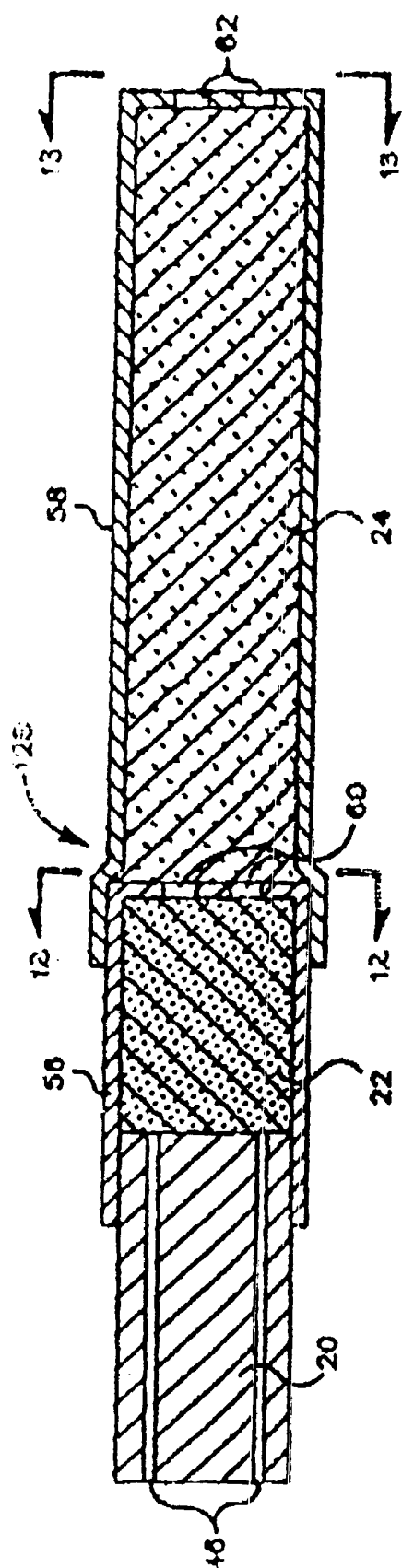


FIG. 11

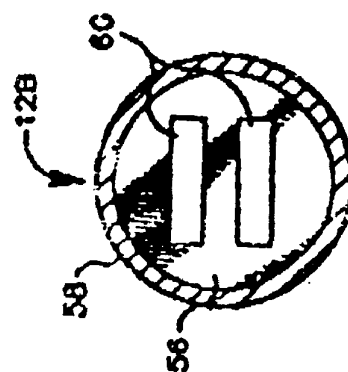


FIG. 12

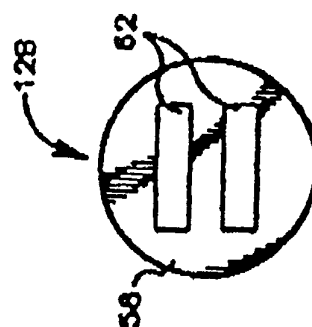


FIG. 13

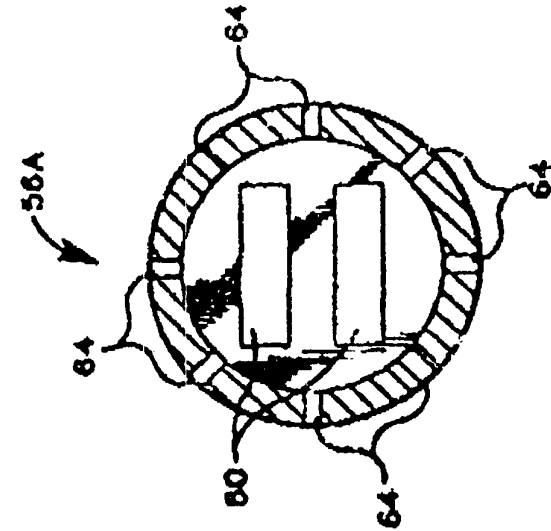


FIG. 14

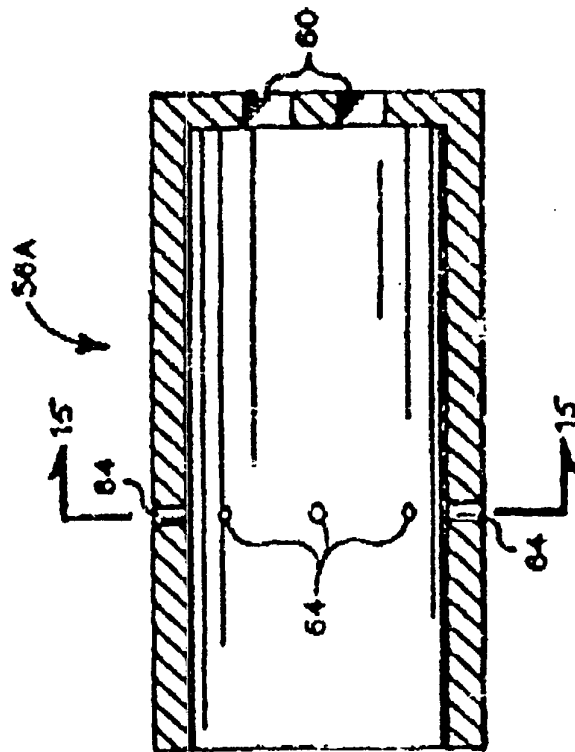


FIG. 15



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Verpackung für tabakbezogene Artikel

Emballage pour articles associés au tabac

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EP-A2- 0 183 397

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EP 2 325 093 B1

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Description

[0001] The invention relates to a package for tobacco-related articles, e.g. for cigarettes or for cigarillos.

[0002] A conventional package for tobacco-related articles comprises a shell having a front wall, a rear wall, two lateral walls opposite to each other and a bottom wall connecting the front wall and the rear wall. The top side of the shell is closed by a lid, which can be opened by swivelling or rotating it about a hinge line provided at the rear wall or one of the lateral walls. For opening or closing such package, the user generally has to apply both of his or her hands.

[0003] FR 1 081 649 discloses a cigarette package comprising an outer shell and an inner shell. The inner shell accommodates the cigarettes and can be moved up and down in the outer shell by means of an actuating knob guided in a slot in the front wall of the outer shell. The top side of the outer shell is closed by two lids. When the inner shell is upwardly moved, the lids open automatically. This package can be handled by one hand. However, the means for actuating the lids are elaborate and tend to be expensive.

[0004] US 2 929 542 describes a slide box for cigarettes in which an inner shell can be slid inside an outer shell. A lid is connected to a top edge of the inner shell by means of a flexible connector, which unlocks the lid after it has been moved out of the outer shell when the inner shell is slid in top direction. This package can be handled by one hand, but this might be inconvenient because the lid does not necessarily open automatically and it might be required to tilt the package for opening the lid.

[0005] US 4 240 548 discloses a push pack comprising an outer shell without bottom and an inner shell. A lid opens automatically when the inner shell is moved in top direction. In order to move the inner shell, however, the user has to push it from the bottom side, which much impedes one-hand operation.

[0006] EP 1 590 251 B1 describes a rigid package for tobacco articles including an outer box and an inner box. The inner box is guided by a kind of elevator for up and down movement. This elevator consists of a flexible member surrounding the inner box in longitudinal direction and being fixed to a wall of the outer box, and it is actuated by sliding the flexible member upwards or downwards by shifting it, at the side opposite to the wall it is fixed at, through an aperture in the outer box. A lid is part of the flexible member. This package enables one-hand operation, but its design is somewhat complicated and tends to be expensive.

[0007] EP 0 183 397 A discloses another cigarette pack comprising an outer shell and an inner shell. A lid having a rear wall is swivelably connected to the rear wall of the inner shell. The inner shell accommodates the cigarettes and can be moved up and down in the outer shell. When the inner shell, starting from the closed state of the pack, is moved upwardly, a connector, which is

attached to the upper end of the rear wall of the lid and runs along the outer face of the rear wall of the lid downwardly into the outer shell, is caught at its lower end by a protrusion at the outer shell so that, when the inner shell is further moved upwardly, the connector pulls down the upper end of the rear wall of the lid, thus opening the lid.

[0008] It is the object of the invention to provide an attractive and moderate-priced package for tobacco-related articles which can be handled in a convenient way by means of one hand.

[0009] This problem is solved by a package for tobacco-related articles having the features of claim 1. Advantageous versions of the invention follow from the dependent claims.

[0010] The package according to the invention is designed to accommodate tobacco-related articles. The package comprises an outer shell having a front wall, a rear wall, two lateral walls opposite to each other and a bottom wall, which connect the front wall and the rear wall, as well as a top side. A lid is adapted to close the top side of the outer shell when it is in a closed state. The lid is swivelably connected to the rear wall or one of the lateral walls of the outer shell at a hinge line, and it can be swivelled about this hinge line for transfer from the closed state to an opened state. Moreover, the package comprises an inner shell which is adapted to accommodate a plurality of tobacco-related articles. The inner shell is shiftably mounted in the outer shell and can be moved from a retracted position, in which it is housed inside the outer shell, to an advanced position, which enables access to the smoking articles.

[0011] At least one wall of the outer shell, selected from the front wall, the rear wall or the two lateral walls, is provided with a cutout (aperture) through which part of the inner shell is exposed. Through the cutout, a user can exert a force onto the inner shell in order to move the inner shell, i.e. in order to shift the inner shell from its retracted to its advanced position or to move it back from its advanced to its retracted position. The cutout can extend over more than one wall of the outer shell, e.g. in a corner area between the front wall and one of the lateral walls. Moreover, more than one cutout is conceivable as well. It is also possible that the bottom wall of the outer shell includes part of the cutout or an additional cutout.

[0012] A hinged connector is provided between a portion of the inner shell and the lid. The hinged connector engages the lid at a distance from the hinge line smaller than the dimension of the lid in a direction perpendicular to the hinge line and is adapted to push the lid into its opened state when the inner shell is moved into its advanced position and to pull the lid into its closed state when the inner shell is moved into its retracted position. Thus, the lid is automatically opened and closed, respectively, when the user moves the inner shell.

[0013] The package according to the invention can be handled in a very convenient way. In contrast to a conventional package, which the user has to hold by one

hand while he or she opens the lid by the other hand, the package according to the invention can be handled or operated just by means of one hand. The user can hold it in one hand, e.g. the rear wall of the outer shell facing his or her palm, and he or she can use his or her thumb in order to grasp through the cutout and shift the inner shell by slightly pressing onto the inner shell and moving the thumb in a direction towards the lid or away from the lid, respectively. Because of the hinged connector, the lid opens and closes automatically. Moreover, the package according to the invention permits an attractive design, and it can be manufactured to a moderate price.

[0014] The one-hand use of the package according to the invention is advantageous in many situations, for example while driving, when operating a computer, when talking on the phone, etc., or, generally, when the user has ready one hand only and wants to take a tobacco-related article. The package can rest well in the user's hand, and the one-hand use of the package is fast and convenient.

[0015] In advantageous embodiments of the invention, the lid comprises a top wall having a front edge, a rear edge, two lateral edges and a bottom side. The top wall of the lid closes the top side of the outer shell when the lid is in its closed state, wherein the hinge line of the lid is located at the rear edge or at one of the lateral edges of the top wall. Since the hinge line of the lid is essentially at the same level as the top wall of the lid (when it is closed), the hinged connector can be designed in a simple and reliable manner. Moreover, this geometrical and technical feature permits attractive design aspects.

[0016] In an advantageous design of the connector, the inner shell comprises a rear wall or a lateral wall having an upper edge, wherein the connector extends from this upper edge and includes a first hinge line at or in the area of this upper edge and a second hinge line at the bottom side of the top wall. Preferably, the distance between the first hinge line and the second hinge line of the connector is greater than the distance between the hinge line of the lid and the second hinge line of the connector, e.g. greater by an amount in the range of from 0.4 mm to 1.8 mm, or by an amount of about 0.7 mm. It will become evident from the embodiments described in more detail below that this condition permits a space-saving, reliable and smooth coupling between the inner shell and the lid.

[0017] Another advantageous geometrical condition for a reliable operation of the lid is that, in the closed state of the lid, the ratio of the distance between the first hinge line of the connector and the hinge line of the lid to the distance between the hinge line of the lid and the second hinge line of the connector is in the range from 0.5 to 1.0, preferably in the range from 0.70 to 0.85, e.g. about 0.78. Again, this condition will become evident from the embodiments described in detail further below.

[0018] When the hinge line of the lid is located at the rear edge or at one of the lateral edges of the top wall, a bevelled edge wall can extend from at least the edge of

the top wall opposite to the hinge line of the lid. The bevelled edge wall is shaped in a sloped or curved manner such that it does not interfere with the outer shell walls during the closing process of the lid and such that it fits into the outer shell when the lid is in its closed state. Thus, it facilitates the closing process by guiding the lid into the top side space of the outer shell, stabilises the package when it is closed, and provides a better protection for the contents of the package.

[0019] The bevelled edge wall can also extend from other edges of the top wall different from the edge comprising the hinge line of the lid. A lid designed in this way can look essentially flat when it is closed, which imparts to the package an interesting and attractive appearance.

[0020] In advantageous versions, the bevelled edge wall is folded from a blank of the outer shell comprising a blank of the lid. The bevelled edge wall can have different kinds of cross-sectional shapes. A triangular shape is preferred because it can be easily folded from a blank and it is stable.

[0021] In other embodiments of the package according to the invention, an edge wall extends from at least the edge of the top wall opposite to the hinge line of the lid. This edge wall extends generally perpendicularly with respect to the top wall of the lid and is visible when the lid is in its closed state. Thus, it is not a bevelled edge wall as described before and provides a more conventional appearance to the package.

[0022] It is also conceivable that the lid comprises an edge wall, wherein the hinge line of the lid is not located at a top wall of the lid, but is arranged at that edge wall.

[0023] The inner shell of the package can comprise a front wall providing a free access area, which facilitates the access to the contents of the inner shell when the inner shell is in its advanced position. This free access area can be designed, e.g., as a cutoff from the front wall or by means of a portion of the front wall having a lowered upper edge or by means of a front wall having generally a low upper edge. Preferably, when the inner shell is in its retracted position, the free access area of the inner shell does not overlap with the cutout of the outer shell, i.e. the free access area is not visible when the package is closed. This improves the appearance of the package.

[0024] Generally, the inner shell can comprise a front wall and a rear wall as well as two lateral walls opposite to each other and a bottom wall, which connect the front wall and the rear wall. It is also conceivable, however, that the inner shell has a lighter structure in which not all of the above-mentioned walls are designed as wall panels. In a lighter structure, an inner wrapper or a bundle wrapper can be applied for providing additional support to the contents of the package.

[0025] In advantageous embodiments of the invention, the front wall of the inner shell comprises a reinforced structure in order to improve its counteraction capabilities when the user touches this front wall, through the cutout, in order to move the inner shell. Such structure can be made from double-layer or triple-layer cardboard, e.g.,

using cardboard panels folded from a blank of the inner shell. It is also conceivable to apply a separate reinforcement panel which is attached to the rest of the inner shell.

[0026] Alternatively or additionally to this reinforcement structure, a reinforcement insert can be inserted into the inner shell. The reinforcement insert can be formed, e.g., as a plastic container, preferably made by injection-moulding. Such design still uses an inner shell, e.g. made from a cardboard blank, which is coupled to the lid via the hinged connector.

[0027] It is also possible to dispense with such cardboard inner shell and to design the inner shell as a plastic container which provides the desired rigidity. In this case, at least part of the connector can be formed as part of the plastic container, but it is also conceivable to attach a connector completely formed from a blank of the lid (e.g., as part of a blank of the outer shell) to the plastic container when assembling the package.

[0028] Preferably, the cutout of the outer shell is provided in the front wall of the outer shell. This is a location which allows for a convenient use of the package. However, it is possible as well to place the cutout at a different wall or in an area which extends over two walls or to provide more than one cutout.

[0029] The cutout of the outer shell can be located in a side area of the front wall of the outer shell, i.e. not in the centre area. This is particularly advantageous when the inner shell comprises a front wall providing a free access area (see above), because in this case the cutout of the outer shell can be placed at a location where it does not overlap with the free access area of the inner shell when the inner shell is in its retracted position. Moreover, in this design, the front wall of the outer shell exhibits a large continuous area which can be used for, e.g., warning hints.

[0030] The cutout of the outer shell can be formed from a blank of the outer shell in which at least part of the blank material of the cutout area is folded back to the inner face of the outer shell. In this way, the edges of the cutout are not sharp or somewhat irregular, but they are determined by the corresponding folding lines, which tend to be smooth and provide a greater thickness of the wall area surrounding the cutout. It can be advantageous when the blank material is not folded back at the top edge of the cutout, because that edge is not seen in detail when the user holds the package in a usual way, whereas a back-folded flap at the top edge of the cutout could interfere with an unimpeded assemblage of the package.

[0031] In advantageous embodiments of the invention, the inner shell comprises, opposite to the cutout of the outer shell, a grip-enhancing surface. Such grip-enhancing surface can be presented, e.g., by means of a relief structure incorporated in the wall material of the inner shell or provided by a sticker glued to the inner shell in the area in question. Another option is a cutout structure, e.g. in a double-layer wall structure of the inner shell in which the outer layer comprises a series of cutouts whereas the inner layer folded to the outer layer is

smooth. Other embodiments include a high-friction coating or rubber-like coating, either applied to a wall or wall area of the inner shell or to a sticker glued to the inner shell in the area in question. The grip-enhancing surface facilitates the operation of the package because it increases the frictional forces to, e.g., the user's thumb.

[0032] The outer shell can be box-shaped. It can also comprise rounded edges, wherein preferably the longitudinal edges between the front wall and both lateral walls are rounded. Another option for the shape of the outer shell is a form with a hexagonal or octagonal cross-sectional shape, wherein the lateral walls or the front wall comprise side panels folded from the rest of the respective lateral wall or from the rest of the front wall (or rear wall) along fold lines running in parallel to a longitudinal axis of the package. Such shapes provide an attractive appearance of the package, whereas additional manufacturing expenses are moderate. The shape of the inner shell can be adjusted accordingly.

[0033] In advantageous embodiments of the invention, the outer shell and/or the inner shell of the package are folded from a respective blank made from cardboard in the weight range from 180 g/m² to 290 g/m². This involves well-established techniques. Cardboard blanks can be designed in a large number of varieties. Other materials for the components of the package are conceivable as well, however, for example cardboard having a weight outside of the range indicated above or laminated materials or plastic materials.

[0034] There are many design options for the hinged connector. For example, it can be folded by part of a blank of the outer shell and by part of a blank of the inner shell, wherein both parts are glued together upon assemblage of the package. Or it can be folded by part of a blank of the outer shell and glued directly to the inner shell. Or it can be folded by part of a blank of the inner shell and glued to the lid, which preferably is made from part of a blank of the outer shell. Regarding the shape of the connector, it can be relatively narrow measured in a direction along the hinge line of the lid. But it can also have the greatest or the almost greatest possible width measured in this direction. Generally, a larger width increases the rigidity of the structure. A trapezoidal shape of the connector, e.g., provides for a large extension where it is required for improving strength but also provides sloped edges which may facilitate the assemblage of the package.

[0035] The package according to the invention is not restricted to a design comprising one inner shell containing one charge or bundle of tobacco-related products only. The invention is also directed to packages including one inner shell containing more than one bundle, and it is further directed to packages including more than one inner shell. For example, the package can comprise at least two inner shells which are arranged side by side. In this case, preferably, the lid is swivelably connected to the rear wall of the outer shell. The lid can be formed from at least two separate parts, which are arranged side

by side and are swivelably connected to the rear wall of the outer shell, wherein each of the separate parts of the lid is associated to one of the inner shells. The front wall of the outer shell can be provided with at least one cutout adapted to expose part of each of the inner shells and to enable exerting a force onto each of the inner shells for moving the respective inner shell and actuating the respective part of the lid via a hinged connector. This at least one cutout can be a single cutout in an area having access to all of the inner shells, or it can include at least two cutouts, one for each inner shell.

[0036] The package according to the invention can be filled with all kinds of tobacco-related articles, for example with cigarettes, cigarillos, cigars, tobacco-containing rods, smokeless tobacco, simulated smoking devices (e.g., electronic cigarettes), inhalors without combustion of tobacco, or aroma reservoirs.

[0037] When filled with tobacco-related articles, the package can be enclosed by, e.g., a cellophane or transparent plastic (e.g., polypropylene) wrapper, which is removed or partially removed by the user before opening the package for the first time. Such kind of wrappers aid in maintaining the aroma and freshness of the tobacco-related articles and serve as a temper-evident closure.

[0038] In a different embodiment of a package for tobacco-related articles, the outer shell does not have a cutout in its front wall, rear wall or lateral walls. In this embodiment, the outer shell rather comprises a cutout in its bottom wall (including a missing bottom). Otherwise, this embodiment can be constructed as outlined above. For advancing the inner shell, the user has to press upon its bottom (through the bottom aperture of the outer shell), while for retracting the inner shell, the user has to manually close the lid.

[0039] In the following, the invention is further explained by means of embodiments. The drawings show in

Figure 1 in parts (a) to (e) several views of a first embodiment of a package for tobacco-related articles according to the invention, i.e. in part (a) an isometric view of the package, the lid being partially opened, in part (b) an isometric view of the package, the lid being fully opened and an inner shell of the package having been moved to an advanced position, in part (c) a side view of the package, the lid being closed, in part (d) a side view of the package in the state according to part (b), and in part (e) a longitudinal section through the package in a plane containing the centre longitudinal axis,

Figure 2 in part (a) a plane view of a blank for the outer shell of the package according to Figure 1 and in part (b) a plane view of a blank for the inner shell of the package according to Figure 1,

Figure 3 in parts (a) to (d) several views of a second embodiment of a package for tobacco-related articles according to the invention, i.e. in part (a) an isometric view of the package, the lid being partially opened, in part (b) an isometric view of the package, the lid being fully opened and an inner shell of the package having been moved to an advanced position, in part (c) a bottom view of the package, and in part (d) a side view of the package in the state according to part (b),

Figure 4 in part (a) a plane view of a blank for the outer shell of the package according to Figure 3 and in part (b) a plane view of a blank for the inner shell of the package according to Figure 3,

Figure 5 in parts (a) and (b) isometric views of a third embodiment of a package according to the invention, which contains two bundles, i.e. in part (a) with the lid partially opened and in part (b) with an inner shell of the package in an advanced position and the lid being fully opened, and

Figure 6 in parts (a) and (b) isometric views of a fourth embodiment of a package according to the invention, i.e. in part (a) with a two-part lid partially opened and in part (b) with two inner shells of the package in an advanced position, the two-part lid being fully opened.

[0040] Figure 1 illustrates a first embodiment of a package 1 for tobacco-related articles.

[0041] The package 1 comprises an outer shell 2, a lid 4 adapted to close the outer shell 2, and an inner shell 6, which is movable within the outer shell 2 from a retracted position, see Figure 1(a), to an advanced position, see Figure 1(b).

[0042] The inner shell 6 accommodates a bundle 8 of tobacco-related articles, e.g. a bundle of cigarettes. The bundle 8 is provided in a conventional manner, e.g. by wrapping a plurality of cigarettes with, e.g., an aluminium foil or aluminium-laminated paper. In the state of the package 1 shown in Figure 1(b), the bundle 8 can be easily opened in order to take out a cigarette.

[0043] The outer shell 2 comprises front wall 10, a rear wall 12, two lateral walls 14 and a bottom wall 16. In the embodiment, the top side 18 provides a free cross-sectional area.

[0044] The front wall 10 includes a cutout 20, i.e. an aperture fully penetrating the front wall 10. In the embodiment, the cutout 20 is located approximately in the centre area of the front wall 10.

[0045] The lid 4 is connected to the upper edge of the rear wall 12 via a hinge line 22 so that it can be swivelled from a closed state, see Figure 1(c), to a fully opened

state, see Figure 1(b), Figure 1(d), and Figure 1(e). In the embodiment, the lid 4 comprises a top wall 24 having a front edge 26 and a rear edge 28, see Figure 1(d), as well as two lateral edges 30, see Figure 1(a). Its bottom side is designated by reference numeral 32, see Figure 1(e). The hinge line 22 runs along the rear edge 28 of lid 4 and is designed from a fold line of the blank the outer shell is formed from.

[0046] Moreover, the lid 4 comprises a front edge wall 34 extending from front edge 26 and two lateral edge walls 36 extending from the two lateral edges 30 of the top wall 24 of lid 4. As can be seen in Figures 1(a), (b), (d) and (e), the edge walls 34 and 36 have a "bevelled" shape. That means, they extend from the front edge 26 and the lateral edges 30, respectively, in a somewhat inwardly inclined manner such that the edge walls 34 and 36 can enter the interior space of the outer shell 2 when the lid 4 is closed. Consequently, the edge walls 34 and 36 are not visible when the lid 4 is closed, see Figure 1(c). In other words, when the lid 4 is closed, only its top wall 24 can be seen, which imparts to the package 1 a striking design.

[0047] When the lid 4 is closed, the edge walls 34 and 36 are located inside the outer shell 2 and stabilise the package 1. In the embodiment, the edge walls 34 and 36 have a triangular cross-sectional shape, see Figure 1(e), which provides for a generally large strength of the edge walls 34 and 36. Moreover, the bevelled or inclined shape of the edge walls 34, 36 facilitates the closing process of the lid 4. In variants of the embodiment according to Figure 1, the cross-sectional shape of the edge walls is not triangular, but different, e.g. more or less rounded.

[0048] The inner shell 6 comprises a front wall 40 and a rear wall 42, see Figure 1(e), two lateral walls 44, see Figure 1(d), as well as a bottom wall 46, see Figure 1(e). The upper edge of the front wall 40 and part of the upper edges of the lateral walls 44 are arranged below the upper edge of the rear wall 42, see Figure 1(b) and Figure 1(d), which provides a free access area 48 for facilitating the removal of the tobacco-related articles of bundle 8.

[0049] In the area of the cutout 20 of the outer shell 2, the front wall 40 of the inner shell 6 is coated with a grip-enhancing, high-frictional material, e.g. a rubber-like material.

[0050] The inner shell 6 is coupled to the lid 4 by means of a hinged connector 50. As shown in Figure 1(b), the connector 50 extends over most of the width of package 1. Figure 1(e) illustrates the details of the connector 50 and explains how it works.

[0051] In the embodiment, the connector 50 extends from the upper edge of the rear wall 42 of the inner shell 6 at a first hinge line 52. The connector 50 is attached to the bottom side 32 of the top wall 24 of lid 4 at a second hinge line 54. The connector 50 can swivel about the hinge lines 52 and 54.

[0052] Moreover, in the embodiment, the distance between the first hinge line 52 and the second hinge line 54 is greater than the distance between the second hinge

line 54 and the hinge line 22 of lid 4, e.g. by an amount of about 0.7 mm.

[0053] When the lid 4 is in its closed state, see Figure 1(c), a user can place the package 1 in the palm of one of his or her hands, touch the front wall 40 of the inner shell 6 through the cutout 20 in the outer shell 2 with his or her thumb and move the thumb upwards. In this way, the user shifts the inner shell 6 from its retracted position upwards until it achieves its fully advanced position. During the movement of the inner shell 6, the connector 50 opens the lid 4 by swivelling it about the hinge line 22. Since during all times of this movement, the hinge lines 22, 52 and 54 form a triangle in the plane of Figure 1(e), the swivel movement of the lid 4 is well-defined.

[0054] Initially, when lid 4 is closed, the ratio of the distance between the first hinge line 52 of the connector 50 and the hinge line 22 of the lid 4 to the distance between the hinge line 22 of the lid 4 and the second hinge line 54 of the connector 50 is about 0.78, in the embodiment. This implies that, on the one hand, the lid 4 experiences a sufficient torque during the initial moments of the opening movement, whereas, on the other hand, the upper edge of the inner shell 6, i.e. the first hinge line 52, is not located too much below the hinge line 22, i.e. the connector mechanism does not waste much space in top of the inner shell 6 when the inner shell 6 assumes its retracted position.

[0055] When the user moves his or her thumb downwards, the inner shell 6 is shifted back to its retracted position, and the connector 50 pulls the lid 4 down to its closed state.

[0056] Other numerical values of the numbers presented above can be chosen as well. A person skilled in the art can optimise the geometry of the connector 50 depending on the actual dimensions of the outer shell 2 and the inner shell 6.

[0057] Figure 2 illustrates a blank 60 of the outer shell 2, see Figure 2(a), as well as a blank 70 of the inner shell 6, see Figure 2(b). In the embodiment, both blanks are made from cardboard of a usual thickness, e.g. in the weight range from 180 g/m² to 290 g/m². Other blank materials are conceivable as well, e.g. laminated cardboard or plastic materials.

[0058] In Figure 2(a), the front wall 10, the rear wall 12, the lateral walls 14, and the bottom wall 16 of the outer shell 2 are indicated by their reference numerals. Moreover, any gluing tabs are designated by reference numeral 62 and any cut-through lines by reference numeral 63. The lines not indicated by reference numerals are usual fold lines. The hatched areas are completely cut away.

[0059] The area of the cutout 20, three tabs 64 are provided which are folded back during the assemblage of the package and are glued to the inner side of the front wall 10 in order to form smooth and well-appearing edges of the cutout 20.

[0060] Reference numeral 65 indicates an area for a warning hint. The size of this area is prescribed by na-

tional regulations. In blank 60, the area 65 is located below the cutout 20.

[0061] Similar to the tabs 64, a reinforcement panel 66 is folded back during assemblage of the outer shell 2 in order to strengthen the outer shell 2 and form a well-appearing upper edge of the front wall 10.

[0062] Figure 2(a) also illustrates how the lid 4 including its top wall 24 and the edge walls 34 and 36 is formed from the blank 60. The edge walls 34 and 36 are folded about their respective fold lines and are fixed to the lower side of top wall 24 by means of respective gluing tabs 62. A first part 68 of the hinged connector 50 is incorporated in the gluing tab 62 of the front edge wall 34.

[0063] The individual steps for assembling the outer shell 2 from blank 60 are evident to a person skilled in the art.

[0064] In a similar way, the blank 70 of the inner shell 6 shown in Figure 2(b) comprises the front wall 40, the rear wall 42, both lateral walls 44 and the bottom wall 46 of the inner shell 6 and additionally some gluing tabs 72. Cut-through lines are indicated by reference numeral 73. Part 74 is a reinforcement part which, after having been folded and glued to the rear wall 42, stabilises the rear wall 42 and provides for a well-appearing upper edge of the rear wall 42.

[0065] A reinforcement panel 76 is folded back (and preferably glued) to the inner side of the front wall 40 in order to stabilise the front wall 40 of the inner shell 6. When the user puts his or her thumb through the cutout 20, he or she exerts some force onto the front wall 40 of the inner shell 6. As long as the bundle 8 in the inner shell 6 is still complete or almost complete, the front wall 40 of the inner shell 6 does not much yield under this pressure. During use of the package 1, however, the residual bundle 8 gets smaller and does not stabilise the inner shell 6 anymore. For this reason, the rigid front wall 40 is advantageous. In addition to reinforcement panel 76, another reinforcement panel can be used. This additional reinforcement panel can be part of the blank of the inner shell 6. A separate reinforcement panel, e.g. made from a stronger material, which is attached during the assembly process of the inner shell 6, is conceivable as well. As an alternative, the inner shell could be made completely from a sufficiently strong plastic material, e.g. as an injection-moulded part.

[0066] Figure 2(b) also shows a second part 78 of the connector 50 which is cut out from the reinforcement part 74 along three cut-through lines 73.

[0067] Again, it is evident to a person skilled in the art how the inner shell 6 is assembled from blank 70.

[0068] After assemblage of the outer shell 2 and the inner shell 6 from the blanks 60 and 70, respectively, is complete, the inner shell 6 is inserted in the outer shell 2 via top side 18, and the first part 68 and the second part 78 of the connector 50 are glued together, e.g. in a position of the lid 4 as in Figure 1(a).

[0069] Different designs of the connector are conceivable as well, e.g. a connector fully integrated in the blank

of the outer shell or a connector fully integrated in the blank of the inner shell. Moreover, the shape of the connector can be different from that shown in Figure 2, e.g. an even wider connector which would stabilise the package even more than the connector 50 of package 1.

[0070] Figure 3 illustrates another embodiment of a package for tobacco-related articles, which is designated by reference numeral 80.

[0071] The package 80 is similar to the package 1 described so far. For this reason, for most parts of package 80, the same reference numerals are used as for package 1. These parts, which include the opening mechanism of the lid 4, are not explained again.

[0072] The main difference between the packages 80 and 1 is the outer shape. In package 80, the outer shell 2 has an octagonal cross-sectional shape, see in particular the bottom view according to Figure 3(c). This octagonal shape is achieved by means of side panels 82 which are folded by fold lines 83 from the front wall 10 and the rear wall 12, respectively. By definition, the side panels 82 are considered as parts of the front wall 10 and the rear wall 12, respectively, but they could be considered as parts of the lateral walls 14 as well.

[0073] Figure 4 (a) shows a blank 84 for the outer shell of package 80. In this case, a warning-hint area 85 is located above the cutout of the front wall. Generally, the cutout in the front wall of the outer shell should not overlap with the free access area of the inner shell when the inner shell is in its retracted position.

[0074] A blank 86 of the inner shell of package 80 is shown in Figure 4(b). The shape of the inner shell is adapted to that of the outer shell, i.e. the inner shell has an octagonal cross-sectional shape as well. In Figure 4 (b), the corresponding side panels and fold lines are indicated by reference numerals 88 and 89, respectively.

[0075] Otherwise, the explanation given for the assemblage of package 1 by means of the blanks 60 and 70 holds for the assemblage of the package 80 by means of the blanks 84 and 86 in an analogous manner.

[0076] Figure 5 illustrates a third embodiment of the package for tobacco-related articles, which is designated by reference numeral 90. In this embodiment, an outer shell 92 with a cutout 93 at its front wall can be closed at its top side by means of a swivelable lid 94. An inner shell 96 is shiftably mounted in the outer shell 92 and can be moved from a retracted position to an advanced position. The lid 94 is coupled to the inner shell 96 by means of a connector.

[0077] As before, a user can move the inner shell 96 and automatically open the lid 94 by gripping with, e.g., the thumb through the cutout 93 and sliding the inner shell 96 upwards. So far, the package 1 and the package 90 are very similar.

[0078] In contrast to package 1, however, package 90 is wider such that its inner shell 96 can accommodate two bundles 98 and 99 of tobacco-related articles, e.g. cigarettes. In practice, one bundle is consumed first, while the other one stays closed at the beginning to keep

its freshness. Afterwards, the other bundle is consumed.
[0079] A fourth embodiment of the package for tobacco-related articles is shown in Figure 6. This package is designated by reference numeral 100.

[0080] The package 100 comprises an outer shell 102 with two cutouts 103 in its front wall. The lid, which is swivelably connected to the upper edge of the rear wall of the outer shell 102, consists of two parts, a first part 104 and a second part 105. Both parts 104 and 105 of the lid are independent from each other.

[0081] The outer shell 102 houses two inner shells, a first inner shell 106 and a second inner shell 107. The first inner shell 106 accommodates one bundle 108 of tobacco-related articles, the second inner shell 107 one bundle 109.

[0082] The first part 104 of the lid is coupled to the first inner shell 106 by means of a connector designed as connector 50 of the embodiment according to Figure 1. Similarly, the second part 105 of the lid is coupled to the second inner shell 107 by means of a corresponding connector. Consequently, both inner shells 106 and 107 including the parts of the lid coupled thereto, i.e. the first part 104 and the second part 105, respectively, can be moved independently from each other. In other words, the package 100 can be considered as two packages 1 arranged side by side with a common outer shell 102.

Claims

1. A package for tobacco-related articles, comprising

- an outer shell (2; 92; 102) having a front wall (10), a rear wall (12), two lateral walls (14) opposite to each other and a bottom wall (16) connecting the front wall (10) and the rear wall (12), as well as a top side (18),
- a lid (4; 94; 104, 105) adapted to close the top side (18) of the outer shell (2; 92; 102) when in a closed state, the lid (4; 94; 104, 105) being swivelably connected to the rear wall (12) or one of the lateral walls (14) of the outer shell (2; 92; 102) at a hinge line (22) and being swivelable about the hinge line (22) for transfer from the closed state to an opened state,
- an inner shell (6; 96; 106, 107) adapted to accommodate a plurality of tobacco-related articles and shiftably mounted in the outer shell (2; 92; 102), wherein the inner shell (6; 96; 106, 107) is moveable from a retracted position, in which it is housed inside the outer shell (2; 92; 102), to an advanced position, which enables access to the smoking articles,
- a cutout (20; 93; 103) in at least one wall of the outer shell (2; 92; 102), selected out of the front wall (10), the rear wall (12) or the two lateral walls (14), which cutout (20; 93; 103) is adapted to expose part of the inner shell (6; 96; 106, 107)

and to enable exerting a force onto the inner shell (6; 96; 106, 107) for moving the inner shell (6; 96; 106, 107),

- a hinged connector (50) between a portion of the inner shell (6; 96; 106, 107) and the lid (4; 94; 104, 105), which engages the lid (4; 94; 104, 105) at a distance from the hinge line (22) smaller than the dimension of the lid (4; 94; 104, 105) in a direction perpendicular to the hinge line (22) and is adapted to push the lid (4; 94; 104, 105) into its opened state when the inner shell (6; 96; 106, 107) is moved into its advanced position and to pull the lid (4; 94; 104, 105) into its closed state when the inner shell (6; 96; 106, 107) is moved into its retracted position.

2. Package according to claim 1, **characterised in that** the lid (4; 94; 104, 105) comprises a top wall (24) having a front edge (26), a rear edge (28), two lateral edges (30) and a bottom side (32) and adapted to close the top side (18) of the outer shell (2; 92; 102) when the lid (4; 94; 104, 105) is in its closed state, the hinge (22) line being located at the rear edge (28) or at one of the lateral edges (30) of the top wall (24).

3. Package according to claim 2, **characterised in that** the inner shell (6; 96; 106, 107) comprises a rear wall (42) or a lateral wall (44) having an upper edge, wherein the connector (50) extends from said upper edge, having a first hinge line (52) at or in the area of said upper edge, and wherein the connector (50) has a second hinge line (54) at the bottom side (32) of the top wall (24).

4. Package according to claim 3, **characterised in that** the distance between the first hinge line (52) and the second hinge line (54) of the connector (50) is greater than the distance between the hinge line (22) of the lid (4; 94; 104, 105) and the second hinge line (54) of the connector (50), preferably greater by an amount in the range of from 0.4 mm to 1.8 mm, most preferred by an amount of about 0.7 mm.

5. Package according to claim 3 or 4, **characterised in that**, in the closed state of the lid (4; 94; 104, 105), the ratio of the distance between the first hinge line (52) of the connector (50) and the hinge line (22) of the lid (4; 94; 104, 105) to the distance between the hinge line (22) of the lid (4; 94; 104, 105) and the second hinge line (54) of the connector (50) is in the range from 0.5 to 1.0, preferably in the range from 0.70 to 0.85, most preferred about 0.78.

6. Package according to anyone of claims 2 to 5, **characterised in that** a bevelled edge wall (34) extends from at least the edge (26) of the top wall (24) opposite to the hinge line (22) of the lid (4; 94; 104, 105),

which bevelled edge wall (34) fits into the outer shell (2; 92; 102) when the lid (4; 94; 104, 105) is in its closed state.

7. Package according to claim 6, **characterised in that** the bevelled edge wall (34, 36) also extends from other edges (30) of the top wall (24) different from the edge (28) comprising the hinge line (22) of the lid (4; 94; 104, 105).
8. Package according to claim 6 or 7, **characterised in that** the bevelled edge wall (34, 36) is folded from a blank (60; 84) of the outer shell (2; 92; 102) comprising a blank of the lid (4; 94; 104, 105), wherein the bevelled edge wall (34, 36) preferably has a triangular cross-sectional shape.
9. Package according to anyone of claims 2 to 5, **characterised in that** an edge wall extends from at least the edge of the top wall (24) opposite to the hinge line (22) of the lid (4; 94; 104, 105), which edge wall extends generally perpendicularly with respect to the top wall (24) of the lid (4; 94; 104, 105) and is visible when the lid (4; 94; 104, 105) is in its closed state.
10. Package according to claim 1, **characterised in that** the lid comprises an edge wall, the hinge line of the lid being located at the edge wall.
11. Package according to anyone of claims 1 to 10, **characterised in that** the inner shell (6; 96; 106, 107) comprises a front wall (40) providing a free access area (48), which is adapted to facilitate access to the contents of the inner shell (6; 96; 106, 107) when the inner shell (6; 96; 106, 107) is in its advanced position.
12. Package according to claim 11, **characterised in that**, when the inner shell (6; 96; 106, 107) is in its retracted position, the free access area (48) of the inner shell (6; 96; 106, 107) does not overlap with the cutout (20; 93; 103) of the outer shell (2; 92; 102).
13. Package according to anyone of claims 1 to 12, **characterised in that** the inner shell (6; 96; 106, 107) comprises a front wall (40), a rear wall (42), and two lateral walls (44) opposite to each other and a bottom wall (46) connecting the front wall (40) and the rear wall (42).
14. Package according to anyone of claims 11 to 13, **characterised in that** the front wall (40) of the inner shell (6; 96; 106, 107) comprises a reinforced structure, preferably made from double-layer or triple-layer cardboard (40, 76).
15. Package according to anyone of claims 1 to 14, **characterised by** a reinforcement insert inserted into the

inner shell (6; 96; 106, 107).

16. Package according to claim 15, **characterised in that** the reinforcement insert is formed as a plastic container, preferably made by injection-moulding.
17. Package according to anyone of claims 1 to 13, **characterised in that** the inner shell is designed as a plastic container, wherein preferably at least part of the connector is formed as part of the plastic container.
18. Package according to anyone of claims 1 to 17, **characterised in that** the cutout (20; 93; 103) of the outer shell (2; 92; 102) is provided in the front wall (10) of the outer shell (2; 92; 102).
19. Package according to claim 18, **characterised in that** the cutout of the outer shell is located in a side area of the front wall of the outer shell (2; 92; 102), wherein preferably the inner shell (6; 96; 106, 107) comprises a front wall (40) providing a free access (48) area which does not overlap with the cutout (20; 93; 103) of the outer shell (2; 92; 102) when the inner shell (6; 96; 106, 107) is in its retracted position.
20. Package according to anyone of claims 1 to 19, **characterised in that** the cutout (20; 93; 103) is formed from a blank (60; 84) of the outer shell (2; 92; 102) in which at least part (64) of the blank material of the cutout area (20; 93; 103) is folded back to the inner face of the outer shell (2; 92; 102).
21. Package according to anyone of claims 1 to 20, **characterised in that**, opposite to the cutout (20; 93; 103) of the outer shell (2; 92; 102), the inner shell (6; 96; 106, 107) comprises a grip-enhancing surface, which preferably includes at least one of the following features: relief structure, cutout structure, high-friction coating, rubber-like coating.
22. Package according to anyone of claims 1 to 21, **characterised in that** the outer shell comprises rounded edges, wherein preferably the longitudinal edges between the front wall and both lateral walls are rounded.
23. Package according to anyone of claims 1 to 21, **characterised in that** the outer shell (2) comprises a hexagonal or octagonal cross-sectional shape, wherein the lateral walls or the front wall (10) comprise side panels (82) folded from the rest of the respective lateral wall or from the rest of the front wall (10) along fold lines (83) running in parallel to a longitudinal axis of the package (80).
24. Package according to anyone of claims 1 to 23, **characterised in that** the outer shell (2; 92; 102) and/or

the inner shell (6; 96; 106, 107) are folded from a respective blank (60, 70; 84, 86) made from cardboard in the weight range from 180 g/m² to 290 g/m².

25. Package according to anyone of claims 1 to 24, **characterised in that** the connector (50) is formed in one of the following ways: folded by part (66) of a blank (60; 84) of the outer shell (2; 92; 102) and by part (78) of a blank (70; 86) of the inner shell (6; 96; 106, 107) and both parts being glued together, folded by part of a blank of the outer shell and glued to the inner shell, folded by part of a blank of the inner shell and glued to the lid.
26. Package according to anyone of claims 1 to 25, **characterised by** at least two inner shells (106, 107) which are arranged side by side.
27. Package according to claim 26, **characterised in that** the lid (104, 105) is swivelably connected to the rear wall of the outer shell (102).
28. Package according to claim 27, **characterised in that** the lid (104, 105) is formed from at least two separate parts (104, 105), which are arranged side by side and are swivelably connected to the rear wall of the outer shell (102), wherein each of the separate parts (104, 105) of the lid is associated to one of the inner shells (106, 107).
29. Package according to claim 28, **characterised in that** the front wall of the outer shell (102) is provided with at least one cutout (103) adapted to expose part of each of the inner shells (106, 107) and to enable exerting a force onto each of the inner shells (106, 107) for moving the respective inner shell (106, 107) and actuating the respective part of the lid (104, 105) via a hinged connector.
30. Package according to anyone of claims 1 to 29, **characterised in that** the package (1; 80; 90; 100) contains tobacco-related articles, wherein the tobacco-related articles are selected from the following group: cigarettes, cigarillos, cigars, tobacco-containing rods, smokeless tobacco, simulated smoking devices, inhalors without combustion of tobacco, aroma reservoirs.

Patentansprüche

1. Packung für tabakbezogene Artikel, mit

- einer äußeren Schale (2; 92; 102) mit einer Vorderwand (10), einer Rückwand (12), zwei einander gegenüberliegenden Seitenwänden (14) und einer Bodenwand (16), die die Vorderwand (10) und die Rückwand (12) verbinden,

sowie einer Oberseite (18),

- einem Deckel (4; 94; 104, 105), der dazu eingerichtet ist, in einem geschlossenen Zustand die Oberseite (18) der äußeren Schale (2; 92; 102) zu schließen, wobei der Deckel (4; 94; 104, 105) an einer Schwenklinie (22) schwenkbar mit der Rückwand (12) oder einer der Seitenwände (14) der äußeren Schale (2; 92; 102) verbunden ist und für einen Übergang von dem geschlossenen Zustand in einen geöffneten Zustand um die Schwenklinie (22) schwenkbar ist,
- einer inneren Schale (6; 96; 106, 107), die dazu eingerichtet ist, eine Anzahl von tabakbezogenen Artikeln aufzunehmen, und verschiebbar in der äußeren Schale (2; 92; 102) gelagert ist, wobei die innere Schale (6; 96; 106, 107) von einer zurückgezogenen Position, in der sie sich in der äußeren Schale (2; 92; 102) befindet, in eine vorgeschobene Position, die einen Zugang zu den Rauchartikeln ermöglicht, bewegbar ist,
- einem Ausschnitt (20; 93; 103) in wenigstens einer Wand der äußeren Schale (2; 92; 102), ausgewählt aus der Vorderwand (10), der Rückwand (12) oder den beiden Seitenwänden (14), wobei der Ausschnitt (20; 93; 103) dazu eingerichtet ist, einen Teil der inneren Schale (6; 96; 106, 107) zu exponieren und es zu ermöglichen, eine Kraft auf die inneren Schale (6; 96; 106, 107) zum Bewegen der inneren Schale (6; 96; 106, 107) auszuüben,
- einem angelenkten Verbinder (50) zwischen einem Teil der inneren Schale (6; 96; 106, 107) und dem Deckel (4; 94; 104, 105), der an dem Deckel (4; 94; 104, 105) in einem Abstand von der Schwenklinie (22) angreift, der kleiner ist als das Maß des Deckels (4; 94; 104, 105) in einer Richtung senkrecht zu der Schwenklinie (22), und dazu eingerichtet ist, den Deckel (4; 94; 104, 105) in seinen geöffneten Zustand zu drücken, wenn die innere Schale (6; 96; 106, 107) in ihre vorgeschobene Position bewegt wird, und den Deckel (4; 94; 104, 105) in seinen geschlossenen Zustand zu ziehen, wenn die innere Schale (6; 96; 106, 107) in ihre zurückgezogene Position bewegt wird.

2. Packung nach Anspruch 1, **dadurch gekennzeichnet, dass** der Deckel (4; 94; 104, 105) eine obere Wand (24) mit einer Vorderkante (26), einer Hinterkante (28), zwei seitlichen Kanten (30) und einer Unterseite (32) aufweist und dazu eingerichtet ist, die Oberseite (18) der äußeren Schale (2; 92; 102) zu schließen, wenn der Deckel (4; 94; 104, 105) in seinem geschlossenen Zustand ist, wobei sich die Schwenklinie (22) an der Hinterkante (28) oder an einer der seitlichen Kanten (30) der oberen Wand (24) befindet.

3. Packung nach Anspruch 2, **dadurch gekennzeichnet, dass** die innere Schale (6; 96; 106, 107) eine Rückwand (42) oder eine Seitenwand (44) mit einer oberen Kante aufweist, wobei der Verbinder (50) von dieser oberen Kante ausgeht und eine erste Schwenklinie (52) an oder im Bereich von dieser oberen Kante hat und wobei der Verbinder (50) eine zweite Schwenklinie (54) an der Unterseite (32) der oberen Wand (24) hat. 5
4. Packung nach Anspruch 3, **dadurch gekennzeichnet, dass** der Abstand zwischen der ersten Schwenklinie (52) und der zweiten Schwenklinie (54) des Verbinders (50) größer ist als der Abstand zwischen der Schwenklinie (22) des Deckels (4; 94; 104, 105) und der zweiten Schwenklinie (54) des Verbinders (50), vorzugsweise größer um einen Betrag im Bereich von 0,4 mm bis 1,8 mm, am meisten bevorzugt um einen Betrag von etwa 0,7 mm. 10
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5. Packung nach Anspruch 3 oder 4, **dadurch gekennzeichnet, dass** im geschlossenen Zustand des Deckels (4; 94; 104, 105) das Verhältnis des Abstands zwischen der ersten Schwenklinie (52) des Verbinders (50) und der Schwenklinie (22) des Deckels (4; 94; 104, 105) zu dem Abstand zwischen der Schwenklinie (22) des Deckels (4; 94; 104, 105) und der zweiten Schwenklinie (54) des Verbinders (50) im Bereich von 0,5 bis 1,0 ist, vorzugsweise im Bereich von 0,70 bis 0,85, am meisten bevorzugt etwa 0,78. 25
30
6. Packung nach einem der Ansprüche 2 bis 5, **dadurch gekennzeichnet, dass** wenigstens von der Kante (26) der oberen Wand (24) gegenüber der Schwenklinie (22) des Deckels (4; 94; 104, 105) eine schräge Randwand (34) ausgeht, die in die äußere Schale (2; 92; 102) passt, wenn der Deckel (4; 94; 104, 105) in seinem geschlossenen Zustand ist. 35
40
7. Packung nach Anspruch 6, **dadurch gekennzeichnet, dass** die schräge Randwand (34, 36) auch von anderen Kanten (30) der oberen Wand (24) ausgeht, die verschieden sind von der Kante (28), die die Schwenklinie (22) des Deckels (4; 94; 104, 105) aufweist. 45
8. Packung nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** die schräge Randwand (34, 36) von einem Zuschnitt (60; 84) der äußeren Schale (2; 92; 102) gefaltet ist, der einen Zuschnitt des Deckels (4; 94; 104, 105) aufweist, wobei die schräge Randwand (34, 36) vorzugsweise eine dreieckige Querschnittsform hat. 50
55
9. Packung nach einem der Ansprüche 2 bis 5, **dadurch gekennzeichnet, dass** zumindest von der Kante der oberen Wand (24) gegenüber der Schwenklinie (22) des Deckels (4; 94; 104, 105) eine Randwand ausgeht, die sich allgemein senkrecht in Bezug auf die obere Wand (24) des Deckels (4; 94; 104, 105) erstreckt und sichtbar ist, wenn der Deckel (4; 94; 104, 105) in seinem geschlossenen Zustand ist. 60
10. Packung nach Anspruch 1, **dadurch gekennzeichnet, dass** der Deckel eine Randwand aufweist, wobei sich die Schwenklinie des Deckels an der Randwand befindet. 65
11. Packung nach einem der Ansprüche 1 bis 10, **dadurch gekennzeichnet, dass** die innere Schale (6; 96; 106, 107) eine Vorderwand (40) aufweist, die einen freien Zugangsbereich (48) bereitstellt, der dazu eingerichtet ist, den Zugang zu dem Inhalt der inneren Schale (6; 96; 106, 107) zu erleichtern, wenn sich die innere Schale (6; 96; 106, 107) in ihrer vorgeschobenen Position befindet. 70
12. Packung nach Anspruch 11, **dadurch gekennzeichnet, dass** der freie Zugangsbereich (48) der inneren Schale (6; 96; 106, 107) mit dem Auschnitt (20; 93; 103) der äußeren Schale (2; 92; 102) nicht überlappt, wenn die innere Schale (6; 96; 106, 107) in ihrer zurückgezogenen Position ist. 75
13. Packung nach einem der Ansprüche 1 bis 12, **dadurch gekennzeichnet, dass** die innere Schale (6; 96; 106, 107) eine Vorderwand (40), eine Rückwand (42) sowie zwei einander gegenüberliegende Seitenwände (44) und eine Bodenwand (46) aufweist, die die Vorderwand (40) und die Rückwand (42) verbinden. 80
14. Packung nach einem der Ansprüche 11 bis 13, **dadurch gekennzeichnet, dass** die Vorderwand (40) der inneren Schale (6; 96; 106, 107) eine verstärkte Struktur aufweist, die vorzugsweise aus doppellagiger oder dreilagiger Pappe (40, 76) hergestellt ist. 85
15. Packung nach einem der Ansprüche 1 bis 14, **gekennzeichnet durch** einen Verstärkungseinsatz, der in die innere Schale (6; 96; 106, 107) eingesetzt ist. 90
16. Packung nach Anspruch 15, **dadurch gekennzeichnet, dass** der Verstärkungseinsatz als ein Kunststoffbehälter gestaltet ist, der vorzugsweise durch Spritzgießen hergestellt ist. 95
17. Packung nach einem der Ansprüche 1 bis 13, **dadurch gekennzeichnet, dass** die innere Schale als Kunststoffbehälter gestaltet ist, wobei vorzugsweise wenigstens ein Teil des Verbinders als Teil des Kunststoffbehälters ausgebildet ist. 100

18. Packung nach einem der Ansprüche 1 bis 17, **dadurch gekennzeichnet, dass** der Ausschnitt (20; 93; 103) der äußeren Schale (2; 92; 102) in der Vorderwand (10) der äußeren Schale (2; 92; 102) vorgesehen ist.
19. Packung nach Anspruch 18, **dadurch gekennzeichnet, dass** sich der Ausschnitt der äußeren Schale in einem Seitenbereich der Vorderwand der äußeren Schale (2; 92; 102) befindet, wobei vorzugsweise die innere Schale (6; 96; 106, 107) eine Vorderwand (40) aufweist, die einen freien Zugangsbereich (48) bereitstellt, der nicht mit dem Ausschnitt (20; 93; 103) der äußeren Schale (2; 92; 102) überlappt, wenn die innere Schale (6; 96; 106, 107) in ihrer zurückgezogenen Position ist.
20. Packung nach einem der Ansprüche 1 bis 19, **dadurch gekennzeichnet, dass** der Ausschnitt (20; 93; 103) aus einem Zuschnitt (60; 84) der äußeren Schale (2; 92; 102) ausgebildet ist, bei dem zumindest ein Teil (64) des zuschnittmaterials des Ausschnittbereichs (20; 93; 103) zurück auf die Innenseite der äußeren Schale (2; 92; 102) gefaltet ist.
21. Packung nach einem der Ansprüche 1 bis 20, **dadurch gekennzeichnet, dass** die innere Schale (6; 96; 106, 107) gegenüber dem Ausschnitt (20; 93; 103) der äußeren Schale (2; 92; 102) eine griffverbessernde Oberfläche aufweist, die vorzugsweise wenigstens eines der folgenden Merkmale aufweist: Reliefstruktur, Ausschnittsstruktur, hochreibende Beschichtung, gummiähnliche Beschichtung.
22. Packung nach einem der Ansprüche 1 bis 21, **dadurch gekennzeichnet, dass** die äußere Schale abgerundete Kanten aufweist, wobei vorzugsweise die Längskanten zwischen der Vorderwand und beiden Seitenwänden abgerundet sind.
23. Packung nach einem der Ansprüche 1 bis 21, **dadurch gekennzeichnet, dass** die äußere Schale (2) eine hexagonale oder oktagonale Querschnittsform aufweist, wobei die Seitenwände oder die Vorderwand (10) Seitentafeln (82) aufweisen, die von dem Rest der jeweiligen Seitenwand oder von dem Rest der Vorderwand (10) entlang von Faltlinien (83) gefaltet sind, die parallel zu einer Längsachse der Packung (80) verlaufen.
24. Packung nach einem der Ansprüche 1 bis 23, **dadurch gekennzeichnet, dass** die äußere Schale (2; 92; 102) und/oder die innere Schale (6; 96; 106, 107) von einem jeweiligen Zuschnitt (60; 70; 84, 86) gefaltet ist, der aus Pappe in einem Gewichtsbereich von 180 g/m² bis 290 g/m² gefertigt ist.
25. Packung nach einem der Ansprüche 1 bis 24, **da-**

durch gekennzeichnet, dass der Verbinder (50) auf eine der folgenden Weisen ausgebildet ist: gefaltet aus einem Teil (68) eines Zuschnitts (60; 84) der äußeren Schale (2; 92; 102) und einem Teil (78) eines Zuschnitts (70; 86) der inneren Schale (6; 96; 106, 107), wobei beide Teile zusammengeklebt sind, gefaltet aus einem Teil eines Zuschnitts der äußeren Schale und an die innere Schale geklebt, gefaltet aus einem Teil eines Zuschnitts der inneren Schale und an den Deckel geklebt.

26. Packung nach einem der Ansprüche 1 bis 25, **gekennzeichnet durch** mindestens zwei innere Schalen (106, 107), die nebeneinander angeordnet sind.
27. Packung nach Anspruch 26, **dadurch gekennzeichnet, dass** der Deckel (104, 105) schwenkbar mit der Rückwand der äußeren Schale (102) verbunden ist.
28. Packung nach Anspruch 27, **dadurch gekennzeichnet, dass** der Deckel (104, 105) aus wenigstens zwei separaten Teilen (104, 105) ausgebildet ist, die nebeneinander angeordnet sind und schwenkbar mit der Rückwand der äußeren Schale (102) verbunden sind, wobei jeder der separaten Teile (104, 105) des Deckels mit einer der inneren Schalen (106, 107) verknüpft ist.
29. Packung nach Anspruch 28, **dadurch gekennzeichnet, dass** die Vorderwand der äußeren Schale (102) mit wenigstens einem Ausschnitt (103) versehen ist, der dazu eingerichtet ist, einen Teil jeder der inneren Schalen (106, 107) zu exponieren und es zu ermöglichen, auf jede der inneren Schalen (106, 107) eine Kraft auszuüben, um die jeweilige innere Schale (106, 107) zu bewegen und den jeweiligen Teil des Deckels (104, 105) über einen angelenkten Verbinder zu betätigen.
30. Packung nach einem der Ansprüche 1 bis 29, **dadurch gekennzeichnet, dass** die Packung (1; 80; 90; 100) tabakbezogene Artikel enthält, wobei die tabakbezogenen Artikel aus der folgenden Gruppe ausgewählt sind: Zigaretten, Cigarillos, Cigarren, Tabak enthaltende Stäbe, rauchloser Tabak, simulierte Rauchvorrichtungen, Inhalationseinrichtungen ohne die Verbrennung von Tabak, Aromareservoir.

Revendications

1. Emballage pour des articles associés au tabac, comprenant
- une coque extérieure (2; 92; 102) ayant une paroi avant (10), une paroi arrière (12), deux parois latérales (14) opposées l'une à l'autre et une

- paroi de fond (16) reliant la paroi avant (10) et la paroi arrière (12) ainsi qu'un côté supérieur (18),
- un couvercle (4; 94; 104, 105) apte à fermer le côté supérieur (18) de la coque extérieure (2; 92; 102) lorsqu'il se trouve dans une position fermée, le couvercle (4; 94; 104, 105) étant relié d'une manière pivotante à la paroi arrière (12) ou à une des parois latérales (14) de la coque extérieure (2; 92; 102) à une ligne d'articulation (22) et pouvant pivoter autour de la ligne d'articulation (22) pour le transfert de l'état fermé à un état ouvert,
 - une coque intérieure (6; 96; 106, 107) apte à recevoir une pluralité d'articles associés au tabac et installée d'une manière déplaçable dans la coque extérieure (2; 92; 102), où la coque intérieure (6; 96; 106, 107) est déplaçable d'une position rétractée, dans laquelle elle est logée à l'intérieur de la coque extérieure (2; 92; 102), à une position avancée qui permet l'accès aux articles à fumer,
 - une découpe (20; 93; 103) dans au moins une paroi de la coque extérieure (2; 92; 102) sélectionnée parmi la paroi avant (10), la paroi arrière (12) ou les deux parois latérales (14); ladite découpe (20; 93; 103) est apte à exposer une partie de la coque intérieure (6; 96; 106, 107) et à permettre d'exercer une force sur la coque intérieure (6; 96; 106, 107) pour déplacer la coque intérieure (6; 96; 106, 107),
 - un connecteur articulé (50) entre une portion de la coque intérieure (6; 96; 106, 107) et le couvercle (4; 94; 104, 105) qui vient en prise avec le couvercle (4; 94; 104, 105) à une distance de la ligne d'articulation (22) plus petite que la dimension du couvercle (4; 94; 104, 105) dans une direction perpendiculaire à la ligne d'articulation (22) et est apte à pousser le couvercle (4; 94; 104, 105) dans son état ouvert lorsque la coque intérieure (6; 96; 106, 107) est amenée dans sa position avancée et à tirer le couvercle (4; 94; 104, 105) dans son état fermé lorsque la coque intérieure (6; 96; 106, 107) est amenée dans sa position rétractée.
2. Emballage selon la revendication 1, **caractérisé en ce que** le couvercle (4; 94; 104, 105) comprend une paroi supérieure (24) ayant un bord avant (26), un bord arrière (28), deux bords latéraux (30) et un côté de fond (32) et apte à fermer le côté supérieur (18) de la coque extérieure (2; 92; 102) lorsque le couvercle (4; 94; 104, 105) se trouve dans son état fermé, la ligne d'articulation (22) étant située au bord arrière (28) ou à un des bords latéraux (30) de la paroi supérieure (24).
 3. Emballage selon la revendication 2, **caractérisé en ce que** la coque intérieure (6; 96; 106, 107) comprend une paroi arrière (42) ou une paroi latérale (44) ayant un bord supérieur, où le connecteur (50) s'étend du dit bord supérieur, ayant une première ligne d'articulation (52) à ou dans la zone dudit bord supérieur, et où le connecteur (50) possède une deuxième ligne d'articulation (54) au côté inférieur (32) de la paroi supérieure (24).
 4. Emballage selon la revendication 3, **caractérisé en ce que** la distance entre la première ligne d'articulation (52) et la deuxième ligne d'articulation (54) du connecteur (50) est plus grande que la distance entre la ligne d'articulation (22) du couvercle (4; 94; 104, 105) et la deuxième ligne d'articulation (54) du connecteur (50), de préférence plus grande selon une quantité dans la plage d'environ 0,4 mm à 1,8 mm, selon la plus grande préférence d'une quantité d'environ 0,7 mm.
 5. Emballage selon la revendication 3 ou 4, **caractérisé en ce que**, à l'état fermé du couvercle (4; 94; 104, 105), le rapport de la distance entre la première ligne d'articulation (52) du connecteur (50) et la ligne d'articulation (22) du couvercle (4; 94; 104, 105) à la distance entre la ligne d'articulation (22) du couvercle (4; 94; 104, 105) et la deuxième ligne d'articulation (54) du connecteur (50) est dans la plage de 0,5 à 1,0, de préférence dans la plage de 0,70 à 0,85, selon la plus grande préférence d'environ 0,78.
 6. Emballage selon l'une quelconque des revendications 2 à 5, **caractérisé en ce qu'**une paroi de bord biseauté (34) s'étend d'au moins le bord (26) de la paroi supérieure (24) opposée à la ligne d'articulation (22) du couvercle (4; 94; 104, 105), ladite paroi de bord biseauté (34) s'ajuste dans la coque extérieure (2; 92; 102) lorsque le couvercle (4; 94; 104, 105) se trouve dans son état fermé.
 7. Emballage selon la revendication 6, **caractérisé en ce que** la paroi de bord biseauté (34, 36) s'étend également à partir d'autres bords (30) de la paroi supérieure (24) différents du bord (26) comprenant la ligne d'articulation (22) du couvercle (4; 94; 104, 105).
 8. Emballage selon la revendication 6 ou 7, **caractérisé en ce que** la paroi de bord biseauté (34, 36) est pliée à partir d'une ébauche (60; 84) de la coque extérieure (2; 92; 102) comprenant une ébauche du couvercle (4; 94; 104, 105), où la paroi de bord biseauté (34, 36) a de préférence une forme triangulaire en section transversale.
 9. Emballage selon l'une quelconque des revendications 2 à 5, **caractérisé en ce qu'**une paroi de bord s'étend à partir d'au moins le bord de la paroi supé-

- rieure (24) opposée à la ligne d'articulation (22) du couvercle (4; 94; 104, 105), ladite paroi de bord s'étend généralement perpendiculairement par rapport à la paroi supérieure (24) du couvercle (4; 94; 104, 105) et est visible lorsque le couvercle (4; 94; 104, 105) se trouve dans son état fermé.
10. Emballage selon la revendication 1, **caractérisé en ce que** le couvercle comprend une paroi de bord, la ligne d'articulation du couvercle étant située à la paroi de bord.
11. Emballage selon l'une quelconque des revendications 1 à 10, **caractérisé en ce que** la coque intérieure (6; 96; 106, 107) comprend une paroi avant (40) réalisant une zone de libre accès (48) qui est apte à faciliter l'accès au contenu de la coque intérieure (6; 96; 106, 107) lorsque la coque intérieure (6; 96; 106, 107) se trouve dans sa position avancée.
12. Emballage selon la revendication 11, **caractérisé en ce que**, lorsque la coque intérieure (6; 96; 106, 107) se trouve dans sa position rétractée, la zone d'accès libre (48) de la coque intérieure (6; 96; 106, 107) ne recouvre pas la découpe (20; 93; 103) de la coque extérieure (2; 92; 102).
13. Emballage selon l'une quelconque des revendications 1 à 12, **caractérisé en ce que** la coque intérieure (6; 96; 106, 107) comprend une paroi avant (40), une paroi arrière (42) et deux parois latérales (44) opposées l'une à l'autre et une paroi de fond (46) reliant la paroi avant (40) et la paroi arrière (42).
14. Emballage selon l'une quelconque des revendications 11 à 13, **caractérisé en ce que** la paroi frontale (40) de la coque intérieure (6; 96; 106, 107) comprend une structure renforcée, de préférence réalisée en carton à double couche ou à triple couche (40, 76).
15. Emballage selon l'une quelconque des revendications 1 à 14, **caractérisé par** un insert de renforcement inséré dans la coque intérieure (6; 96; 106, 107).
16. Emballage selon la revendication 15, **caractérisé en ce que** l'insert de renforcement est réalisé comme un contenant plastique, réalisé de préférence par moulage par injection.
17. Emballage selon l'une quelconque des revendications 1 à 13, **caractérisé en ce que** la coque intérieure est conçue comme un contenant plastique, ou de préférence au moins une partie du connecteur est réalisée en tant que partie du contenant plastique.
18. Emballage selon l'une quelconque des revendications 1 à 17, **caractérisé en ce que** la découpe (20; 93; 103) de la coque extérieure (2; 92; 102) est réalisée dans la paroi avant (10) de la coque extérieure (2; 92; 102).
19. Emballage selon la revendication 18, **caractérisé en ce que** la découpe de la coque extérieure se situe dans une zone latérale de la paroi avant de la coque extérieure (2; 92; 102), où de préférence la coque intérieure (6; 96; 106, 107) comprend une paroi avant (40) réalisant une zone d'accès libre (48) qui ne recouvre pas la découpe (20; 93; 103) de la coque extérieure (2; 92; 102) lorsque la coque intérieure (6; 96; 106, 107) se trouve dans sa position rétractée.
20. Emballage selon l'une quelconque des revendications 1 à 19, **caractérisé en ce que** la découpe (20; 93; 103) est réalisée à partir d'une ébauche (60; 84) de la coque extérieure (2; 92; 102), où au moins une partie (64) du matériau d'ébauche de la zone de découpe (20; 93; 103) est repliée vers la face intérieure de la coque extérieure (2; 92; 102).
21. Emballage selon l'une quelconque des revendications 1 à 20, **caractérisé en ce que**, opposé à la découpe (20; 93; 103) de la coque extérieure (2; 92; 102), la coque intérieure (6; 96; 106, 107) comprend une surface améliorant la préhension, qui comprend de préférence au moins une des caractéristiques suivantes: structure en relief, structure découpée, revêtement à haute friction, revêtement semblable à du caoutchouc.
22. Emballage selon l'une quelconque des revendications 1 à 21, **caractérisé en ce que** la coque extérieure comprend des bords arrondis, où de préférence les bords longitudinaux entre la paroi avant et les deux parois latérales sont arrondis.
23. Emballage selon l'une quelconque des revendications 1 à 21, **caractérisé en ce que** la coque extérieure (2) comprend une forme hexagonale ou octogonale en section transversale, où les parois latérales ou la paroi avant (10) comprennent des panneaux latéraux (82) pliés à partir du reste de la paroi latérale respective ou du reste de la paroi avant (10) le long de lignes de pliage (83) s'étendant parallèlement à un axe longitudinal de l'emballage (80).
24. Emballage selon l'une quelconque des revendications 1 à 23, **caractérisé en ce que** la coque extérieure (2; 92; 102) et/ou la coque intérieure (6; 96; 106, 107) sont pliées à partir d'une ébauche respective (60, 70; 84, 86) réalisée en carton dans la plage de poids de 180 g/m² à 290 g/m².

25. Emballage selon l'une quelconque des revendications 1 à 24, **caractérisé en ce que** le connecteur (50) est réalisé selon l'une des manières suivantes: plié en partie (68) d'une ébauche (60; 84) de la coque extérieure (2; 92; 102) et en partie (78) d'une ébauche (70; 86) de la coque intérieure (6; 96; 106, 107), et les deux parties sont collées ensemble, plié en partie à partir d'une ébauche de la coque extérieure et collé à la coque intérieure, plié en partie à partir d'une ébauche de la coque intérieure et collé au couvercle. 5 10
26. Emballage selon l'une quelconque des revendications 1 à 25, **caractérisé par** au moins deux coques intérieures (106, 107) qui sont agencées côte à côte. 15
27. Emballage selon la revendication 26, **caractérisé en ce que** le couvercle (104, 105) est relié d'une manière pivotante à la paroi arrière de la coque extérieure (102). 20
28. Emballage selon la revendication 27, **caractérisé en ce que** le couvercle (104, 105) est réalisé en au moins deux parties séparées (104, 105) qui sont agencées côte à côte et sont reliées d'une manière pivotante à la paroi arrière de la coque extérieure (102), où chacune des parties séparées (104, 105) du couvercle est associée à une des coques intérieures (106, 107). 25 30
29. Emballage selon la revendication 28, **caractérisé en ce que** la paroi avant de la coque extérieure (102) présente au moins une découpe (103) apte à exposer une partie de chacune des coques intérieures (106, 107) et apte à exercer une force sur chacune des coques intérieures (106, 107) pour déplacer la coque intérieure respective (106, 107) et pour actionner la partie respective du couvercle (104, 105) par un connecteur articulé. 35 40
30. Emballage selon l'une quelconque des revendications 1 à 29, **caractérisé en ce que** l'emballage (1; 80; 90; 100) contient des articles associés au tabac, où les articles associés au tabac sont sélectionnés dans le groupe suivant: cigarettes, cigarillos, cigares, tiges contenant du tabac, tabac sans fumée, dispositifs à fumer simulés, inhalateur sans combustion de tabac, réservoirs d'arômes. 45 50 55

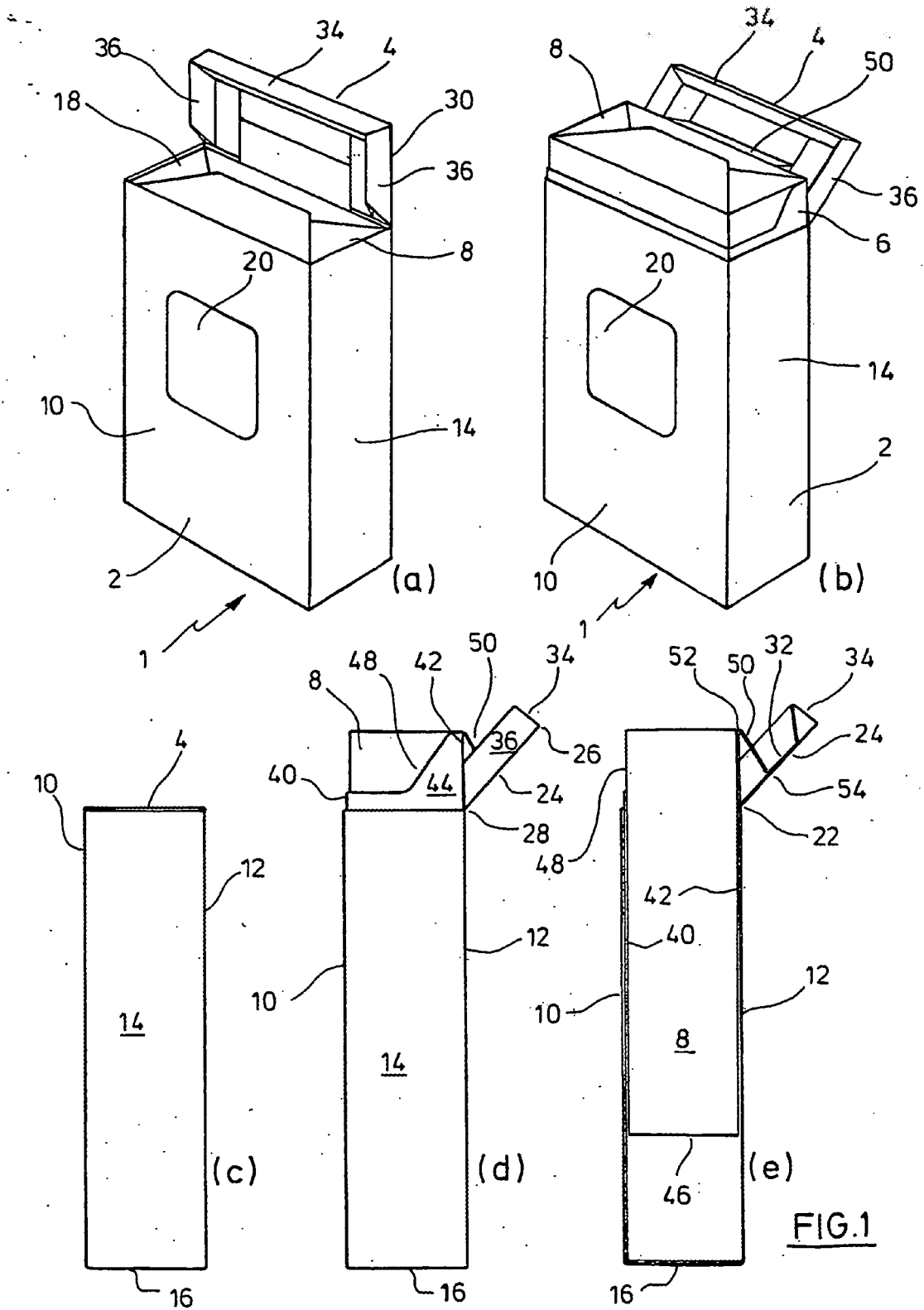
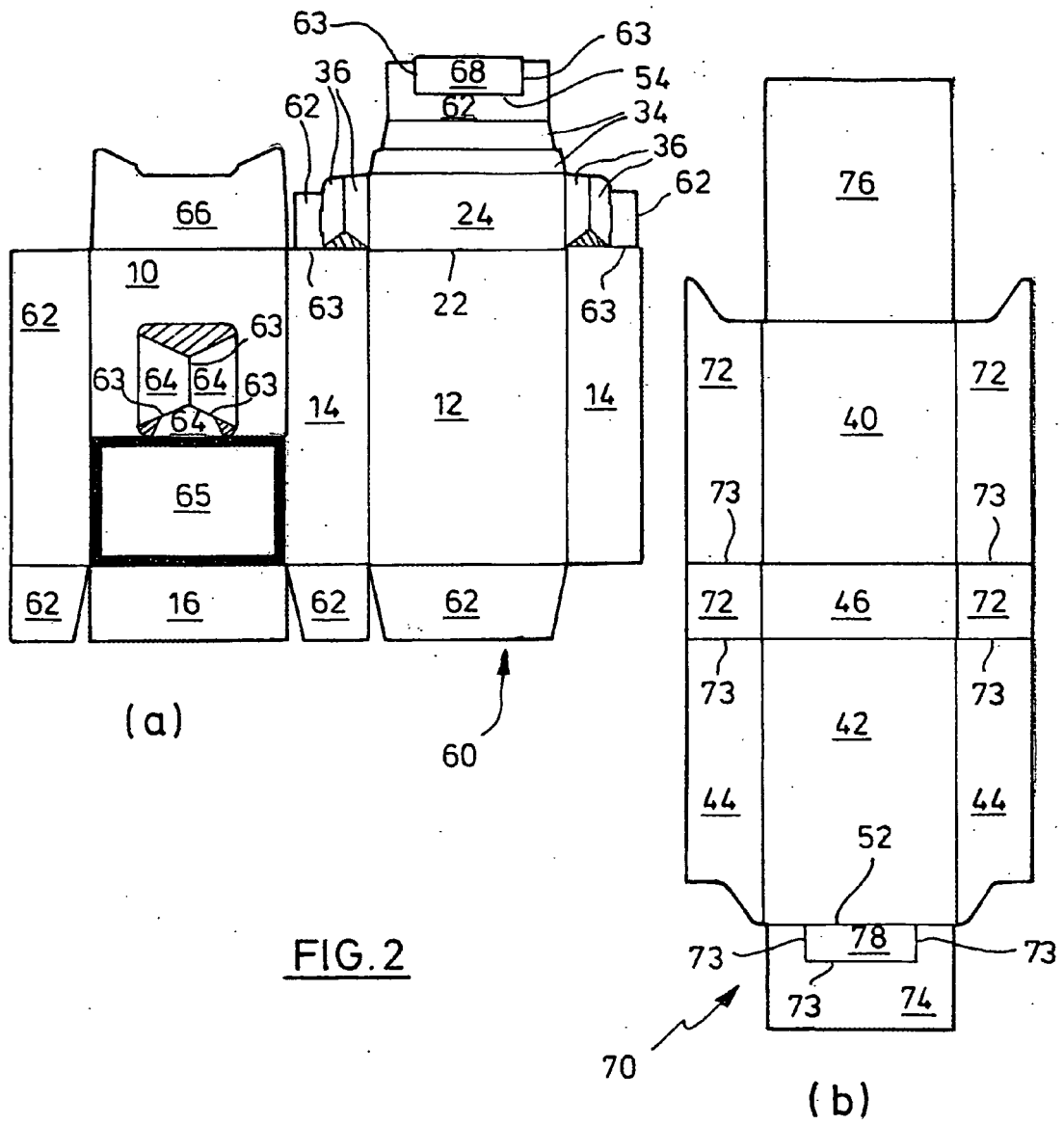


FIG.1



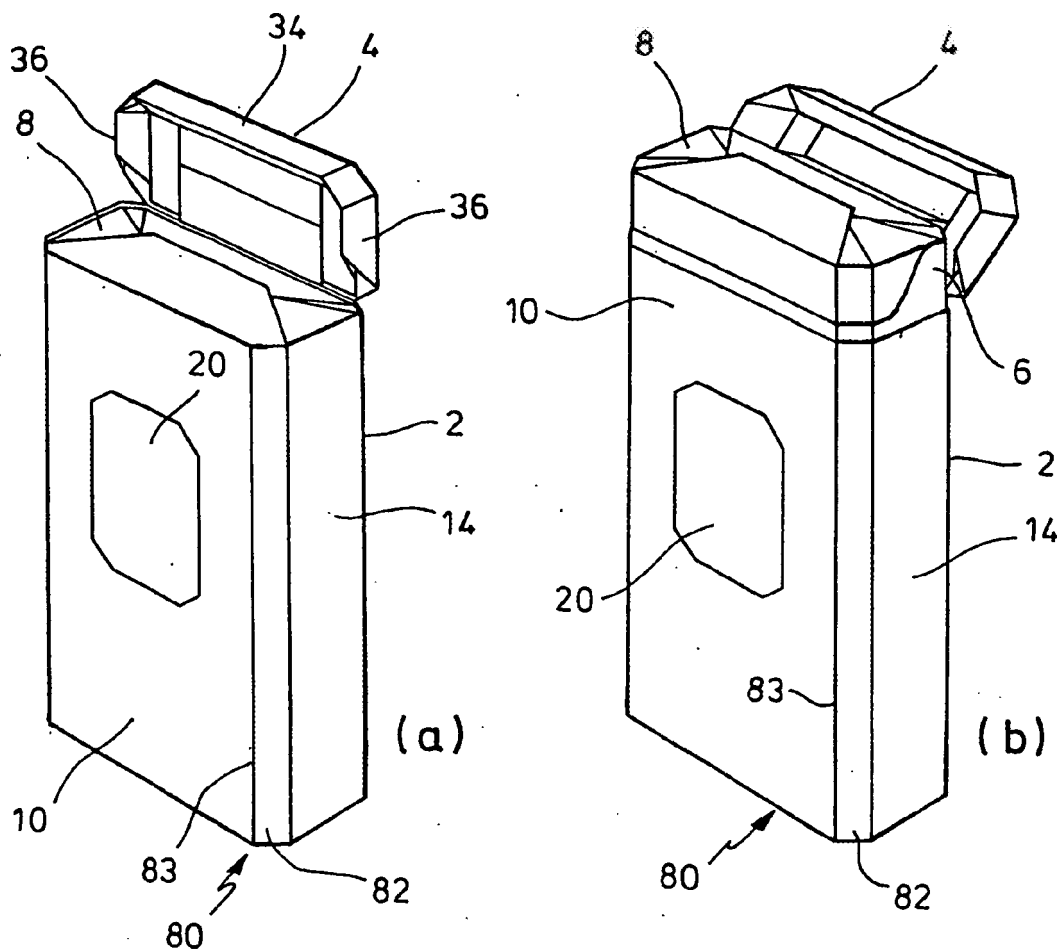
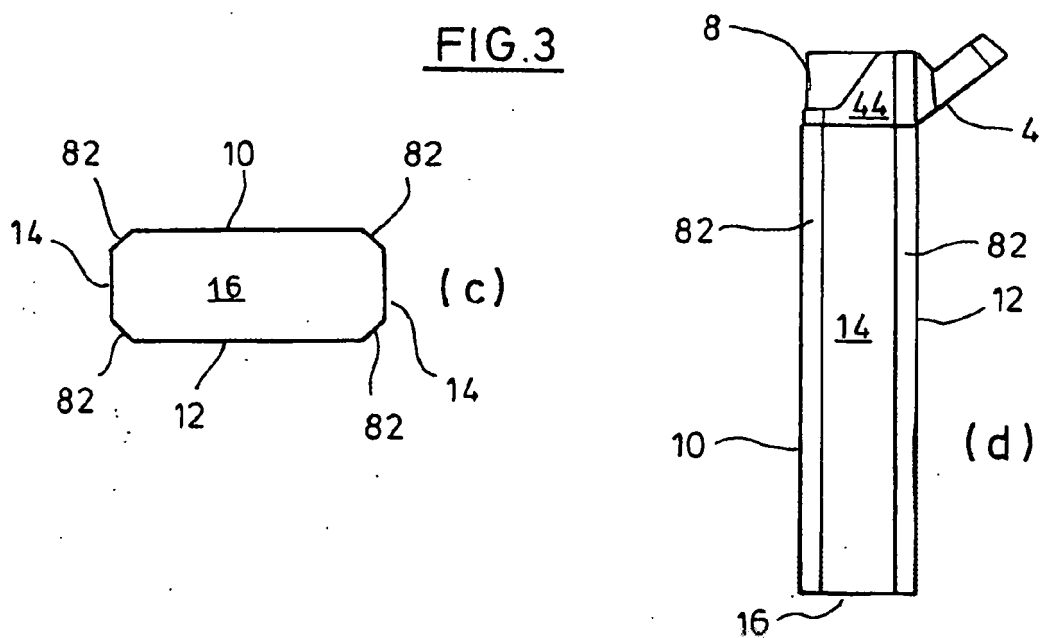
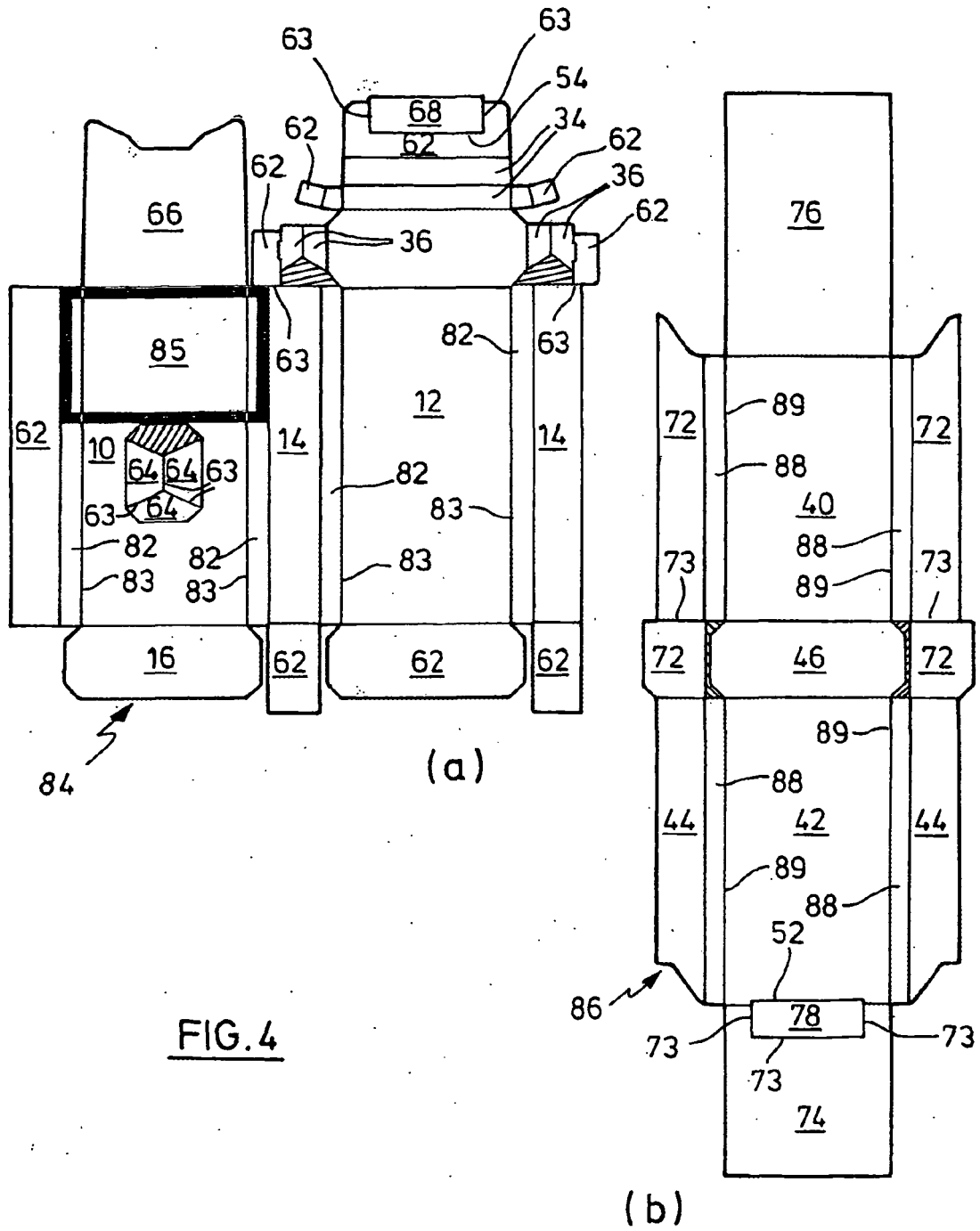


FIG. 3





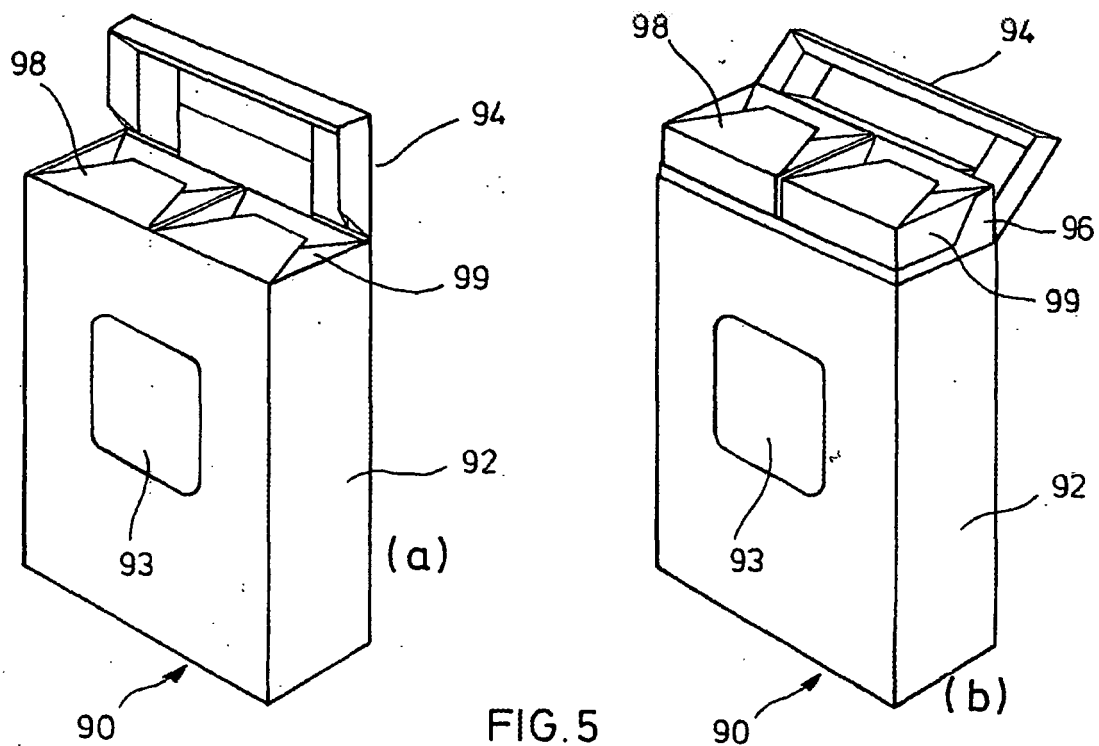


FIG. 5

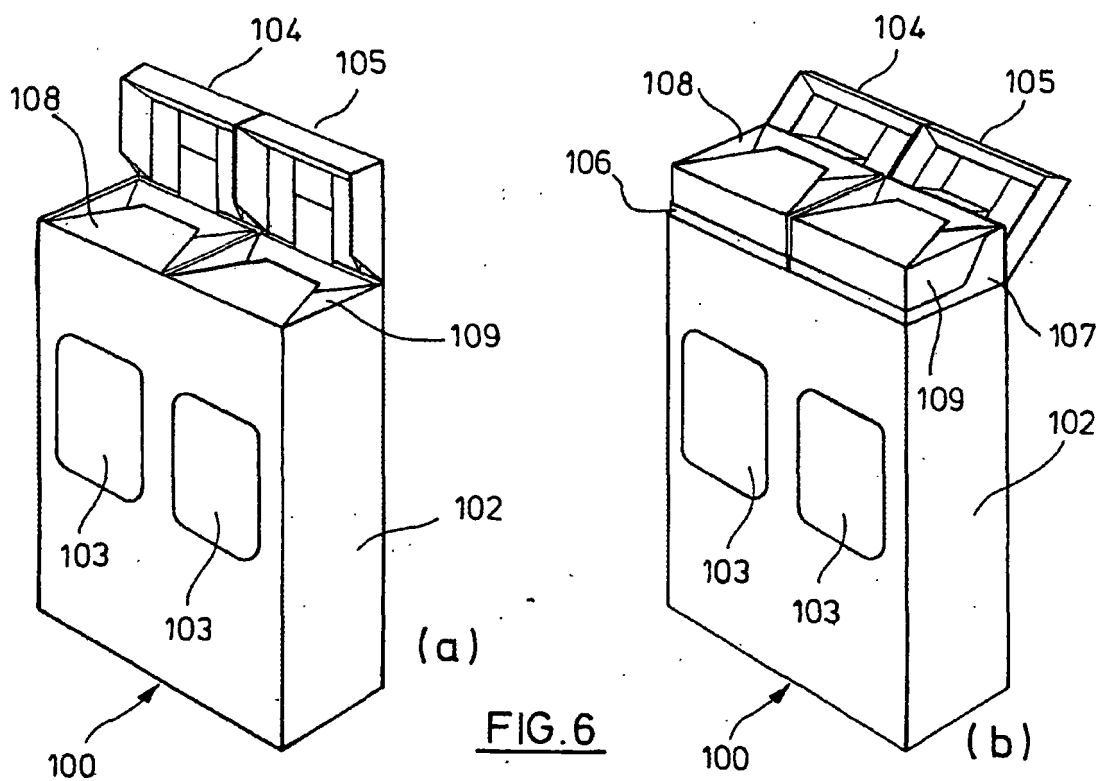


FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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(54) Title: A LIQUID PHARMACEUTICAL FORMULATION COMPRISING NICOTINE FOR THE ADMINISTRATION TO THE ORAL CAVITY

(57) Abstract: A liquid pharmaceutical formulation comprising nicotine in any form for administration to the oral cavity being alkalized by buffering and/or pH regulation. The administration is preferably by spraying and most preferably by spraying under the tongue. A method for manufacturing said formulation. Use of said formulation in therapy, such as therapy for treating addiction to tobacco.



WO 03/055486 A1

**A liquid pharmaceutical formulation comprising nicotine
for the administration to the oral cavity**

Technical Field

This invention relates to a liquid pharmaceutical formulation for delivering
5 nicotine to a subject. This invention also relates to a method and a system for delivering nicotine as well as manufacturing and use of said liquid pharmaceutical formulation.

Background of the Invention

Tobacco dependence and reduction thereof

10 In recent years, with the recognition of the harmful effects of tobacco smoking, there have been numerous campaigns and programs by governmental agencies and various health groups and other interested organisations to disseminate information about the adverse health effects resulting from tobacco smoking. Moreover, and as a result of this recognition of the harmful effects, there have been many
15 programs directed to attempts in reducing smoking incidence.

Nicotine is an organic compound and is the principal alkaloid of tobacco. Nicotine is the chief active ingredient in the tobacco used in cigarettes, cigars, snuff and the like. Nicotine is also an addictive drug, though, and smokers characteristically display a strong tendency to relapse after having successfully stopped smoking
20 for a time. Nicotine is the world's second most used drug, after caffeine from coffee and tea.

The main problem with tobacco smoking is its enormous implications on health. Today it is estimated that smoking-related diseases cause some 3 – 4 million deaths per year. In the US Surgeon General's 1988 report on The Health Consequences of Smoking, it was estimated that in the US alone about 300.000 deaths are
25 caused each year by diseases related to cigarette smoking. In fact, excessive smoking is now recognized as one of the major health problems throughout the world. This grim consequence of tobacco smoking has urged many medical associations and health authorities to take very strong actions against the use of tobacco.

30 Even though tobacco smoking is decreasing in many developed countries today it is hard to see how the societies could get rid of the world's second most used drug.

The most advantageous thing a heavy smoker can do is to reduce or preferably even stop smoking completely. Experience shows, however, that most smokers find this extremely difficult since, mostly, tobacco smoking result in a dependence disorder or craving. The WHO has in its International Classification of Disorders a diagnosis called Tobacco Dependence. Others, like the American Psychiatric Association call the addiction Nicotine Dependence. It is generally accepted that these difficulties to stop smoking result from the fact that those heavy smokers are dependent on nicotine. The most important risk factors are, however, substances that are formed during the combustion of tobacco, such as carcinogenic tar products, carbon monoxide, aldehydes, and hydrocyanic acid.

Effects of nicotine

The administration of nicotine can give satisfaction and the usual method is by smoking, either by smoking e g a cigarette, a cigar or a pipe, or by snuffing or chewing tobacco. However, smoking has health hazards and it is therefore desirable to formulate an alternative manner of administering nicotine in a pleasurable manner that can be used to facilitate withdrawal from smoking and/or used as a replacement for smoking.

Upon smoking of a cigarette, nicotine is quickly absorbed into the smoker's blood and reaches the brain within around ten seconds after inhalation. The quick uptake of nicotine gives the consumer a rapid satisfaction, or kick. The satisfaction, then, lasts during the time of smoking the cigarette and for a period of time thereafter. The poisonous, toxic, carcinogenic, and addictive nature of smoking has provided efforts for methods, compositions and devices, which help in breaking the habit of smoking.

Nicotine is an addictive poisonous alkaloid $C_5H_4NC_4H_7NCH_3$, derived from the tobacco plant. Nicotine is also used as an insecticide. Approximately forty milligrams of nicotine may kill an adult (Merck Index).

Nicotine replacement products

One way to reduce smoking is to provide nicotine in a form or manner other than by smoking and some products have been developed to fulfill this need. Nicotine containing formulations are currently the dominating treatments for tobacco

dependence.

The success in achieving reduction in the incidence of smoking has been relatively poor using presently known products. State of the art involves both behavioral approaches and pharmacological approaches. More than 80% of the tobacco smokers who initially quit smoking after using some behavioral or pharmacological approach to singly reduce smoking incidence generally relapse and return to the habit of smoking at their former rate of smoking within about a one year's period of time.

As an aid for those who are willing to stop smoking there are several ways and forms of nicotine replacement products available on the market, such as nicotine chewing gums according to US 3,845,217. Several methods and means have been described for diminishing the desire of a subject to use tobacco, which comprises the step of administering to the subject nicotine or a derivative thereof as described in e.g. US 5,939,100 (nicotine containing microspheres) and US 4,967,773 (nicotine containing lozenge).

The effects of pH on the absorption of nicotine is discussed e.g. in Eur J Clin Pharmacol, Vol. 56, 2001, pages 813 – 818, L. Molander et al., "Pharmacokinetic investigation of a nicotine sublingual tablet". The effects of pH on a liquid nicotine formulation for administration to the oral cavity are though not disclosed.

The use of skin patches for transdermal administration of nicotine has been reported (Rose, in Pharmacological Treatment of Tobacco Dependence, (1986) pp. 158 - 166, Harvard Univ. Press). Nicotine-containing skin patches that are in wide use today can cause local irritation and the absorption of nicotine is slow and affected by cutaneous blood flow.

Nicotine-containing nose drops have been reported (Russell et al., British Medical Journal, Vol. 286, p. 683 (1983); Jarvis et al., British Journal of Addiction, Vol. 82, p. 983 (1987)). Nose drops, however, are difficult to administer and are not convenient for use at work or in other public situations. Ways of administering nicotine by way of delivery directly into the nasal cavity by spraying is known from US 4,579,858, DE 32 41 437 and WO/93 127 64. There may, though, be local nasal

irritation with use of nasal nicotine formulations. The difficulty in administration also results in unpredictability of the dose of nicotine administered.

Also, inhaling devices resembling a cigarette are known for uptake of nicotine vapors as suggested in US 5,167,242. An aerosol for depositing nicotine in the
5 lungs is disclosed in DE 32 41 437.

Mouth sprays comprising nicotine are known in the art, e g according to US 6,024,097 wherein is disclosed a method of assisting a smoker in giving up the smoking habit whereby is used a plurality of aerosol dispensers comprising progressively lesser concentrations of nicotine. The aerosol is intended to be administered into the mouth. The liquid in the dispensers essentially consists of nicotine
10 and alcohol.

A similar mouth spray is disclosed in US 5,810,018, whereby in addition the aerosol comprises progressively greater concentrations of at least one selected stimulant.

15 WO 98/24420 discloses an aerosol device with an active and a propellant. The device may be used for e g sublingual administration. Nicotine is mentioned as an active in a long "laundry list" of drugs. There are though no examples on nicotine formulations.

US 5,721,257 discloses a method for treating a condition responsive to nicotine therapy comprising a first treatment with transdermally administered nicotine
20 and a second treatment with transmucosally administered nicotine. It is stated that the transmucosal administration may be accomplished via an aerosol to the nasal membranes. No administration to the oral cavity is disclosed.

WO 97/38663 discloses a buccal aerosol spray using a non-polar solvent.
25 Nicotine is mentioned as one useful active in this spray.

US 5,955,098 likewise discloses a buccal non-polar spray wherein nicotine may be an active.

None of the known mouth sprays comprise any buffering and/or pH regulating means.

30

Prior art and problems thereof

The captioned means and methods do not satisfy the craving that certain users of tobacco experience. Specifically these means and methods generally do not provide for a sufficiently rapid uptake of nicotine without adverse effects.

5 This means that none of the hitherto known means and methods satisfactorily fulfills the following well-known NRT teaching by Russel et al:

I: A fast delivery or "boost" of nicotine, sufficiently rapid to give positive subjective nicotine effects in contrast with current nicotine gums and patches, will lead to faster craving relief, and

10 II: faster craving relief will give better craving control, and

III: better craving control should result in higher overall quit rates.

For the captioned see Russel, M.A.H., Stapleton, J.A. and Feyerabend C.

Nicotine boost per cigarette as the controlling factor of intake regulation of smokers; In: Clark et al. (Eds.) *Effects of Nicotine on Biological Systems II*,

15 *Advances in Pharmacological Sciences*, Birkhäuser Verlag, Basel, (1995) 233-238.

In light of the aforementioned problems there is a strong need and interest to develop means and methods for the administration of nicotine to provide a fast satisfaction to a person craving for nicotine or to provide a sense of smoking satisfaction without smoking, whereby also may be avoided problems associated
20 with the prior art means and methods. The present invention addresses said need and interest.

Summary of the Invention

In view of the foregoing disadvantages known in the art when trying to deliver nicotine to a subject so as to obtain a rapid transmucosal uptake of nicotine
25 in the oral cavity of the subject the present invention provides a new and improved product, systems and methods for obtaining a rapid transmucosal uptake of nicotine in the oral cavity of the subject.

Objects of the present invention are to provide an efficient and effective product, as well as methods and systems for a rapid uptake of nicotine in a subject
30 to avoid the disadvantages of previously known products and methods. The present invention also satisfactorily satisfies the above teaching of Russel et al.

Thus, the present invention provides a method for delivering nicotine in any form to a subject comprising administering to a subject a liquid pharmaceutical formulation containing nicotine in any form into the oral cavity of the subject and allowing the nicotine in any form to be absorbed into the systemic circulation of the subject essentially by rapid buccal uptake of nicotine as well as a method for manufacturing said liquid pharmaceutical formulation.

The present invention also provides a method for obtaining reduction of the urge to smoke or use tobacco containing material and/or for providing a fast sense of smoking satisfaction without smoking, comprising the steps of replacing at least partly the tobacco containing material with said liquid pharmaceutical formulation, administering to a subject a liquid pharmaceutical formulation containing nicotine in any form into the oral cavity of the subject and allowing the nicotine to be systemically absorbed by the subject essentially by buccal uptake of nicotine.

Furthermore, the present invention provides a system for delivering nicotine in any form to a subject, comprising said liquid pharmaceutical formulation and at least one other means for obtaining reduction of the urge to smoke or use of tobacco as well as a system for obtaining reduction of the urge to smoke or otherwise use of tobacco and/or for providing a sense of smoking satisfaction without smoking, comprising a liquid pharmaceutical formulation as per above and at least one other method for obtaining reduction of the urge to smoke or otherwise use tobacco. Said system may be a system wherein the at least one other method is selected from the group consisting of administration through chewing gums, nasal sprays, transdermal patches, inhaling devices, lozenges, tablets and parenteral methods, subcutaneous methods, intravenous methods, rectal methods, vaginal methods and transmucosal methods; or other use of tobacco.

The present invention provides for a flexible, convenient and discrete use in comparison with other means for transmucosal delivery of nicotine, e.g. chewing gums, lozenges and tablets. No chewing or sucking is necessary. Further and in contrast to other transmucosal dosage forms the present liquid pharmaceutical formulation provides nicotine in a form being directly buccally absorbable by a subject. Known formulations for nasal delivery of nicotine are inconvenient – side

effects include running nose, nasal irritation and irritation of the eyes. The nicotine in chewing gums, lozenges and tablets need pass a transformation phase, involving e.g. mastication, disintegration, melting and/or dissolution, prior to being present in a directly absorbable form. A nicotine patch provides for a discrete administration, but does not provide for a fast uptake of nicotine.

A product according to the present invention is alkalized by buffering and/or pH regulation in such a way that upon administration of the liquid pharmaceutical formulation the pH of the liquid of the oral cavity is increased by 0.3 - 4 pH units, or preferably increased by 0.5 - 2.5 pH units.

Use of said product will according to the invention rapidly deliver nicotine in any form to a subject and will also provide for obtaining a quick and/or sustained and/or complete reduction of the urge to smoke or use tobacco and/or for providing a sense of smoking satisfaction without smoking resembling the sense of smoking satisfaction obtained after regular smoking or use of tobacco.

Legend of Figures

Figure 1 is a diagram showing venous blood plasma level concentrations of nicotine after two different ways of administering nicotine. For both ways of administration one unit dose was administered at time zero. No further doses were administered. 50 persons, all being nicotine users, took part in this test. "Spray" represents 200 µl of a liquid pharmaceutical formulation according to below Example 4 being sprayed under the tongue. This unit dose comprised 3.5 mg nicotine measured as free base. "Microtab" represents one tablet of Nicorette® Microtab, comprising 4 mg nicotine measured as free base. Nicorette® Microtab is pharmacologically equivalent to Nicorette® Gum. "Spray" comprises a buffer. "Microtab" comprises no buffer. With "Spray" the liquid pharmaceutical formulation was held in the mouth for one minute before swallowing. With "Microtab" the tablet was kept under the tongue until dissolved. Each symbol on the respective graph represents one measurement of nicotine in venous blood plasma.

Figure 2 shows mean plasma concentrations after sublingual administration of three liquid pharmaceutical formulations with pH 6, 7 and 8.5 respectively. For each formulation 200 µl was sprayed under the tongue at time zero. For all said

three formulations the concentration of nicotine was 10 mg/ml, i.e. each 200 µl spray dose as above contained 2 mg nicotine calculated as free base. The formulation with pH 8.5 was a formulation according to below Example 1. The formulations with pH 7 and pH 6 were formulations according to below Example 2 and Example 3 respectively.

Figure 3 compares the venous blood nicotine plasma profile vs. time of a single dose of the current Nicorette® Gum, extra strength (4 mg), with the corresponding plasma profile when smoking a "light" (low-nicotine) cigarette. One objective with the present invention is to obtain a buccal nicotine formulation providing for a pK profile being closer to the pK profile for a cigarette than is provided using presently known buccal nicotine formulations.

Figure 4 shows the mean score values from 52 smoking volunteers in a randomized open study of the "urge to smoke" (craving), as estimated and recorded on a visual analogue scale (VAS) as a function of time when the same formulations as in Fig. 1 were used. The craving scores were recorded directly after smoking one cigarette and during the abstinence of 7 hours before the administration of the nicotine products. The scores were then recorded more frequently during 1 hour after the administration. The heart rate was also monitored in this study. This figure clearly shows that the present invention provides for a much faster reduction of the urge to smoke score than do present buccal nicotine formulations. For example, about 2 minutes after administration of a formulation according to the present invention the craving score is reduced by 50 %. With Nicorette® Microtab a 50 % decrease in craving score is obtained only more than 10 minutes after administration.

Detailed Description of the Invention

Definitions

The terms "tobacco", "tobacco containing material" and similar are herein intended to mean such material for any type of use of tobacco including smoking, snuffing or chewing whereby is used inter alia a cigarette, a cigar, pipe tobacco, snuff and chewing tobacco.

The term "fast reduction of the urge to smoke or use tobacco " is herein intended to mean an initial priming of the subject so as to achieve a reduction of the urge to smoke or use tobacco.

The term "transient" is intended to pertain to a non-permanent change of a biological and/or physiological state, upon which after a certain period of time said state will return to its value or behavior prior to said change.

The term "buccal" and "buccally" are herein intended to pertain to all of or any part of the soft tissue lining of the oral cavity.

The term "liquid of the oral cavity" is herein intended to mean saliva and/or saliva mixed with a quantity of the liquid pharmaceutical formulation.

The term "incidence of administration" is herein intended to mean administration of one or more single doses of the liquid pharmaceutical formulation within the same time frame, said time frame being dependent on the needs of the subject receiving the administration, said time frame extending from a few seconds to around ten minutes.

The buffering agent and the pH regulating means

Absorption of nicotine from the oral cavity to the systemic circulation is dependent on the pH of the saliva and the pKa of nicotine, which is about 7.8. Assuming a pH of the saliva of 6.8 only about 10% of the nicotine in saliva will be in the free base form. Thus, in order to promote absorption of nicotine in a free base form, which is the form predominantly absorbed through the mucosa, the pH of the saliva must be increased. At a pH of 8.8 about 90% of the nicotine in saliva will then be in the free base form.

Hence and according to the invention, the liquid pharmaceutical formulation is alkalized by buffering and/or pH regulation. This may be achieved by including physiologically acceptable buffering substances or agents, or by other means. With other means it is intended to include buffering by any component in the product, which may not normally act as a buffering agent, such as a self-buffering additive and/or pH regulating forms of nicotine.

By buffering and/or pH regulation thereby increasing the pH of the saliva the uptake of nicotine is changed, e g increased compared to the nicotine uptake when

the saliva is not alkalized by buffering and/or pH regulation. Also, since the trans-mucosal uptake of nicotine in the oral cavity according to the invention is faster than for nicotine not being buffered and/or pH regulated according to the invention, less nicotine will be swallowed and reach the gastrointestinal (GI) tract. The nicotine that reaches the GI tract will be subjected to first pass metabolism, which reduces the total amount of intact nicotine absorbed additionally reducing the rate of nicotine absorption. This means that the absorption kinetics of nicotine that is not co-administered with a buffer according to the invention will generally be slower and the bioavailability will generally be lower than when administered together with a buffer.

For buffering may be used one or more buffering agents selected from the group consisting of carbonates including bicarbonate or sesquicarbonate, glycinate, phosphate, glycerophosphate or citrate of an alkali metal, such as potassium or sodium, or ammonium, and mixtures thereof.

Further embodiments may use trisodium or tripotassium citrate, and mixtures thereof.

Still further embodiments may comprise different phosphate systems, such as trisodium phosphate, disodium hydrogen phosphate; and tripotassium phosphate, dipotassium hydrogen phosphate, and calcium hydroxide, sodium glycinate; and mixtures thereof.

Alkali metal carbonates, glycinates and phosphates are preferred buffering agents.

The pH regulation may also be obtained by using pH-regulating forms of nicotine, e g nicotine free base.

The amount of the buffering agent or agents in the liquid pharmaceutical formulation is preferably sufficient in the specific embodiments to raise the pH of the saliva to above 7, as specified above and, to maintain the pH of the saliva in the oral cavity above 7, e g pH 7 - 11. Otherwise expressed the liquid pharmaceutical formulation should be alkalized by buffering and/or pH regulation in such a way that upon administration to a subject the pH of the liquid of the oral cavity of the subject is transiently increased by about 0.3 - 4 pH units, preferably by about 0.5 -

2.5 pH units. The amount of buffering agent(s) required to achieve such an increase in pH is readily calculated by a person skilled in the art.

The nicotine may be formulated in different forms, e g in different complexes or salts or as free base.

5 The active ingredient

According to the invention, the liquid pharmaceutical formulation product comprises nicotine in any form to provide a fast transmucosal uptake of the nicotine in the oral cavity of a subject so as to obtain a reduction of the urge to smoke and/or use tobacco, and/or a rapid "nicotine kick" and/or a "nicotine head rush". Thereby
10 may also be achieved a systemic maintenance level of nicotine.

The nicotine should be in a saliva soluble form to facilitate the subsequent uptake of the nicotine from the saliva in the oral cavity into the systemic circulation of the subject.

In preferred embodiments, the nicotine in any form is primarily selected from
15 the group consisting of the free base form of nicotine, a nicotine salt, a nicotine derivative, a nicotine inclusion complex or nicotine in any non-covalent binding; and mixtures thereof.

Still further the inclusion complex may be a cyclodextrin, such as β -cyclodextrin.

20 Even more further the nicotine salt may be a tartrate, hydrogen tartrate, citrate or malate.

According to the invention, the uptake of the nicotine through any tissue or mucosa in the oral cavity is improved in relation to the uptake obtained by a liquid nicotine-containing pharmaceutical formulation devoid of alkalizing buffering
25 agents or devoid of alkalizing pH-regulating means.

The nicotine may act as a stimulant to e g obtain a rapid reduction of the urge to smoke or to use tobacco.

With nicotine it is intended to include nicotine, 3-(1-methyl-2-pyrrolidinyl)-pyridine, with its base form, including synthetic nicotine as well as nicotine extracts
30 from tobacco plants, or parts thereof, such as the genus *Nicotiana* alone or in combination; or pharmaceutically acceptable salts.

The most preferable embodiment incorporates nicotine as the free base form or as a water-soluble pharmaceutically acceptable salt, or as an inclusion complex, such as a cyclodextrin complex, e g β -cyclodextrin. But any other suitable pharmaceutically acceptable form may also be employed.

- 5 Numerous nicotine salts are known, and may be used, e g the salts presented in Table 1, such as preferably the tartrate, hydrogen tartrate, citrate, malate, and/or hydrochloride.

Table 1 Possible acids used for nicotine salt formation

Acid	Molar ratio* of Acid:nicotine
Formic	2:1
Acetic	3:1
Propionic	3:1
Butyric	3:1
2-Methylbutyric	3:1
3-Methylbutyric	3:1
Valeric	3:1
Lauric	3:1
Palmitic	3:1
Tartaric	2:1
Citric	2:1
Malic	2:1
Oxalic	2:1
Benzoic	1:1
Gentisic	1:1
Gallic	1:1
Phenylacetic	3:1
Salicylic	1:1
Phthalic	1:1
Picric	2:1
Sulfosalicylic	1:1
Tannic	1:5
Pectic	1:3
Alginic	1:2
Hydrochloric	2:1
Chloroplatinic	1:1
Silicotungstic	1:1
Pyruvic	2:1
Glutamic	1:1
Aspartic	1:1

* recommended upon manufacturing

Amount of the nicotine in the liquid pharmaceutical formulation

- 5 The nicotine in any form is according to the invention formulated to provide the subject with a dose to achieve an effect. The effect may be to provide a sense of

smoking satisfaction without smoking. Another effect of the administered nicotine in any form may be a reduction of the urge to smoke or use tobacco.

The effect may also be a combination of a reduction of said urge and providing a sense of smoking satisfaction without smoking. The amount of the nicotine
5 should be sufficient to provide such an effect in a subject. This amount may, of course, vary from person to person.

According to the invention, embodiments of the liquid pharmaceutical formulation comprise nicotine in such concentrations that the amount of nicotine delivered at each incidence of administration is about 0.05 - 10 mg calculated as the
10 free base form of nicotine, preferably about 0.25 - 6 mg and most preferably about 0.5 - 4 mg.

Release and uptake of nicotine

Presently existing pharmaceutical administration forms for oral administration of nicotine normally provide a slow release and a slow uptake of the nicotine
15 compared to smoking. The slow uptake of the nicotine provides a $t_{\max}$, i.e. the time-point where the nicotine has its maximum level measured in the plasma of venous blood after a single dose at about 30 - 45 minutes after administration.

The time point for reaching a sense of satisfaction or reduction of urge to smoke or use tobacco after administration is individual, but may in existing pharmaceutical forms for administering nicotine generally be reached after approximately
20 30 minutes when regarded as coinciding with $t_{\max}$. According to the present invention, such a sense of satisfaction may be reached after a shorter period of time due to a rapid transmucosal uptake in the oral cavity due to the buffering and/or pH regulation and due to the absence of rate-limiting steps, such as tablet or lozenge
25 melting, tablet or lozenge disintegration and dissolution and chewing gum mastication, followed by drug dissolution.

The liquid phase

The liquid phase of the present liquid pharmaceutical formulation may comprise water. The liquid phase may also comprise an alcohol, such as ethanol,
30 glycerol, propylene glycol and polyethylene glycol, or mixtures thereof. It may also

comprise one or more lipids. Further it may comprise mixtures of the above ingredients.

Other additives to the liquid pharmaceutical formulation

Other additives may be added optionally to the liquid pharmaceutical formulation.

Optional additives comprise one or more stabilizing additives, such as those selected from the group consisting of antioxidants including vitamin E, i.e. tocopherols, vitamin C, i.e. ascorbic acid and its salts, sodium pyrosulfite, butylhydroxytoluene, butylated hydroxyanisole; and preservatives including parabenes, benzalkonium chloride, chlorbutanol, benzyl alcohol, beta-phenylethyl alcohol, cetylpyridinium chloride; and chelating agents, such as EDTA; and galates, such as propyl galate.

Further optional additives comprise one or more additives selected from the group consisting of:

- enhancers, such as azone;
- vitamins, such as vitamins C and E;
- minerals, such as fluorides, especially sodium fluoride, sodium monofluorophosphate and stannous fluoride;
- anti-odours, such as zinc and cyclodextrins;
- propellants, such as 1,1,2,2-tetrafluoroethane (HFC-134a), optionally being liquefied, and 1,1,1,2,3,3,3-heptafluoropropane (HFC-227), optionally being liquefied;
- sweeteners including one or more synthetic sweetening agents and/or natural sugars, such as those selected from the groups consisting of artificial sweeteners e.g. saccharin and its sodium and calcium salts, aspartame, acesulfame and its potassium salt, thaumatin and glycyrrhizin;
- polyhydric alcohols such as sorbitol, xylitol, mannitol and glycerol;
- monosaccharides including glucose (also called dextrose), fructose (also called laevulose) and galactose;
- disaccharides including saccharose (also called sucrose), lactose (also called milk sugar) and maltose (also called malt sugar);

- mixtures of sugars including liquid glucose syrup e g starch hydrolysates containing a mixture of chiefly dextrose, maltose, dextrins and water, invert sugar syrup e g sucrose inverted by invertase containing a mixture of dextrose, laevulose and water, high sugar content syrups such as treacle, honey and malt extract;
- 5 and mixtures thereof;
- flavoring and/or aromatizing agents, such as those selected from the group consisting of essential oils obtained by distillations, solvent extractions or cold expressions of fresh or dried flowers, buds, leaves, stems, fruit, seeds, peel, bark, or root e g oil of peppermint, spearmint, eucalyptus, wintergreen, niaouli,
- 10 clove, cardamom, cinnamon, bitter almond, coriander, caraway, ginger, juniper, orange, bitter orange, lemon, grapefruit, mandarine, bergamot, thyme, fennel and rosemary;
- natural flavors and aroma agents including either diluted solutions of essential oils or concentrates of flavor components with natural origin from e g fruits,
- 15 berries, nuts, spices, mints, tobacco, cocoa, coffee, tea, vanilla, liquorice, caramel, toffee, honey, wine, liquors and brews;
- synthetic flavors and aroma agents consisting of mixtures of chemicals comprising hydrocarbons, alcohols, aldehydes, esters, ketones, ethers and oxides blended to match the natural flavor of e g fruits, berries, nuts, spices, mints,
- 20 tobacco, cocoa, coffee, tea, vanilla, liquorice, caramel, toffee, honey, wine, liquors or brews;
- and mixtures thereof.

Surface active agents

One or more of the compounds of the liquid pharmaceutical formulation may
 25 be solubilized in one or more surface active agents and/or emulsifiers, such as nonionic, cationic, anionic or zwitterionic surfactants, including amphiphilic block copolymers, or mixtures thereof.

Specifically one or more of the compounds of the liquid pharmaceutical formulation may be solubilized in one or more surface-active agents selected from
 30 nonionic surface-active agents including poloxamers, e g:

- poly (oxypropylene)-poly (oxyethylene) block copolymers, polyoxyethylene alkyl ethers, polyoxyethylene castor oil derivatives, polyoxyethylene sorbitan fatty acid esters, mono- and diglycerides and esters thereof, polyoxyethylene stearates, polyglycerolesters of fatty acids (including polyglycerolpolyricinoleic acid (PGPR)), and sorbitan fatty acid esters,
- cationic surface-active agents including secondary, quaternary and tertiary ammonium compounds and cationic phospholipids,
- anionic surface-active agents including fatty acid salts, lactylates, especially sodium and/or calcium stearylactylate, alkyl sulphates, alkyl sulphonates, latanol, and anionic phospholipids, such as phosphatidylserine,
- zwitterionic surface-active agents including zwitterionic phospholipids, such as phosphatidylcholine and phosphatidylethanolamine,
- or mixtures thereof,
- preferably surface-active agents or mixtures thereof being nonionic.

15 Method for delivering nicotine in any form to a subject

According to the invention, a method for delivering nicotine in any form to a subject comprises the steps of:

- a) administering to a subject a liquid pharmaceutical formulation product containing nicotine in any form according to the invention into the oral cavity of the subject, and
- b) allowing the nicotine in any form in the liquid pharmaceutical formulation to be mixed with the saliva in the oral cavity and absorbed into the blood plasma of the subject essentially by buccal uptake.

One embodiment results in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 30 minutes.

One further embodiment results in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 20 minutes.

In still one further embodiment, said nicotine in any form is absorbed resulting in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 15 minutes.

30 Method for obtaining reduction of the urge to smoke or use tobacco

A method for obtaining reduction of the urge to smoke or use tobacco-con-

taining material and/or for providing a sense of smoking satisfaction without smoking according to the invention comprises the steps of:

- a) replacing at least partly the tobacco containing material with a liquid pharmaceutical formulation according to any of claims 1 - 22,
- 5 b) administering to a subject a liquid pharmaceutical formulation containing nicotine in any form according to any of claims 1 - 22 into the oral cavity of the subject, and
- c) allowing the nicotine in any form in the liquid pharmaceutical formulation to be absorbed by the subject essentially by buccal uptake.

10 The administration to the oral cavity takes place by spraying, dropping or pipetting, preferably by spraying, most preferably by spraying under the tongue. The administration is intended for the oral cavity, not for e g the lungs or the upper respiratory tract.

In one embodiment said nicotine in any form results in a $t_{\max}$ of nicotine in
15 venous blood of the subject after about 3 - 30 minutes.

In one further embodiment said nicotine in any form results in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 20 minutes.

In still one further embodiment said nicotine in any form results in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 15 minutes.

20 Even further embodiments of the method for delivering nicotine to a subject may comprise the steps of combining at least one other method for obtaining reduction of the urge to smoke or use of tobacco.

The liquid pharmaceutical formulation may be used for obtaining a quick and/or sustained and/or complete reduction of the urge to smoke or use tobacco
25 and/or for providing a sense of smoking satisfaction without smoking as further discussed below.

The fast relief provides the subject with a sense of rapid smoking satisfaction without smoking.

One embodiment reduces the urge to smoke or use of tobacco by reaching a
30 $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 30 minutes by the use of a liquid pharmaceutical formulation according to the invention.

One further embodiment reduces the urge to smoke or use tobacco by reaching a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 20 minutes by the use of a liquid pharmaceutical formulation according to the invention.

Still one further embodiment reduces the urge to smoke or use tobacco by reaching a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 15 minutes by the use of a liquid pharmaceutical formulation according to the invention.

Cessation of the urge to smoke or use tobacco

For some of the users, it may be a goal to terminate the usage of nicotine completely, due to several reasons e g health, economical, social or behavioral. This may be achieved by further decreasing the delivered amount of nicotine in any form gradually over time. In specific embodiments of the invention, the method described above for obtaining craving relief may further comprise the steps of decreasing the amount of nicotine in the liquid pharmaceutical formulation gradually over time, and/or the steps of reducing the incidence of administration of the liquid pharmaceutical formulation gradually over time, and/or the steps of reducing the dosage size of the liquid pharmaceutical formulation gradually over time, so as to achieve a relief of tobacco craving and/or to achieve a sense of smoking satisfaction. This method results in a weaning process gradually over time.

Different types of smokers reach the sense of reduced craving at different plasma levels of nicotine. This may, of course, affect the individual types of programs for administering a liquid pharmaceutical formulation according to the invention. Different types of smokers include e g peak seekers or smokers that crave for a plasma level of nicotine constantly being above the level below which withdrawal symptoms occur.

One strategy may be to lower the frequency of administering the liquid pharmaceutical formulation. Other embodiments include varying the dose of the nicotine in said liquid pharmaceutical formulation as well as the combination of these two embodiments.

Systems for delivering nicotine and for obtaining craving relief

According to the invention there is a system for delivering nicotine in any form to a subject. Such a system comprises a liquid pharmaceutical formulation

according to the invention and at least one other means for obtaining reduction of the urge to smoke.

Another system according to the invention may be a system for obtaining reduction of the urge to smoke or use tobacco and/or for providing a sense of smoking satisfaction without smoking. Such a system comprises a liquid pharmaceutical formulation according to the invention and at least one other method for obtaining reduction of the urge to smoke or use tobacco. Other methods may be a concomitant or concurrent method selected from the group consisting of administration through chewing gums, nasal sprays, transdermal patches, inhaling devices, lozenges, tablets and parenteral methods, subcutaneous methods, intravenous methods, rectal methods, vaginal methods and transmucosal methods; or use of tobacco.

In a specific embodiment, the at least one other method comprises administration of nicotine.

Use of the liquid pharmaceutical formulation

The use of the liquid pharmaceutical formulation according to the invention is for obtaining a fast and/or complete reduction of the urge to smoke and use tobacco or for providing a sense of smoking without smoking as described above.

The dose of the nicotine is chosen to give the subject an individual sensory perception and satisfaction with an effect of the nicotine in any form. The use of the liquid pharmaceutical formulation may also be a sole use according to the invention or a combination with other means or methods known in the field of drug abuse. Specifically, the present invention may be used in combination with other means as described above in the methods in the paragraphs above.

The use may give a quick reduction of the urge to smoke or use tobacco whereby is reached a $t_{\max}$ of nicotine in venous blood after about 3 - 20 minutes.

In a specific embodiment, the use of the liquid pharmaceutical formulation according to the invention will reduce the urge to smoke or use tobacco by reaching a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 15 minutes.

According to the invention, a use of a liquid pharmaceutical formulation according to the invention is for delivering nicotine in any form to a subject.

In one embodiment, the delivering of nicotine in any form results in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 30 minutes.

In another embodiment, the delivering of nicotine in any form results in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 20 minutes.

5 In still another embodiment, the delivering of nicotine in any form results in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 15 minutes.

As readily shown and concluded from the figures, e g Figure 4, the shorter the $t_{\max}$ the faster the relief of the craving, i e of the urge to smoke.

Examples on embodiments and manufacturing of the liquid

10 **pharmaceutical formulation**

The below examples are non-limiting and for illustrating the present invention. Alternatives and variations of the below examples within the scope of the present invention as per the below claims may be carried out by a person skilled in the art. Ingredients as per the below examples may be exchanged for equivalent
15 ingredients, preferably as per above. The formulations according to Examples 2 and 3 were made for comparative purposes as seen from Figure 2.

Example 1

Manufacturing of a 1000 ml formulation with 10 mg nicotine/ml and around pH 8.5.

20 **Mixture 1**

To a beaker containing 800 ml water of 90°C was added 0.7 g methyl para-hydroxybenzoate, acting as preservative, and 0.3 g propyl para-hydroxybenzoate, acting as preservative. The additives were dissolved during stirring for about 10 minutes. Then was added 10.45 g sodium dihydrogen phosphate, acting as buffering
25 agent, and 0.5 g EDTA, acting as chelating agent, to the solution, which was stirred for about 5 minutes. Then the solution was cooled to 30°C during stirring.

Mixture 2

To a beaker containing 15.9 g ethanol of room temperature, acting as solvent, was added 0.045 g peppermint oil, acting as flavoring agent. The liquid was mixed
30 for 2 minutes.

Final mixture

Mixture 2 was added during stirring to a beaker containing 150 ml water. Gently 10 g nicotine (base) was added to the beaker. Then Mixture 1 was added to the beaker and stirred for 5 minutes. The pH of the Final mixture was checked and
5 adjusted to about pH 8.5 with sodium hydroxide (20%) and to volume with water.

Example 2

Manufacturing of a 1000 ml formulation with 10 mg nicotine/ml and around pH 7.0.

This Example 2 differs from Example 1 only for pH. The formulation according to Example 2 contains a non-alkalizing buffering agent. This formulation was
10 for use as a comparison in Figure 2.

Mixture 1

To a beaker containing 800 ml water of 90°C was added 0.7 g methyl para-hydroxybenzoate, acting as preservative, and 0.3 g propyl para-hydroxybenzoate,
15 acting as preservative. The additives were dissolved during stirring for about 10 minutes. Then was added 10.45 g sodium dihydrogen phosphate, acting as buffering agent, and 0.5 g EDTA, acting as chelating agent, to the solution, which was stirred for about 5 minutes. Then the solution was cooled to 30°C during stirring.

Mixture 2

20 To a beaker containing 15.9 g ethanol of room temperature, acting as solvent, was added 0.045 g peppermint oil, acting as flavoring agent. The liquid was mixed for 2 minutes.

Final mixture

Mixture 2 was added during stirring to a beaker containing 150 ml water. Gently 10 g nicotine (base) was added to the beaker. Then Mixture 1 was added to the beaker and stirred for 5 minutes. The pH of the Final mixture was checked and
25 adjusted to about pH 7.0 with hydrochloric acid and to volume with water.

Example 3

Manufacturing of a 1000 ml formulation with 10 mg nicotine/ml and around
30 pH 6.0.

This Example 3 differs from Example 1 only for pH. The formulation according to Example 3 contains a non-alkalizing buffering agent. This formulation was for use as a comparison in Figure 2.

Mixture 1

5 To a beaker containing 800 ml water of 90°C was added 0.7 g methyl para-hydroxybenzoate, acting as preservative, and 0.3 g propyl para-hydroxybenzoate, acting as preservative. The additives were dissolved during stirring for about 10 minutes. Then was added 10.45 g sodium dihydrogen phosphate, acting as buffering agent, and 0.5 g EDTA, acting as chelating agent, to the solution, which was stirred
10 for about 5 minutes. Then the solution was cooled to 30°C during stirring.

Mixture 2

To a beaker containing 15.9 g ethanol of room temperature, acting as solvent, was added 0.045 g peppermint oil, acting as flavoring agent. The liquid was mixed for 2 minutes.

15 Final mixture

Mixture 2 was added during stirring to a beaker containing 150 ml water. Gently 10 g nicotine (base) was added to the beaker. Then Mixture 1 was added to the beaker and stirred for 5 minutes. The pH of the Final mixture was checked and adjusted to about pH 6.0 with hydrochloric acid and to volume with water.

20 Example 4

Manufacturing of a 1000 ml formulation with 17.5 mg nicotine/ml and around pH 9.0.

Mixture 1

To a beaker containing 600 ml water of room temperature was added 12.0 g
25 Synperonic® PE/F27, being a poloxamer acting as non-ionic surface active agent. The additive was dissolved during stirring for about 20 minutes. Then was added 0.5 g EDTA, acting as chelating agent, and 0.4 g sodium saccharin, acting as sweetener, to the liquid which was stirred until all ingredients were dissolved. Then was added 16.8 g sodium hydrogen carbonate, acting as buffering agent, and the
30 solution was stirred until a clear solution was obtained.

Mixture 2

To a beaker containing 250.0 g ethanol of room temperature, acting as solvent, was added 0.7 g methyl para-hydroxybenzoate acting as preservative, and 0.3 g propyl para-hydroxybenzoate acting as preservative. The liquid was mixed
5 until the ingredients were dissolved. Then was added 5.0 g peppermint oil, acting as flavoring agent, and 1.5 g aroma agent. The liquid was mixed until a clear solution was obtained.

Final mixture

Mixture 2 was gently added to Mixture 1 during stirring for about 1 minute.
10 Then was added 17.5 g nicotine (base) and the liquid was stirred for about 2 minutes. The pH of the Final mixture was checked and adjusted to around pH 9.0 with hydrochloric acid. The Final mixture was transferred to a 1000 ml volumetric flask and adjusted to 1000 ml volume by water. Finally the pH of the solution was checked to remain at around pH 9.0.

15 Example 5

Manufacturing of a 1000 ml formulation with 14.3 mg nicotine/ml and around pH 9.0.

Mixture 1

To a beaker containing 600 ml water of room temperature was added 20.0 g
20 Synperonic® PE/F27 being a poloxamer, acting as non-ionic surface active agent. The additive was dissolved during stirring for about 20 minutes. Then was added 2.0 g Acesulfame K, acting as sweetener, to the liquid which was stirred until all ingredients were dissolved. Then was added 20.0 g sodium hydrogen carbonate, acting as buffering agent, and the liquid was stirred until a clear solution was
25 obtained.

Mixture 2

To a beaker containing 95.0 g ethanol of room temperature, acting as solvent, was added 3.5 g peppermint oil, acting as flavoring agent, and 1.0 g aroma agent. The liquid was mixed until a clear solution was obtained.

Final mixture

Mixture 2 was gently added to Mixture 1 during stirring for about 1 minute. Then was added 14.3 g nicotine (base) and the liquid was stirred for about 2 minutes. The pH of the Final mixture was checked and adjusted to around pH 9.0 with hydrochloric acid. The Final mixture was transferred to a 1000 ml volumetric flask and adjusted to 1000 ml volume by water. Finally the pH of the solution was checked to remain at around pH 9.0.

The formulation according to Example 5 is a preferred composition.

Example 6

10 Manufacturing of a 1000 ml formulation with 14.3 mg nicotine/ml and around pH 9.0.

Mixture 1

To a beaker containing 600 ml water of room temperature was added 20.0 g Synperonic® PE/F27 being a poloxamer, acting as non-ionic surface active agent. 15 The additive was dissolved during stirring for about 20 minutes. Then was added 0.2 g benzalkonium chloride, acting as preservative, and 2.0 g Acesulfame K, acting as sweetener, to the liquid which was stirred until all ingredients were dissolved. Then was added 20.0 g sodium hydrogen carbonate, acting as buffering agent, and the liquid was stirred until a clear solution was obtained.

20 Mixture 2

To a beaker containing 95.0 g ethanol of room temperature, acting as solvent, was added 3.5 g peppermint oil, acting as flavoring agent, and 1.0 g aroma agent. The liquid was mixed until a clear solution was obtained.

Final mixture

25 Mixture 2 was gently added to Mixture 1 during stirring for about 1 minute. Then was added 14.3 g nicotine (base) and the liquid was stirred for about 2 minutes. The pH of the Final mixture was checked and adjusted to around pH 9.0 with hydrochloric acid. The Final mixture was transferred to a 1000 ml volumetric flask and adjusted to 1000 ml volume by water. Finally the pH of the solution was 30 checked to remain at around pH 9.0.

The formulation according to Example 6 is a another preferred composition.

Example 7

Manufacturing of a 1000 ml formulation with 14.3 mg nicotine/ml and around pH 9.0.

Mixture 1

- 5 To a beaker containing 600 ml water of room temperature was added 20.0 g Synperonic® PE/F27 being a poloxamer, acting as non-ionic surface active agent. The additive was dissolved during stirring for about 20 minutes. Then was added 0.5 g EDTA, acting as chelating agent, and 2.0 g Acesulfame K, acting as sweetener, to the liquid which was stirred until all ingredients were dissolved. Then
- 10 was added 20.0 g sodium hydrogen carbonate, acting as buffering agent, and the liquid was stirred until a clear solution was obtained.

Mixture 2

- To a beaker containing 95.0 g ethanol of room temperature, acting as solvent, was added 0.7 g methyl para-hydroxybenzoate acting as preservative, and 0.3 g
- 15 propyl para-hydroxybenzoate acting as preservative. The liquid was mixed until the ingredients were dissolved. Then was added 3.5 g peppermint oil, acting as flavoring agent, and 1.0 g aroma agent. The liquid was mixed until a clear solution was obtained.

Final mixture

- 20 Mixture 2 was gently added to Mixture 1 during stirring for about 1 minute. Then was added about 2 ml sodium hydroxide (50%) and 4 g nicotine bitartrate. The pH of the Final mixture was not allowed to decrease below pH 8 during the addition of the nicotine bitartrate. The preceding procedure with adding of sodium hydroxide and nicotine bitartrate was repeated until totally 40.7 g nicotine bitartrate
- 25 was added. The pH of the Final mixture was adjusted to around pH 9.0. The Final mixture was transferred to a 1000 ml volumetric flask and adjusted to 1000 ml volume by addition of water. Finally the pH of the solution was checked to remain at around pH 9.0.

Example 8

Manufacturing of a 1000 ml formulation with 17.5 mg nicotine/ml and pH 10.94.

To a beaker containing 950 ml water of room temperature was added 17.5 g nicotine (base) during stirring for about 5 minutes. The volume was adjusted to 1000 ml volume by addition of water. Finally the pH was checked.

Example 9

Manufacturing of a 1000 ml formulation with 17.5 mg nicotine/ml and pH 11.55.

10 To a beaker containing 950 ml water of room temperature was added 35 g sodium carbonate anhydrous during stirring until complete dissolution. Then 17.5 g nicotine (base) was added during stirring for about 5 minutes. The volume was adjusted to 1000 ml volume by addition of water. Finally the pH was checked.

Example 10

15 Manufacturing of a 1000 ml formulation with 15.65 mg nicotine/ml and pH 11.79.

To a beaker containing 950 ml water of room temperature was added 158 g glycine sodium salt during stirring until complete dissolution. Then 15.65 g nicotine (base) was added during stirring for about 5 minutes. The volume was adjusted to 20 1000 ml volume by addition of water. Finally the pH was checked.

Example 11

Buffer capacity determinations

Method: 10.0 ml of the respective below solutions was titrated with 0.1 M HCl to pH 7.0. The amount of 0.1 M HCl needed to decrease pH from 9.0 to 8.0 was 25 determined.

Definitions: (1) Sodium hydrogen carbonate (NaHCO_3). Mw: 84.0
(2) Disodium phosphate dodecahydrate ($\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$) Mw: 358.1

Ingredient\Batch	DKN0293	DKN0294	DKN0295	DKN0296	DKN0290	DKN0291
Nicotine (mg/ml)			10.0		10.0	10.0
NaHCO ₃ (mg/ml)	16.8		16.8	8.4		
Na ₂ HPO ₄ ·12H ₂ O (mg/ml)		71.6		35.8	71.6	
Purified water ad	1 ml	1 ml	1 ml	1 ml	1 ml	1 ml
Buffer Capacity PH=9.0-8.0 (mekv/l)	26.5	9.5	50	15.8	40	29

All solutions were adjusted to a pH of 9.0 when needed. A higher pH may cause irritation and corrosion, which might be harmful to the tissue of the oral cavity.

16.8 mg/ml of NaHCO₃ corresponds to 0.2 M.

71.6 mg/ml of Na₂HPO₄·12H₂O corresponds to 0.2 M.

5 8.4 mg/ml of NaHCO₃ corresponds to 0.1 M.

35.8 mg/ml of Na₂HPO₄·12H₂O corresponds to 0.1 M

Nicotine base has an alkalizing effect, but has too weak a buffering capacity on its own. The buffering capacity of the formulation is significantly and sufficiently increased when a buffering agent is added.

10 The above data clearly show that the present formulations have a good buffering capacity, providing for the desired rapid transmucosal uptake of nicotine.

A liquid pharmaceutical formulation according to the present invention may be administered using suitable devices being available on the market, e g spray devices.

15 Analysis of nicotine

The analysis of nicotine uptake and of the effect of the invention may be done according to standard procedures known in the art, e g using a bioanalysis for the determination of nicotine in the plasma of a subject.

Effects of the invention

20 Comparative tests were conducted as described above under Legend of figures.

Figure 1 shows that with a liquid pharmaceutical formulation according to the present invention the venous blood plasma level of nicotine ascends signify-

cantly more rapidly than with Nicorette Microtab[®]. Nicorette Microtab[®] has the same pharmacokinetic profile as, i e is pharmacologically equivalent with, Nicorette Gum[®] and all other nicotine chewing gums currently on the market. Nicotine chewing gums presently represent around half of the world sales of medicinal
5 nicotine-containing products for smoking cessation and similar indications.

Figure 2 shows that the higher the pH of a liquid pharmaceutical formulation according to the present invention the faster the absorption kinetics and the higher the plasma concentration of nicotine.

Figures 3 and 4 further show that a formulation according to the present
10 invention provides for a fast craving relief manifested through a significantly faster reduction in the urge to smoke compared to known oral nicotine formulations.

Use for therapy, treatment and manufacturing

The liquid pharmaceutical formulation product according to the invention may be used in therapy. Said therapy may be a treatment of a disease or medical
15 indication selected from the group consisting of reduction in use of tobacco, cessation of use of tobacco, other use of tobacco, temporary abstinence from abstaining from use of tobacco, Alzheimer's disease, Crohn's disease, Parkinson's disease, Tourette's syndrome, and ulcerative colitis; and weight control.

Nicotine in any form may be used for the manufacturing of a liquid pharma-
20 ceutical formulation according to the invention for the treatment of a disease or medical indication selected from the group consisting of reduction in use of tobacco, cessation of use of tobacco, other use of tobacco, temporary abstinence from abstaining from using tobacco, Alzheimer's disease, Crohn's disease, Parkinson's disease, Tourette's syndrome, and ulcerative colitis; and weight control.

25

CLAIMS

1. A liquid pharmaceutical formulation comprising nicotine in any form, characterized in that it is for administration to the oral cavity and that it is alkalized by buffering and/or pH regulation.
- 5 2. A liquid pharmaceutical formulation according to claim 1, characterized in that it is for administration to the oral cavity by spraying, dropping or pipetting, preferably by spraying, most preferably by spraying under the tongue.
3. A liquid pharmaceutical formulation according to any of claims 1 or 2, characterized in that it is alkalized by buffering and/or pH regulation in such
10 a way that upon administration to a subject the pH of the liquid of the oral cavity of the subject is transiently increased by about 0.3 to about 4 pH units.
4. A liquid pharmaceutical formulation according to claim 3, characterized in that it is alkalized by buffering and/or pH regulation in such a way that upon administration to a subject the pH of the liquid of the oral cavity of the subject
15 is transiently increased by about 0.5 to about 2.5 pH units.
5. A liquid pharmaceutical formulation according to any of claims 1 - 4, characterized in that it is alkalized by buffering and/or pH regulation by the use of one or more buffering agents selected from the group consisting of a carbonate, such as mono-carbonate, bicarbonate or sesquicarbonate; glycinate, phosphate,
20 glycerophosphate, acetate, gluconate or citrate of an alkali metal, such as potassium or sodium, or of ammonium, and mixtures thereof; and/or by the use of pH regulating agents, such as agents selected from the group consisting of sodium hydroxide, potassium hydroxide, calcium hydroxide and calcium oxide; and/or by using at least partly pH regulating forms of nicotine.
- 25 6. A liquid pharmaceutical formulation according to any of claims 1 - 5, wherein the nicotine in any form is selected from the group consisting of the free base form of nicotine, a nicotine salt, or a nicotine derivative; and mixtures thereof.
7. A liquid pharmaceutical formulation according to any of claims 1 - 5, wherein the nicotine in any form is selected from the group consisting of a nicotine
30 inclusion complex or nicotine in any non-covalent binding; and mixtures thereof.
8. A liquid pharmaceutical formulation according to claim 7, wherein the

nicotine inclusion complex is a cyclodextrin complex, such as a β -cyclodextrin complex.

9. A liquid pharmaceutical formulation according to claim 6, wherein the nicotine salt is a salt formed as tartrate, hydrogen tartrate, citrate or malate.

5 10. A liquid pharmaceutical formulation according to any of claims 1 - 9, wherein the amount of nicotine in any form delivered at each incidence of administration is about 0.05 - 10 mg calculated as the free base form of nicotine.

11. A liquid pharmaceutical formulation according to claim 10, wherein the amount of nicotine in any form delivered at each incidence of administration is
10 about 0.25 - 6 mg calculated as the free base form of nicotine.

12. A liquid pharmaceutical formulation according to claim 11, wherein the amount of nicotine in any form delivered at each incidence of administration is about 0.5 - 4 mg calculated as the free base form of nicotine.

13. A liquid pharmaceutical formulation according to any of claims 1 - 12,
15 wherein the liquid phase comprises water.

14. A liquid pharmaceutical formulation according to any of claims 1 - 12, wherein the liquid phase comprises an alcohol, such as ethanol, glycerol, propylene glycol and polyethylene glycol, or mixtures thereof.

15. A liquid pharmaceutical formulation according to any of claims 1 - 12,
20 wherein the liquid phase comprises one or more lipids.

16. A liquid pharmaceutical formulation according to any of claims 1 - 15, wherein the liquid phase comprises water and/or an alcohol, such as ethanol, glycerol, propylene glycol and polyethylene glycol, and/or one or more lipids or mixtures thereof.

25 17. A liquid pharmaceutical formulation according to any claims 1-16, characterized in that it further comprises one or more flavoring and/or aromatizing agents, such as those selected from the group consisting of essential oils obtained by distillations, solvent extractions or cold expressions of fresh or dried flowers, buds, leaves, stems, fruit, seeds, peel, bark, or root e g oil of pepper-
30 mint, spearmint, eucalyptus, wintergreen, niaouli, clove, cardamom, cinnamon, bitter almond, coriander, caraway, ginger, juniper, orange, bitter orange, lemon,

grapefruit, mandarine, bergamot, thyme, fennel and rosemary;

natural flavors and aroma agents including either diluted solutions of essential oils or concentrates of flavor components with natural origin from e g fruits, berries, nuts, spices, mints, tobacco, cocoa, coffee, tea, vanilla, liquorice,

5 caramel, toffee, honey, wine, liquors and brews;

synthetic flavors and aroma agents consisting of mixtures of chemicals comprising hydrocarbons, alcohols, aldehydes, esters, ketones, ethers and oxides blended to match the natural flavor of e g fruits, berries, nuts, spices, mints, tobacco, cocoa, coffee, tea, vanilla, liquorice, caramel, toffee, honey, wine, liquors

10 or brews;

and mixtures thereof.

18. A liquid pharmaceutical formulation according to any of claims 1 - 17, characterized in that it further comprises one or more stabilizing additives, such as those selected from the group consisting of antioxidants including vitamin

15 E, i e tocopheroles, vitamin C, i e ascorbic acid and its salts, sodium pyrosulfite, butylhydroxytoluene, butylated hydroxyanisole; and preservatives including parabenes, benzalkonium chloride, chlorbutanol, benzyl alcohol, beta-phenylethylal alcohol, cetylpyridinium chloride; and chelating agents, such as EDTA; and galates, such as propyl galate.

20 19. A liquid pharmaceutical formulation according to any of claims 1 - 18, characterized in that it further comprises one or more additives selected from the group consisting of:

thickening agents, such as natural, semisynthetic or synthetic polymers, e g starch and starch derivatives, cellulose and cellulose derivatives, polyethylene

25 glycols and derivatives thereof, polyacrylates, and polyvinyl esters and ethers;

enhancers, such as azone;

vitamins, such as vitamins C and E;

minerals, such as fluorides, especially sodium fluoride, sodium monofluoro phosphate and stannous fluoride;

30 anti-odours, such as zinc and cyclodextrins;

propellants, such as 1,1,2,2-tetrafluoroethane (HFC-134a), optionally being

liquefied, and 1,1,1,2,3,3,3-heptafluoropropane (HFC-227), optionally being liquefied;

sweeteners including one or more synthetic sweetening agents and/or natural sugars, such as those selected from the groups consisting of

5 artificial sweeteners e g saccharin and its sodium and calcium salts, aspartame, acesulfame and its potassium salt, thaumatin and glycyrrhizin;

polyhydric alcohols such as sorbitol, xylitol, mannitol and glycerol; monosaccharides including glucose (also called dextrose), fructose (also called laevulose) and galactose;

10 disaccharides including saccharose (also called sucrose), lactose (also called milk sugar) and maltose (also called malt sugar);

mixtures of sugars including liquid glucose syrup e g starch hydrolysates containing a mixture of chiefly dextrose, maltose, dextrans and water, invert sugar syrup e g sucrose inverted by invertase containing a mixture of dextrose, laevulose

15 and water, high sugar content syrups such as treacle, honey and malt extract; and mixtures thereof;

20. A liquid pharmaceutical formulation according to any of claims 1 - 19, characterized in that one or more of the compounds of the liquid pharmaceutical formulation is/are solubilized in one or more surface active agents and/or emulsifiers, such as nonionic, cationic, anionic or zwitterionic surfactants, including amphiphilic block copolymers, or mixtures thereof.

21. A liquid pharmaceutical formulation according to claim 20, characterized in that one or more of the compounds of the liquid pharmaceutical formulation is/are solubilized in one or more surface active agents selected from

25 nonionic surface-active agents including poloxamers, e g poly (oxypropylene)-poly(oxyethylene) block copolymers, polyoxyethylene alkyl ethers, polyoxyethylene castor oil derivatives, polyoxyethylene sorbitan fatty acid esters, mono- and diglycerides and esters thereof, polyoxyethylene stearates, polyglycerolesters of fatty acids (including polyglycerolpolyricinoleic acid (PGPR)), and sorbitan fatty acid esters,

cationic surface-active agents including secondary, quaternary and tertiary

ammonium compounds and cationic phospholipids,

anionic surface-active agents including fatty acid salts, lactylates, especially sodium and/or calcium stearylactylate, alkyl sulphates, alkyl sulphonates, latanol, and anionic phospholipids, such as phosphatidylserine,

- 5 zwitterionic surface-active agents including zwitterionic phospholipids, such as phosphatidylcholine and phosphatidylethanolamine, or mixtures thereof, preferably surface-active agents or mixtures thereof being nonionic.

22. A liquid pharmaceutical formulation according to any of claims 1 - 21,
10 c h a r a c t e r i z e d in that it comprises nicotine base, sodium hydrogen carbonate acting as buffering agent, water acting as solvent, ethanol acting as co-solvent, a poloxamer acting as surface active agent, EDTA acting as chelating agent, Acesulfame K acting as sweetener, optionally one or more preservatives, and optionally one or more flavoring or aroma agents.

15 23. A method for delivering nicotine in any form to a subject comprising the steps of

a) administering to a subject a liquid pharmaceutical formulation according to any of claims 1- 22 into the oral cavity of the subject, and

b) allowing the nicotine in any form in the liquid pharmaceutical
20 formulation to be systematically absorbed by the subject essentially by buccal uptake of nicotine.

24. A method according to claim 23, wherein absorption of said nicotine in any form results in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 30 minutes.

25 25. A method according to any of claims 23 - 24, wherein absorption of said nicotine in any form results in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 20 minutes.

26. A method according to any of claims 23 - 25, wherein absorption of said nicotine in any form results in a $t_{\max}$ of nicotine in venous blood of the subject after
30 about 3 - 15 minutes.

27. A method for obtaining reduction of the urge to smoke or otherwise use

tobacco containing material and/or for providing a sense of smoking satisfaction without smoking, comprising the steps of

- a) replacing at least partly the tobacco containing material with a liquid pharmaceutical formulation according to any of claims 1 - 22,
- 5 b) administering to a subject a liquid pharmaceutical formulation according to any of claims 1 - 22 into the oral cavity of the subject, and
- c) allowing the nicotine in any form in the liquid pharmaceutical formulation to be systematically absorbed by the subject essentially by buccal uptake of nicotine.

10 28. A method according to claim 27, wherein absorption of said nicotine in any form results in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 30 minutes.

29. A method according to any of claims 27 - 28, wherein absorption of said nicotine in any form results in a $t_{\max}$ of nicotine in venous blood of the subject after
15 about 3 - 20 minutes.

30. A method according to any of claims 27 - 29, wherein absorption of said nicotine in any form results in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 15 minutes.

31. A method according to any of claims 27 - 30, wherein the administering
20 to a subject of the liquid pharmaceutical formulation takes place by spraying, dropping or pipetting, preferably by spraying, most preferably by spraying under the tongue.

32. A method for obtaining reduction of the urge to smoke or otherwise use tobacco containing material and/or for providing a sense of smoking satisfaction
25 without smoking wherein a method according to claim 27 - 31 is used in combination with one or more other methods for obtaining reduction of the urge to smoke or otherwise use tobacco containing material and/or for providing a sense of smoking satisfaction without smoking.

33. A method according to claim 32, wherein the one or more other methods
30 is/are selected from the group consisting of administration through chewing gums, nasal sprays, transdermal patches, inhaling devices, lozenges, tablets and parenteral

means or methods, subcutaneous means or methods, intravenous means or methods, rectal means or methods, vaginal means or methods and transmucosal means or methods; or use of tobacco.

34. A method according to claim 33, wherein the one or more other methods
5 comprises administration of nicotine.

35. A system for delivering nicotine in any form to a subject, comprising a liquid pharmaceutical formulation according to any of claims 1 - 22 and at least one other means for delivering nicotine in any form to a subject.

36. A system for obtaining reduction of the urge to smoke or use of tobacco
10 and/or for providing a sense of smoking satisfaction without smoking, comprising a liquid pharmaceutical formulation according to any of claims 1 - 22 and at least one other means for obtaining reduction of the urge to smoke or use tobacco.

37. A system according to any of claims 35 - 36, wherein the at least one other means is/are selected from the group consisting of administration through
15 chewing gums, nasal sprays, transdermal patches, inhaling devices, lozenges, tablets and parenteral means or methods, subcutaneous means or methods, intravenous means or methods, rectal means or methods, vaginal means or methods and transmucosal means or methods; or use of tobacco.

38. A system according to claim 37, wherein the at least other means com-
20 prises administration of nicotine.

39. Use of a liquid pharmaceutical formulation according to any of claims 1 - 22 for obtaining a quick and/or complete reduction of the urge to smoke or use tobacco and/or for providing a sense of smoking satisfaction without smoking.

40. A use according to claim 39, wherein the reduction of the urge to smoke
25 or use tobacco is reduced by reaching a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 30 minutes.

41. A use according to any of claims 39 and 40, wherein the reduction of the urge to smoke or use tobacco is reduced by reaching a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 20 minutes.

30 42. A use according to any of claims 39 - 41, wherein the reduction of the urge to smoke or use of tobacco is reduced by reaching a $t_{\max}$ of nicotine in venous

blood of the subject after about 3 - 15 minutes.

43. A use according to any of claims 39 - 42, wherein delivering of nicotine in any form results in a $t_{\max}$ of nicotine in venous blood of the subject after about 3 - 30 minutes, preferably after about 3- 20 minutes, and most preferably after about 3 - 5 15 minutes.

44. A method for manufacturing a liquid pharmaceutical formulation according to any of claims 1 - 22, comprising the steps of:

- a) making a first mixture comprising a first solvent, at least one buffering agent and/or other means for pH regulation, and optionally nicotine in any form,
- 10 b) optionally adding first components to said first mixture, said first components optionally having been initially solubilized,
- c) optionally making one or more second mixture(s) comprising one or more second solvent(s) and second component(s), which may comprise nicotine in any form,
- 15 d) optionally mixing the first mixture and the optional one or more second mixture(s) to a final mixture, optionally under addition of one or more further solvent(s), and optionally under addition of nicotine in any form,
- e) optionally adjusting the pH of the final mixture.

45. A method according to claim 44, wherein the mixing is done in a temperature from about room temperature to about 95°C.

46. The method according to any of claims 44 - 45, wherein the nicotine in any form is selected from the group consisting of the free base form of nicotine, a nicotine salt, a nicotine derivative, such as a nicotine inclusion complex or nicotine in any non-covalent binding; and mixtures thereof.

25 47. The method according to any of claims 44 - 46, wherein the buffering and/or pH regulation is obtained by the use of one or more buffering agents selected from the group consisting of a carbonate, such as monocarbonate, bicarbonate or sesquicarbonate; glycinate, phosphate, glycerophosphate, acetate, gluconate or citrate of an alkali metal, such as potassium or sodium, or ammonium, and mixtures thereof; and/or by the use of pH regulating agents, such as agents selected from the group consisting of sodium hydroxide, potassium hydroxide, calcium hydroxide and 30

calcium oxide; and/or by using at least partly pH regulating forms of nicotine.

48. The method according to any of claims 44 - 47, wherein the first solvent and the optional one or more second solvent(s) is/are chosen from water and/or an alcohol, such as ethanol, glycerol, propylene glycol and polyethylene glycol, and/or
5 one or more lipids or mixtures thereof.

49. The method according to any of claims 44 - 48, wherein the optional first and second components are chosen from

- one or more flavoring and/or aromatizing agents, such as those selected from the group consisting of essential oils obtained by distillations, solvent extractions or
10 cold expressions of fresh or dried flowers, buds, leaves, stems, fruit, seeds, peel, bark, or root e g oil of peppermint, spearmint, eucalyptus, wintergreen, niaouli, clove, cardamom, cinnamon, bitter almond, coriander, caraway, ginger, juniper, orange, bitter orange, lemon, grapefruit, mandarine, bergamot, thyme, fennel and rosemary;

- 15 natural flavors and aroma agents including either diluted solutions of essential oils or concentrates of flavor components with natural origin from e g fruits, berries, nuts, spices, mints, tobacco, cocoa, coffee, tea, vanilla, liquorice, caramel, toffee, honey, wine, liquors and brews;

- synthetic flavors and aroma agents consisting of mixtures of chemicals
20 comprising hydrocarbons, alcohols, aldehydes, esters, ketones, ethers and oxides blended to match the natural flavor of e g fruits, berries, nuts, spices, mints, tobacco, cocoa, coffee, tea, vanilla, liquorice, caramel, toffee, honey, wine, liquors or brews;

and mixtures thereof;

- 25 one or more stabilizing additives, such as those selected from the group consisting of antioxidants including vitamin E, i e tocopheroles, vitamin C, i e ascorbic acid and its salts, sodium pyrosulfite, butylhydroxytoluene, butylated hydroxyanisole; and preservatives including parabenes, benzalkonium chloride, chlorbutanol, benzyl alcohol, beta-phenylethylal alcohol, cetylpyridinium chloride;
30 and chelating agents, such as EDTA; and galates, such as propyl galate;

one or more additives selected from the group consisting of

- thickening agents, such as natural, semisynthetic or synthetic polymers, e g starch and starch derivatives, cellulose and cellulose derivatives, polyethylene glycols and derivatives thereof, polyacrylates, and polyvinyl esters and ethers;
- enhancers, such as azone;
- 5 vitamins, such as vitamins C and E;
- minerals, such as fluorides, especially sodium fluoride, sodium monofluoro phosphate and stannous fluoride;
- anti-odours, such as zinc and cyclodextrins;
- propellants, such as 1,1,2,2-tetrafluoroethane (HFC-134a), optionally being
- 10 liquefied, and 1,1,1,2,3,3,3-heptafluoropropane (HFC-227), optionally being liquefied;
- sweeteners including one or more synthetic sweetening agents and/or natural sugars, such as those selected from the groups consisting of
- artificial sweeteners e g saccharin and its sodium and calcium salts, aspar-
- 15 tame, acesulfame and its potassium salt, thaumatin and glycyrrhizin;
- polyhydric alcohols such as sorbitol, xylitol, mannitol and glycerol; mono-saccharides including glucose (also called dextrose), fructose (also called laevulose) and galactose;
- disaccharides including saccharose (also called sucrose), lactose (also called
- 20 milk sugar) and maltose (also called malt sugar);
- mixtures of sugars including liquid glucose syrup e g starch hydrolysates containing a mixture of chiefly dextrose, maltose, dextrans and water, invert sugar syrup e g sucrose inverted by invertase containing a mixture of dextrose, laevulose and water, high sugar content syrups such as treacle, honey and malt extract;
- 25 and mixtures thereof.
50. The method according to any of claims 44 - 49, wherein the first and/or second components is/are solubilized in one or more surface active agents and/or emulsifiers, such as nonionic, cationic, anionic or zwitterionic surfactants, including amphiphilic block copolymers, or mixtures thereof, whereby preferably the one or
- 30 more surface active agents is/are selected from

nonionic surface-active agents including poloxamers, e g
poly(oxypropylene)-poly(oxyethylene) block copolymers, polyoxyethylene alkyl
ethers, polyoxyethylene castor oil derivatives, polyoxyethylene sorbitan fatty acid
esters, mono- and diglycerides and esters thereof, polyoxyethylene stearates, poly-
5 glycerolesters of fatty acids (including polyglycerolpolyricinoleic acid (PGPR)),
and sorbitan fatty acid esters,

cationic surface-active agents including secondary, quaternary and tertiary
ammonium compounds and cationic phospholipids,

anionic surface-active agents including fatty acid salts, lactylates, especially
10 sodium and/or calcium stearylactylate, alkyl sulphates, alkyl sulphonates, latanol,
and anionic phospholipids, such as phosphatidylserine,

zwitterionic surface-active agents including zwitterionic phospholipids, such
as phosphatidylcholine and phosphatidylethanolamine,

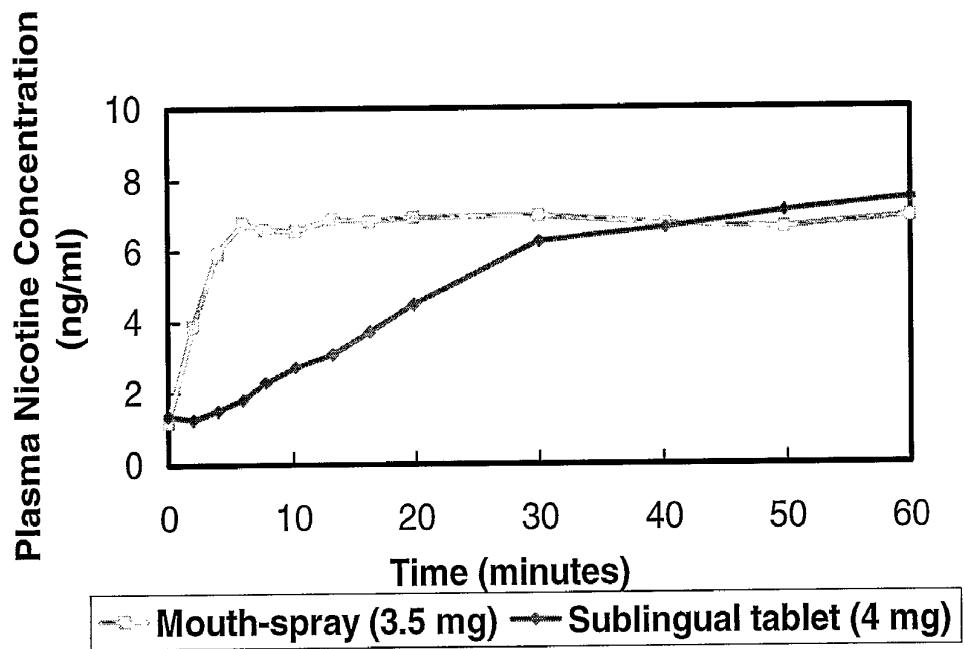
or mixtures thereof, whereby most preferably the surface-active agents or
15 mixtures thereof are nonionic.

51. A liquid pharmaceutical formulation according to any of claims 1 - 22
for use in therapy.

52. A liquid pharmaceutical formulation according to claim 51, wherein the
therapy is treatment of a disease selected from the group consisting of addiction to
20 tobacco or nicotine, Alzheimer's disease, Crohn's disease, Parkinson's disease,
Tourette's syndrome, ulcerative colitis; and weight control.

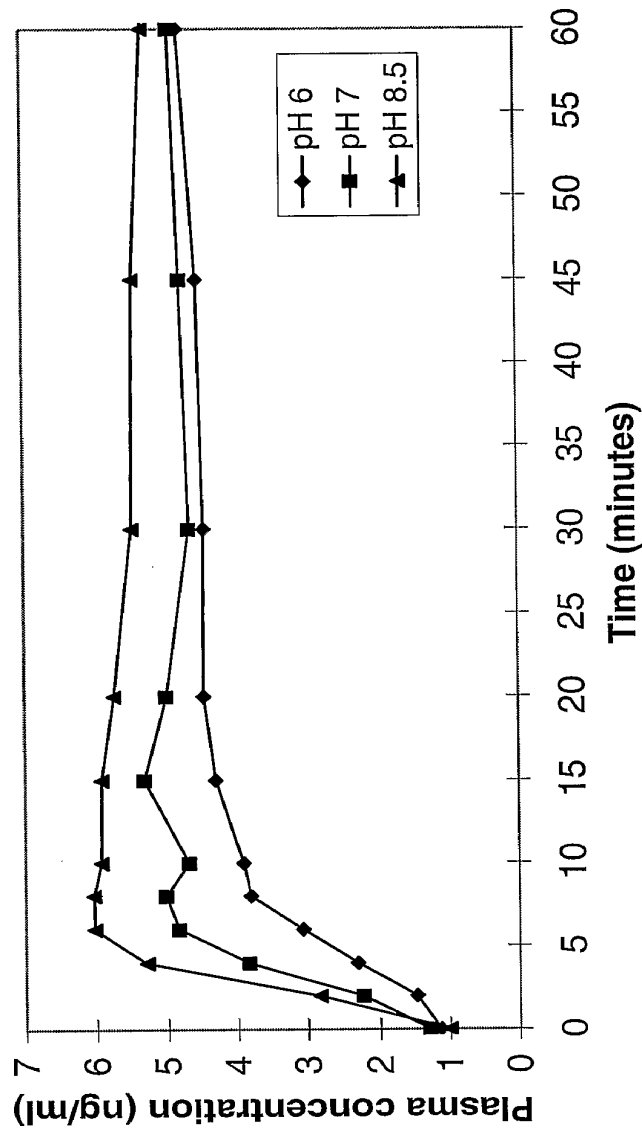
53. Use of nicotine in any form for the manufacturing of a liquid pharma-
ceutical formulation according to any of claims 1 - 22 for the treatment of a disease
selected from the group consisting of addiction to tobacco or nicotine, Alzheimer's
25 disease, Crohn's disease, Parkinson's disease, Tourette's syndrome, ulcerative
colitis; and weight control.

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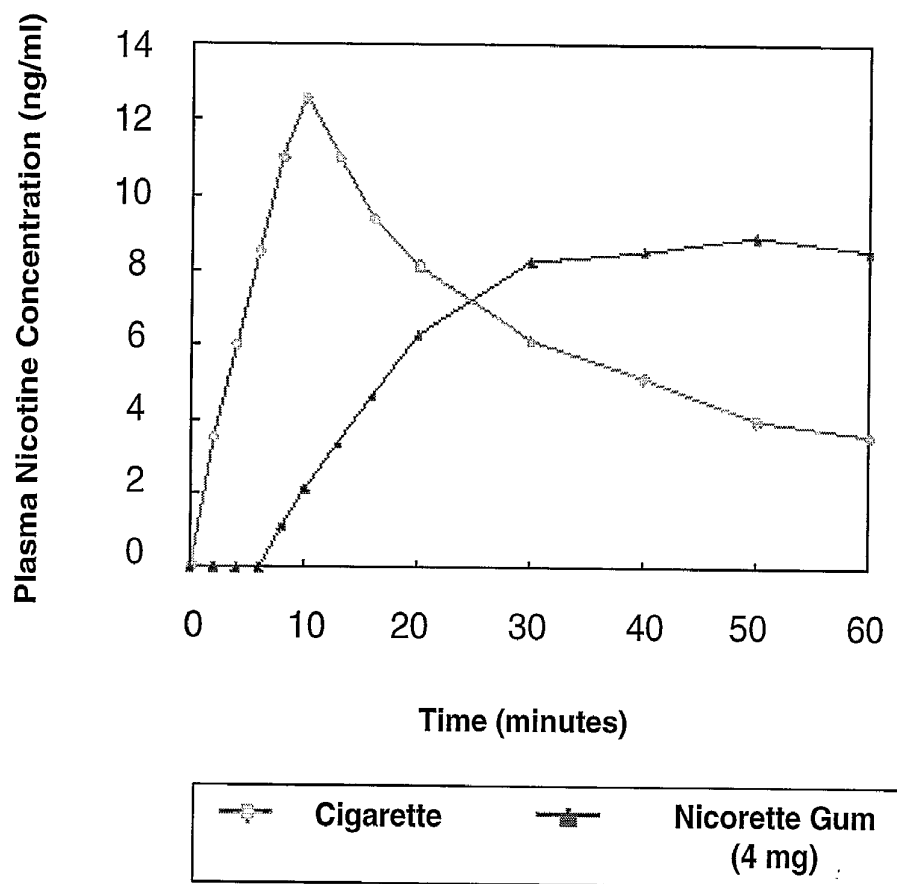
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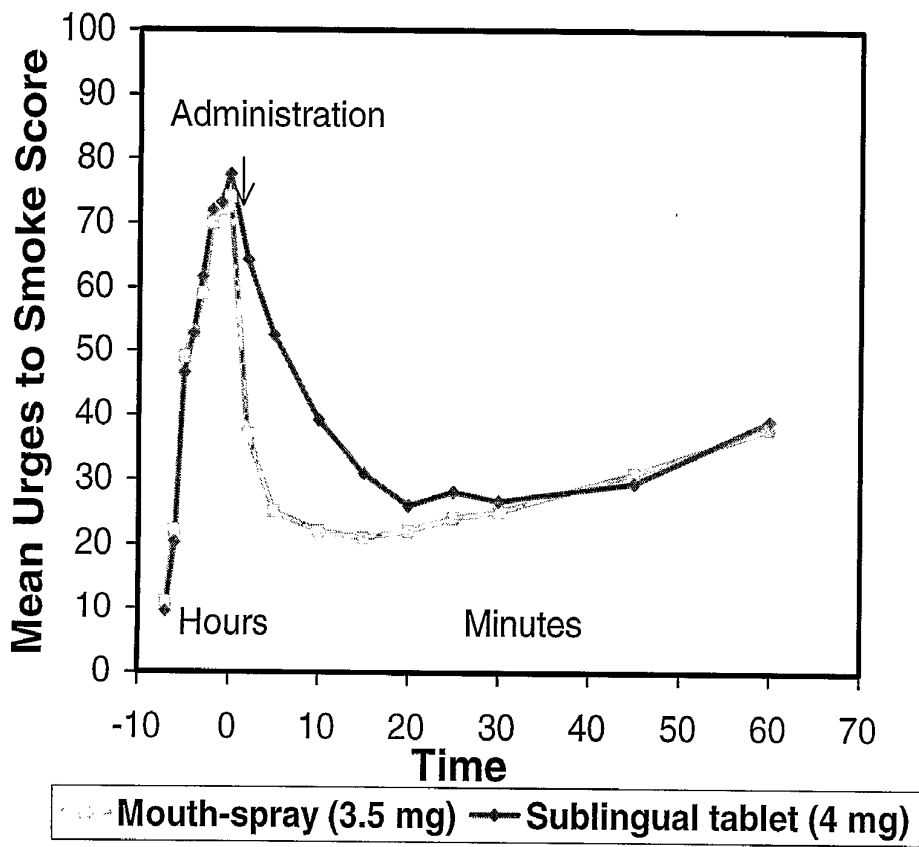
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SUBSTITUTE SHEET (RULE 26)

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SUBSTITUTE SHEET (RULE 26)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 02/02358

A. CLASSIFICATION OF SUBJECT MATTER		
IPC7: A61K 31/465, A61P 25/34 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)		
IPC7: A61K		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPO-INTERNAL, CHEM. ABS DATA		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5721257 A (RICHARD W. BAKER ET AL), 24 February 1998 (24.02.98), see column 15, lines 45-67, column 16, lines 1-44 and example 33	1,3-53
Y	--	2
Y	US 5955098 A (HARRY A. DUGGER, III), 21 Sept 1999 (21.09.99), see the claims and example	2
A	Eur J Clin Pharmacol, Volume 56, 2001, L. Molander et al: "Pharmacokinetic investigation of a nicotine sublingual tablet", page 813 - page 819	1-53
<div style="display: flex; justify-content: space-between;"> ☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex. </div>		
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"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</p> <p>"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</p> <p>"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</p> <p>"&" document member of the same patent family</p> </div> </div>		
Date of the actual completion of the international search		Date of mailing of the international search report
3 April 2003		04-04-2003
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer Carolina Gómez Lagerlöf/EÖ Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 02/02358

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>Expert Opin. Pharmacother., Volume 2, no. 10, 2001, Bridgette E Garrett et al: "Tobacco addiction and pharmacological interventions", page 1545 - page 1555</p> <p style="text-align: center;">-- -----</p>	1-53

Form PCT/ISA/210 (continuation of second sheet) (July 1998)

INTERNATIONAL SEARCH REPORTInternational application No.
PCT/SE02/02358**Box I Observations where certain claims were found unsearchable (Continuation of item 1 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.: **23-34**
because they relate to subject matter not required to be searched by this Authority, namely:
see next sheet
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 II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

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

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 an additional fee, this Authority did not invite payment of any additional fee.
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.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE02/02358

Claims 23-34 relate to methods of treatment of the human or animal body by surgery or by therapy/ diagnostic methods practised on the human or animal body/Rule 39.1.(iv). Nevertheless, a search has been executed for these claims. The search has been based on the alleged effects of the compounds/compositions.

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/02/03

International application No.

PCT/SE 02/02358

Patent document cited in search report			Publication date	Patent family member(s)			Publication date
US	5721257	A	24/02/98	US	5362496	A	08/11/94
				US	5593684	A	14/01/97
US	5955098	A	21/09/99	AU	2190797	A	07/11/97
				CA	2252050	A	23/10/97
				EP	0904055	A	31/03/99
				EP	1275374	A	15/01/03
				WO	9738663	A	23/10/97



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(54) **Method and apparatus for cleaning a heating element of aerosol-generating device**

(57) A method of using an aerosol-generating device (10) comprises the steps of, bringing a heating element (90) of the aerosol-generating device into contact with an aerosol-forming substrate (30), raising the temperature of the heating element (90) to a first temperature to heat the aerosol-forming substrate (30) sufficiently to form an aerosol, removing the heating element from con-

tact with the aerosol-forming substrate and heating the heating element to a second temperature, higher than the first temperature, to thermally liberate organic materials adhered to or deposited on the heating element.

An embodiment of an aerosol-generating device (10) comprises a heating element (90) coupled to a controller (19) for heating the heating element to the first temperature and to the second temperature.

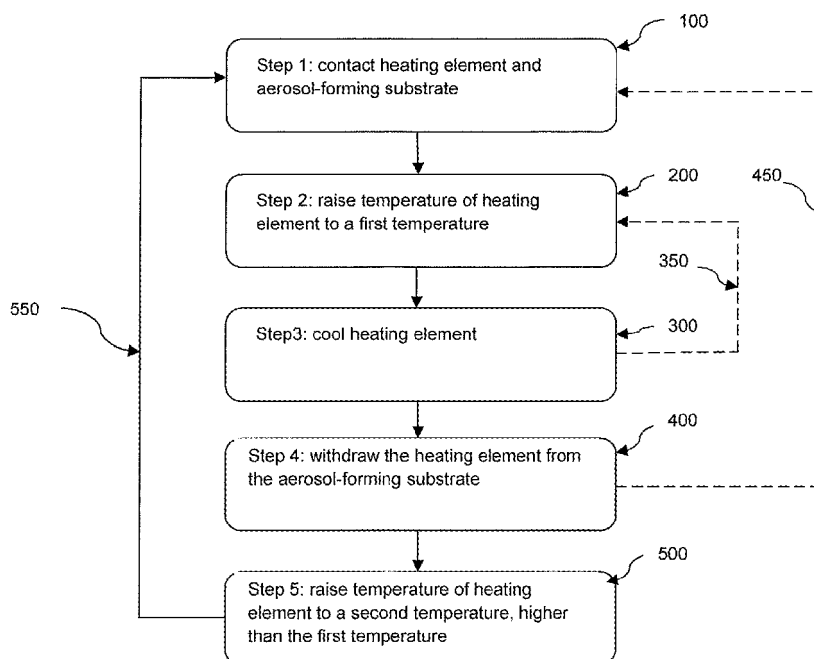


Figure 4

Description

[0001] The present specification relates to a method of using an aerosol-generating device having a reusable heating element and to an aerosol-generating device comprising a heating element for use in the consumption of a smoking article.

[0002] Smoking articles in which an aerosol-forming substrate, such as a tobacco containing substrate, is heated rather than combusted are known in the art. The aim of such heated smoking articles is to reduce known harmful smoke constituents produced by the combustion and pyrolytic degradation of tobacco in conventional cigarettes. Typically in such heated smoking articles, an aerosol is generated by the transfer of heat from a heat source to a physically separate aerosol-forming substrate or material, which may be located within, around or downstream of the heat source. During smoking, volatile compounds are released from the aerosol-forming substrate by heat transfer from the heat source and entrained in air drawn through the smoking article. As the released compounds cool, they condense to form an aerosol that is inhaled by the consumer.

[0003] A number of prior art documents disclose aerosol-generating devices for consuming or smoking heated smoking articles. Such devices include, for example, heated smoking systems and electrically heated smoking systems. One advantage of these systems is that they significantly reduce sidestream smoke, while permitting the smoker to selectively suspend and reinitiate smoking. An example of a heated smoking system is disclosed in U.S. Patent No. 5,144,962, which includes in one embodiment a flavour-generating medium in contact with a heater. When the medium is exhausted, both it and the heater are replaced. An aerosol-generating device where a smoking article can be replaced without the need to remove the heating element is desirable.

[0004] Typically, smoking articles for use with aerosol-generating devices comprise an aerosol-forming substrate that is assembled, often with other elements or components, in the form of a rod. Typically, such a rod is configured in shape and size to be inserted into an aerosol-generating device that comprises a heating element for heating the aerosol-forming substrate.

[0005] Other aerosol-generating devices, such as the electrical lighter disclosed in U.S. Patent No. 5,878,752, use a sleeve, e.g., ceramic or metal, surrounds the heater fixture, and a resistive heating element is in thermal proximity with the sleeve. In conjunction with the sleeve-type heater, a cleaning element is optionally inserted into the cigarette receptacle of the electrical lighter or placed at the exit thereof to absorb, attract and/or catalytically break down the thermally liberated condensates. In such systems, the cigarette heater fixture may be defined by blades that concentrically surround an inserted cigarette.

[0006] In contrast to such systems, direct contact between a heating element, for example an electrically actuated heating element, and the aerosol-forming sub-

strate may provide an efficient means for heating the aerosol-forming substrate to form an inhalable aerosol. In such a device configuration, heat from a heating element may be conveyed almost instantaneously to at least a portion of the aerosol-forming substrate when the heating element is actuated, and this may facilitate the rapid generation of an aerosol. Furthermore, the overall heating energy required to generate an aerosol may be lower than would be the case in a system where the aerosol-forming substrate does not directly contact a heating element and initial heating of the substrate occurs by convection or radiation. Where a heating element is in direct contact with an aerosol-forming substrate, the initial heating of portions of the substrate that are in contact with the heating element will be effected by conduction.

[0007] The present specification provides a method of using an aerosol-generating device, an aerosol-generating device, and a kit comprising an aerosol-generating device as set out in this specification. Various embodiments are set out in this specification.

[0008] Thus, in one aspect the present specification may provide a method of using an aerosol-generating device that has a reusable heating element for heating an aerosol-forming substrate. The method comprises the steps of bringing the heating element into direct contact with the aerosol-forming substrate and raising the temperature of the heating element to a first temperature to heat the aerosol-forming substrate such that an aerosol is formed. The method then provides the steps of removing or withdrawing the heating element from contact with the aerosol-forming substrate and raising the temperature of the heating element to a second temperature sufficient to thermally liberate organic materials deposited on the heating element. The second temperature is a higher temperature than the first temperature. The thermal liberation may occur by a pyrolysis or carbonisation reaction.

[0009] The aerosol-forming substrate may be a solid aerosol-forming substrate. Alternatively, the aerosol-forming substrate may comprise both solid and liquid components. The aerosol-forming substrate may comprise a tobacco-containing material containing volatile tobacco flavour compounds, which are released from the substrate upon heating. Alternatively, the aerosol-forming substrate may comprise a non-tobacco material. The aerosol-forming substrate may further comprise an aerosol former. Examples of suitable aerosol formers are glycerine and propylene glycol.

[0010] If the aerosol-forming substrate is a solid aerosol-forming substrate, the solid aerosol-forming substrate may comprise, for example, one or more of: powder, granules, pellets, shreds, spaghettis, strips or sheets containing one or more of: herb leaf, tobacco leaf, fragments of tobacco ribs, reconstituted tobacco, processed tobacco, homogenised tobacco, extruded tobacco and expanded tobacco. The solid aerosol-forming substrate may be in loose form, or may be provided in a suitable container or cartridge. For example, the aerosol-forming

material of the substrate may be contained within a paper or wrap and have the form of a plug. Where an aerosol-forming substrate is in the form of a plug, the entire plug including any wrapping paper is considered to be the aerosol-forming substrate.

[0011] Optionally, the solid aerosol-forming substrate may contain additional tobacco or non-tobacco volatile flavour compounds, to be released upon heating of the substrate. The solid aerosol-forming substrate may also contain capsules that, for example, include the additional tobacco or non-tobacco volatile flavour compounds and such capsules may melt during heating of the solid aerosol-forming substrate.

[0012] Optionally, the solid aerosol-forming substrate may be provided on or embedded in a thermally stable carrier. The carrier may take the form of powder, granules, pellets, shreds, spaghettis, strips or sheets. The solid aerosol-forming substrate may be deposited on the surface of the carrier in the form of, for example, a sheet, foam, gel or slurry. The solid aerosol-forming substrate may be deposited on the entire surface of the carrier, or alternatively, may be deposited in a pattern in order to provide a non-uniform flavour delivery during use.

[0013] In preferred embodiments, the aerosol-forming substrate is contained in a smoking article, for example a rod-shaped smoking article such as a cigarette. The smoking article is preferably of suitable size and shape to engage with the aerosol-generating device so as to bring the aerosol-forming substrate into contact with the heating element of the device. For example, the smoking article may have a total length between approximately 30 mm and approximately 100 mm. The smoking article may have an external diameter between approximately 5 mm and approximately 12 mm.

[0014] The terms upstream and downstream may be used to describe relative positions of elements or components of the smoking article. For simplicity, the terms "upstream" and "downstream" as used herein refer to a relative position along the rod of the smoking article with reference to the direction in which the aerosol is drawn through the rod.

[0015] The heating element may conveniently be shaped as a needle, pin, rod, or blade that may be inserted into a smoking article in order to contact the aerosol-forming substrate. The aerosol-generating device may comprise more than one heating element and in the following description reference to a heating element means one or more heating elements.

[0016] The temperature of the heating element can be raised to both the first temperature and to the second temperature. The temperature may be raised by any suitable method. For example, the temperature may be raised by conduction caused by contact with another heat source. The temperature may be raised by inductive heating caused by a fluctuating electromagnetic field. The temperature may be raised by resistive heating caused by passing an electric current through a conductive wire or resistive track. In one embodiment, the track

may have a resistance between 0.5 and 5 ohms.

[0017] Preferably the heating element comprises a rigid electrically insulating substrate with an electrically conductive track or wire disposed on its surface. Preferably the size and shape of the electrically insulating substrate allow it to be inserted directly into an aerosol-forming substrate. If the electrically insulating substrate is not sufficiently rigid, the heating element may comprise a further reinforcement means. A current may be passed through the track or wire to heat the heating element and the aerosol-forming substrate.

[0018] It is preferable that the aerosol-generating device further comprises electronic circuitry arranged to control the supply of current to the heating element to control the temperature. The aerosol-generating device may also comprise means for sensing the temperature of the heating element. This may enable the electronic circuitry or control circuitry to raise the temperature of the heating element to both the first temperature and the second temperature. It is preferred that the first temperature is a temperature high enough to cause the evolution of volatile compounds from the aerosol-forming substrate and, thus, the formation of an aerosol. It is preferred that the first temperature is not high enough to burn the aerosol-forming substrate.

[0019] Preferably the first temperature is lower than about 375 degrees centigrade. For example the first temperature may be between 80 degrees centigrade and 375 degrees centigrade, for example between 100 degrees centigrade and 350 degrees centigrade. The length of time that the heating element is held at the first temperature may be fixed. For example, the first temperature may be maintained for a period of greater than 2 seconds, for example between 2 seconds and 10 seconds. The length of time that the heating element is held at the first temperature may be a variable. For example, the aerosol-generating device may comprise a sensor that determines when a user is drawing on the smoking article and the time may be controlled by the length of time that the user draws on the smoking article.

[0020] During a period in which the heating element is in contact with the aerosol-forming substrate, the heating element undergoes a thermal cycle during which it is heated to the first temperature and then cooled. The heating element is preferably cooler than the first temperature when it is removed from contact with the aerosol-forming substrate. During contact, particles of the aerosol-forming substrate may adhere to a surface of the heating element. Furthermore, volatile compounds and aerosol evolved by the heat from the heating element may become deposited on a surface of the heating element. Particles and compounds adhered to and deposited on the heating element may prevent the heating element from functioning in an optimal manner. These particles and compounds may also break down during use of the aerosol-generating device and impart unpleasant or bitter flavours to a user. For these reasons it is desirable to clean the heating element periodically.

[0021] It is preferred that the second temperature is a temperature high enough to thermally liberate organic compounds that are in contact with the heating element. The organic compounds may be any particles or compounds adhered to or deposited on a surface of the heating element during a period of contact between the heating element and a substrate.

[0022] Thermal liberation of organic compounds may occur by pyrolysis. Pyrolysis is a process in which chemical compounds decompose due to the action of heat. Organic compounds generally pyrolyse to form organic vapours and liquids, which in the present specification may migrate away from the heating element leaving it in a cleaned state.

[0023] It is preferred that organic materials deposited on the heating element are thermally liberated by raising the temperature of the heating element to about 430 degrees centigrade or greater. For example, the temperature may be raised to greater than 475 degrees centigrade or greater than 550 degrees centigrade. The temperature may be raised to higher temperatures such as greater than 600 degrees centigrade or greater than 800 degrees centigrade.

[0024] It is preferable that the heating element is held at the second temperature for a period of time to effect thermal liberation of organic compounds. For example, the heating element may be held at the second temperature for more than 5 seconds. Preferably, the heating element is held at the second temperature for a period of between 5 seconds and 60 seconds, for example between 10 seconds and 30 seconds.

[0025] Smoking articles for use with aerosol-generating devices comprise an amount of an aerosol-forming substrate. The aerosol-forming substrate may be consumed entirely during a single thermal cycle of the heating element. In one such an embodiment, the heater will be constantly on and the temperature will be regulated by the amount of energy provided to the heating element during operation. This may be the case, for example, if the heating element is maintained at the first temperature for the duration of the consumption of the smoking article. Alternatively, the heating element is repeatedly pulsed through thermal cycles to the first temperature and back. These pulses may occur simultaneously with periods when a user is drawing on the smoking article. A portion of aerosol is generated each time the temperature reaches the first temperature and aerosol generation ceases each time the heating element cools again. When no further aerosol is generated the smoking article has been consumed. Thus, there may be more than 5 or more than 10 or more than 15 thermal cycles in which the heating element is raised to the first temperature and then cooled before the smoking article is consumed.

[0026] A user may remove a consumed smoking article and replace it with a fresh, unconsumed, smoking article without performing the step of raising the temperature of the heating element to the second temperature. In other words, the user may consume more than one article be-

fore performing a cleaning step to thermally liberate organic materials from the heating element.

[0027] Thus, the temperature of the heating element may be raised to the first temperature a plurality of times before the step of raising the heating element to the second temperature is carried out.

[0028] The step of raising the temperature of the heating element to the second temperature to thermally liberate organic materials adhered to or deposited on the heating element may be termed a cleaning step.

[0029] The cleaning step may be actuated manually by a user. For example, a user may decide that the heating element needs to be cleaned and actuate a cleaning cycle in which the heating element is raised to the second temperature for a predetermined period of time. Actuation may be effected by pressing a button on the aerosol-generating device. Preferably, the cleaning cycle is terminated automatically after a predetermined or pre-programmed thermal cycle.

[0030] The aerosol-generating device may comprise a sensing means to determine whether or not a smoking article is engaged with the aerosol-generating device. If a smoking article is engaged, preferably the aerosol-generating means comprises control means, for example control software that acts to prevent the heating element being heated to the second temperature, thereby preventing the cleaning cycle from being actuated while a smoking article is engaged with the aerosol-generating device.

[0031] The cleaning step may be actuated automatically. For example, the aerosol-generating device may comprise means for detecting when the heating element is removed from contact with the aerosol-generating substrate, for example when a smoking article is removed from the device. When such an event is detected the heating element may automatically be cycled through a cleaning regime in which the heating element is heated to the second temperature for a period of time.

[0032] Control means associated with the aerosol-generating device may record the number of smoking articles consumed by a user and automatically trigger a cleaning cycle after a predetermined number of smoking articles have been consumed.

[0033] In some embodiments, an aerosol-generating device may comprise a battery to provide energy for heating the heating element. It may be advantageous if the aerosol-generating device is associated with a docking station for re-charging the battery and for other functions. It may be advantageous that a cleaning cycle is triggered when the aerosol-generating device is docked in a docking station. The docking station may be able to supply more power to the heating element than the aerosol-generating device, and the second temperature may, therefore, be higher. A higher second temperature may result in a more efficient or faster cleaning process.

[0034] In one aspect the specification may provide an aerosol-generating device comprising a heating element coupled to a controller. The controller is programmed to

actuate the heating element through a first thermal cycle in which the temperature of the heating element is raised to a first temperature lower than about 400 degrees centigrade in order to produce an average temperature of 375 degrees centigrade over the heating element surface and a maximum temperature anywhere on the surface, i.e., a maximum localized temperature, of 420 degrees centigrade. This allows an aerosol to be formed from an aerosol-forming substrate disposed in proximity to the heating element without burning the aerosol-forming substrate. The controller is further programmed to actuate the heating element through a second thermal cycle in which the temperature of the heating element is raised to a second temperature higher than about 430 degrees centigrade in order to thermally liberate organic material deposited on the heating element.

[0035] Preferably the first temperature is greater than 80 degrees centigrade. For example the first temperature may be between 80 degrees centigrade and 375 degrees centigrade, or between 100 degrees centigrade and 350 degrees centigrade.

[0036] The aerosol-generating device may be any device for performing a method described above. For example, the aerosol-generating device may be any device comprising a controller programmed to perform a method described above or defined in the claims.

[0037] The controller may be housed by the aerosol-generating device. Alternatively the controller may be housed within a docking station that is couplable to the aerosol-generating device and thereby to the heating element of the aerosol-generating device.

[0038] In one aspect the specification may provide a kit comprising an aerosol-generating device suitable for receiving a smoking article and comprising a heating element, the kit further comprising instructions to clean the heating element by thermally liberating organic material adhered to or deposited on the heating element. The instructions may describe how to thermally liberate organic material, for example by heating. The instructions may describe how a user should activate an automatic cleaning cycle programmed into the aerosol-generating device.

[0039] A kit may comprise a docking station that is couplable to the aerosol-generating device. The instructions may describe how a user should activate an automatic cleaning cycle programmed into the docking station.

[0040] A kit may further comprise one or more smoking articles. A kit may include instructions to carry out any method described above or defined in the claims.

[0041] Features described in relation to one aspect of the specification may also be applicable to other embodiments discussed herein.

Exemplary embodiments

[0042] Exemplary embodiments will now be described with reference to the figures, in which;

Figure 1 is a schematic cross-sectional diagram of a first embodiment of an aerosol-generating device engaged with a smoking article;

Figure 2 is a schematic diagram illustrating a heating element of the first embodiment of an aerosol-generating device;

Figure 3A is an illustration showing a heating element of the first embodiment of an aerosol-generating device with a surface that has been soiled with organic components;

Figure 3B is an illustration showing the heating element of figure 3A after the organic components have been thermally liberated;

Figure 4 is a flow diagram illustrating a first embodiment of a method;

Figure 5 is a block diagram illustrating the configuration of an aerosol-generating device; and

Figure 6 is a flow diagram illustrating a second embodiment of a method.

Figure 1 illustrates a portion of an aerosol-generating device 10 according to a first embodiment. The aerosol-generating device 10 is engaged with a smoking article 20 for consumption of the smoking article 20 by a user.

[0043] The smoking article 20 comprises four elements, an aerosol-forming substrate 30, a hollow tube 40, a transfer section 50, and a mouthpiece filter 60. These four elements are arranged sequentially and in coaxial alignment and are assembled by a cigarette paper 70 to form a rod 21. The rod has a mouth-end 22, which a user inserts into his or her mouth during use, and a distal end 23 located at the opposite end of the rod to the mouth end 22. Elements located between the mouth-end 22 and the distal end 23 can be described as being upstream of the mouth-end or, alternatively, downstream of the distal end.

[0044] When assembled, the rod 21 is 45 millimetres long and has a diameter of 7.2 millimetres.

[0045] The aerosol-forming substrate 30 is located upstream of the hollow tube 40 and extends to the distal end 23 of the rod 21. The aerosol-forming substrate comprises a bundle of crimped cast-leaf tobacco wrapped in a filter paper (not shown) to form a plug. The cast-leaf tobacco includes additives, including glycerine as an aerosol-forming additive.

[0046] The hollow tube 40 is located immediately downstream of the aerosol-forming substrate 30 and is formed from a tube of cellulose acetate. The tube 40 defines an aperture having a diameter of 3 millimetre. One function of the hollow tube 40 is to locate the aero-

sol-forming substrate 30 towards the distal end 23 of the rod 21 so that it can be contacted with a heating element. The hollow tube 40 acts to prevent the aerosol-generating substrate 30 from being forced along the rod towards the mouth-end 22 when a heating element is inserted into the aerosol-forming substrate 30.

[0047] The transfer section 50 comprises a thin-walled tube of 18 millimetres in length. The transfer section 50 allows volatile substances released from the aerosol-forming substrate 30 to pass along the rod 21 towards the mouth end 22. The volatile substances may cool within the transfer section to form an aerosol.

[0048] The mouthpiece filter 60 is a conventional mouthpiece filter formed from cellulose acetate, and having a length of 7.5 millimetres.

[0049] The four elements identified above are assembled by being tightly wrapped within a cigarette paper 70. The paper in this specific embodiment is a standard cigarette paper having standard properties or classification. The paper in this specific embodiment is a conventional cigarette paper. For example, the paper may be a porous material with a non-isotropic structure comprising cellulose fibers (crisscross s of fibers, interlinked by H-bonds), fillers and combustion agents. The filler agent may be CaCO₃ and the burning agents can be one or more of the following: K/Na citrate, Na acetate, MAP (mono-ammonium phosphate), DSP (di-sodium phosphate). The final composition per squared meter may be approximately 25 g fiber + 10 g Calcium carbonate, + 0.2 g burning additive. The porosity of the paper may be between 0 to 120 coresta. The interface between the paper and each of the elements locates the elements and defines the rod 15 of the smoking article 1.

[0050] The interface between the paper and each of the elements locates the elements and defines the rod 21 of the smoking article 20. Although the specific embodiment described above and illustrated in figure 1 has five elements assembled in a cigarette paper, it will now be clear to one of ordinary skill in the art that a smoking article according to the embodiments discussed here may have additional elements and these elements may be assembled in an alternative cigarette wrapper or equivalent. Likewise, a smoking article according to the invention may have fewer elements. Moreover, it will now be apparent to one of ordinary skill in the art that various dimensions for the elements discussed in relation to the various embodiments discussed here are merely exemplary, and that suitable, alternative dimensions for the various elements may be chosen without deviating from the spirit of the embodiments discussed herein.

[0051] The aerosol-generating device 10 comprises a sheath 12 for receiving the smoking article 20 for consumption. A heating element 90 is located within the sheath 12 and positioned to engage with the distal end 23 of the smoking article. The heating element 90 is shaped in the form of a blade terminating in a point 91.

[0052] As the smoking article 20 is pushed into the sheath 12 the point 91 of the heating element 90 engages

with the aerosol-forming substrate 30. By applying a force to the smoking article, the heating element 90 penetrates into the aerosol-forming substrate 30. Once properly located, further penetration is prevented as the distal end 23 of the smoking article 20 abuts an end wall 17 of the sheath 12, which acts as a stop.

[0053] When the smoking article 20 is properly engaged with the aerosol-generating device 10, the heating element 90 has been inserted into the aerosol-forming substrate 30.

[0054] Figure 2 illustrates a heating element 90 as comprised in the aerosol-generating device 10 of figure 1 in greater detail. The heating element 90 is substantially blade-shaped. That is, the heating element has a length that in use extends along the longitudinal axis of a smoking article engaged with the heating element, a width and a thickness. The width is greater than the thickness. The heating element 90 terminates in a point or spike 91 for penetrating a smoking article 20. The heating element comprises an electrically insulating substrate 92, which defines the shape of the heating element 90. The electrically insulating material may be, for example, alumina (Al₂O₃), stabilized zirconia (ZrO₂). It will now be apparent to one of ordinary skill in the art that the electrically insulating material may be any suitable electrically insulating material and that many ceramic materials are suitable for use as the electrically insulating substrate.

[0055] Tracks 93 of an electrically conductive material are plated on a surface of the insulating substrate 92. The tracks 93 are formed from a thin layer of platinum. Any suitable conductive material may be used for the tracks, and the list of suitable materials includes many metals, including gold, that are well known to the skilled person. One end of the tracks 93 is coupled to a power supply by a first contact 94, and the other end of the tracks 93 is coupled to a power supply by a second contact 95. When a current is passed through the tracks 93, resistive heating occurs. This heats the entire heating element 90 and the surrounding environment. When a current passing through the tracks 93 of the heating element 90 is switched off, there is no resistive heating and the temperature of the heating element 90 is swiftly lowered.

[0056] Heater element 90 also includes collar 96. The collar 96 may be formed of a suitable material that allows for conduction of electricity, so long as the design of the collar 96 is also selected to minimize resistive heating. In one embodiment, when the tracks 93 are formed of platinum or a platinum alloy, the collar 96 may be formed of gold or silver, or an alloy including either. Because of the difference in the electrical resistivity of the collar 96 material, less heat is generated over the collar area and the collar 96 sees a lower average temperature than the portion of heater element 90 including tracks 96. In another embodiment, the collar 96 may be formed of an insulating material, such as a ceramic or other appropriate insulator.

[0057] Collar 96 provides a cold zone as compared to

the average surface temperature of the portion of heater element 90 that includes tracks 93. For example, the average temperature of the cold zone may be greater than 50 degrees centigrade cooler than the average surface temperature of the portion of heater element 90 including the tracks 93 during operation. Including the collar 96 may provide a number of benefits including that it reduces the temperature seen by any on-board electronics. In addition, collar 96 protects against the melting or degradation of various portions of device 10, when materials such as plastic are used in the device. The collar also reduces condensation at the distal end of the device because such aerosol is cooled as it passes over the collar 96. This reduction of condensation seen by electronics (not shown) and contacts 94 and 95 included in the device 10 helps protect such elements.

[0058] The aerosol-generating device 10 comprises a power supply and electronics (not shown) that allow the heating element 90 to be actuated. Such actuation may be manually operated or may occur automatically in response to a user drawing on the smoking article. When the heating element is actuated, the aerosol-forming substrate is warmed and volatile substances are generated or evolved. As a user draws on the mouth end of the smoking article 20, air is drawn into the smoking article and the volatile substances condense to form an inhalable aerosol. This aerosol passes through the mouth-end 22 of the smoking article and into the user's mouth.

[0059] In a specific embodiment (schematically illustrated in figure 5) an aerosol-generating device comprises a processor or controller 19 coupled to a heating element 90 to control heating of the heating element. The controller 19 is programmed to actuate the heating element through a first thermal cycle in which the temperature of the heating element is raised to a first temperature of 375 degrees centigrade. This allows the formation of an aerosol from an aerosol-forming substrate disposed in proximity to the heating element. The controller is further programmed to actuate the heating element through a second thermal cycle in which the temperature of the heating element is raised to a second temperature of 550 degrees centigrade for a period of 30 seconds. This allows organic material deposited on the heating element to decompose or pyrolyse.

[0060] A specific embodiment of a method of using an aerosol-generating device will now be described with reference to figures 1 and 4. Figure 4 is a flow diagram setting out the steps carried out in an embodiment of the inventive method.

[0061] Step 1 - (Reference numeral 100 in figure 4): A heating element 90 of an aerosol-generating device 10 is brought into contact with an aerosol-forming substrate 30 contained within a smoking article 20. In order to achieve this, the smoking article 20 is inserted into a sheath 12 of the aerosol-generating device 10. A heating element 90 is located within the sheath 12, and projects from a bottom surface 17 of the sheath 12 such that it may be inserted into any smoking article that is received

in the sheath. As the smoking article 20 is slid into the sheath 12, a tip or point 91 of the heating element 90 contacts a distal end 23 of the smoking article. Further movement of the smoking article towards the bottom end 17 of the sheath causes the heating element 90 to penetrate into an aerosol-forming substrate located at the distal end 23 of the smoking article 20. Once the smoking article has been fully inserted into the sheath, the distal end 23 of the smoking article abuts the bottom surface 17 of the sheath 12 and the heating element has reached maximum penetration.

[0062] Step 2: (Reference numeral 200) As the user draws or puffs on a mouth end 22 of the smoking article 20, sensors in the aerosol-generating device 10 may detect this event. In the event of detecting a user puffing or drawing, a controller 19 sends instructions that activate the heating element to heat to a first temperature. A current is passed through conductive tracks 93 disposed on the heating element, which results in resistive heating of the heating element. The first temperature is 375 degrees centigrade, which is sufficient to liberate volatile compounds from the aerosol-forming substrate 20. These volatile compounds condense to form an inhalable aerosol, which is drawn through the smoking article and into a user's mouth. Alternatively, a continuous heating may be used during operation of device 10 and detection of a user puffing or drawing may be used to trigger heating to compensate for any temperature drop of heater element 90 during the user puffing or drawing.

[0063] Step 3: (Reference numeral 300) When the user stops drawing or ends his puff on the mouth end 22 of the smoking article 20, sensors in the aerosol-generating device detect this event. The controller 19 sends instructions to switch off the current passing through the heating element 90. This stops the resistive heating of the tracks 93, and the temperature of the heating element is swiftly lowered. As the temperature is lowered, aerosol stops being generated. Alternatively, during the continuous heating discussed above, the controller 19 may instead simply reduce the amount of energy seen during the user puffing or drawing, based on a desired set point temperature.

[0064] If the aerosol-forming substrate 30 still contains volatile compounds, the user may take another puff on the smoking article 20 and repeat step 2 (indicated by arrow 350 in figure 4). Steps 2 and 3 may be repeated as often as necessary to consume the smoking article.

[0065] Step 4: (Reference numeral 400) When the user has finished with the smoking article 20, for example when no more aerosol is generated on heating the aerosol-forming substrate 30, the smoking article 20 is removed from the sheath 12 of the aerosol-generating apparatus 10. This means that the heating element 90 is removed from contact with the aerosol-forming substrate 30. Almost inevitably, the heating element 90 will have become soiled with some deposits or residues derived from the aerosol-forming substrate 30. Such deposits may impair performance of the heating element. For ex-

ample, deposits on the heating element may inhibit thermal transfer between the heating element and the aerosol-forming substrate. Deposits on a heating element may also inhibit temperature sensing when the heating element is utilized to sense temperature. Deposits on a heating element may also generate bitter compounds on repeated heating, which may impair the flavour of aerosols generated when consuming subsequent smoking articles.

[0066] If a user feels that the deposits on the heating element are at a sufficiently low level, he may decide to consume a further smoking article. In this case, steps 1 to 4 may be repeated. This is indicated by the arrow 450 in figure 4.

[0067] Step 5: (Reference numeral 500) If a user believes that the heating element is in need of cleaning, he then presses a button (not shown) on the aerosol-generating device 10 that causes the controller to activate a cleaning cycle. During the heating cycle, current is passed through the tracks 93 of the heating element 90 to raise the temperature of the heating element to a second temperature. This second temperature is 550 degrees centigrade, a temperature at which deposits on the heating element can thermally degrade or pyrolyse. The heating element 90 is held at a temperature of 550 degrees centigrade for a period of 30 seconds to thermally liberate the organic compounds deposited on the heating element 90.

[0068] Figure 3A illustrates a portion of an aerosol-generating device. This figure illustrates a heating element 90 after use of the device to consume a smoking article. That is, figure 3A illustrates a heating element 90 of an aerosol-generating device after step 4 of the method described above. It can be seen that the heating element 90 is coated in organic deposits, which appear to be black in figure 3A.

[0069] Figure 3B illustrates the same heating element as illustrated in figure 3A after the performance of a cleaning cycle as described by step 5 above. That is, the heating element 90 of figure 3A has been heated to a temperature of 550 degrees centigrade and held at that temperature for a period of 30 seconds. It can be seen that the black deposits visible in figure 3A have been removed and the heating element has been cleaned. In Figure 3B, the heating element now has a shiny appearance where the organic deposits have been removed.

[0070] After cleaning, the aerosol-generating device is ready for use. Steps 1 to 5 may be repeated. This is indicated by the arrow 550 in figure 4.

[0071] In the embodiment of a method described above, the step of heating the heating element to a first temperature to produce an aerosol occurred when the device detected a user taking a puff. In other embodiments, a user may manually activate the heating element to produce an aerosol.

[0072] In the embodiment of a method described above, the step of initiating a cleaning cycle was manually activated. In other embodiments, a cleaning cycle may

be automatically triggered every time a smoking article is removed from the aerosol-generating device.

[0073] The aerosol-generating device 10 may be used in conjunction with a docking station (not illustrated). A docking station may be used, for example, to recharge batteries used to power the aerosol-generating device. Figure 6 illustrates an embodiment of a method that may be used when the aerosol-generating device coupled to a docking station.

[0074] Steps 1 to 4 are the same as described above in relation to figure 4. Figure 6 uses the same reference numerals for steps that are the same as previously described.

[0075] Step 5: (Reference numeral 600) The aerosol-generating device 10 is coupled to a docking station (not shown) for receiving the device.

[0076] Step 6: (Reference numeral 700) When the aerosol-generating device 10 is detected, a controller activates a cleaning cycle. During the heating cycle, current is passed through tracks 93 of the heating element 90 to raise the temperature of the heating element to a second temperature. This second temperature is 550 degrees centigrade, a temperature at which deposits on the heating element can thermally degrade or pyrolyse. The heating element 90 is held at a temperature of 550 degrees centigrade for a period of 30 seconds to thermally liberate the organic compounds deposited on the heating element 90. In one embodiment, the controller may be triggered from a signal from the docking station indicating that the device has not been cleaned after a predetermined number of uses, e.g., the user has contacted the heating element 90 with 10 or more times without performing a cleaning cycle. The controller 19 may then force the user to perform a cleaning cycle. For example, the user may be prohibited from activating heater element 90 unless a cleaning cycle is first performed. Controller 19 itself may contain instructions for locking the device 10 or the docking station may maintain information regarding use and provide the locking and unlocking instructions to the controller 19.

[0077] Step 7: (Reference numeral 800) The aerosol-generating device is removed from the docking station. The aerosol-generating device is ready for use. Steps 1 to 7 may be repeated. This is indicated by the arrow 850 in figure 6.

[0078] The exemplary embodiments described above illustrate but do not limit the invention. In view of the above discussed exemplary embodiments, other embodiments consistent with the above exemplary embodiments will now be apparent to one of ordinary skill in the art.

Claims

1. A method of using an aerosol-generating device (10) having a reusable heating element (90), comprising the steps of, bringing the heating element (90) into contact with

- an aerosol-forming substrate (30), raising the temperature of the heating element (90) to a first temperature to heat the aerosol-forming substrate (30) sufficiently for an aerosol to be formed, removing the heating element (90) from contact with the aerosol-forming substrate (30), and raising the temperature of the heating element (90) to a second temperature, higher than the first temperature, to thermally liberate organic materials adhered to or deposited on the heating element (90).
2. A method of using an aerosol-generating device (10) according to claim 1 in which the organic materials deposited on the heating element (90) are thermally liberated by raising the temperature of the heating element (90) to a second temperature of greater than about 430 degrees centigrade.
 3. A method of using an aerosol-generating device (10) according to claim 1 or 2 in which the heating element (90) is held at the second temperature for a period of between 5 seconds and 60 seconds.
 4. A method of using an aerosol-generating device (10) according to any preceding claim in which the aerosol-forming substrate (30) comprises tobacco.
 5. A method of using an aerosol-generating device (10) according to any preceding claim in which an aerosol is formed as a result of heating the heating element (90) to an average first temperature of between 80 degrees centigrade and 375 degrees centigrade with a maximum localized temperature of 420 degrees centigrade while in contact with the aerosol-forming substrate (30).
 6. A method of using an aerosol-generating device (10) according to any preceding claim in which the step of raising the temperature of the heating element (90) to a first temperature to heat the aerosol-forming substrate (30) sufficiently to form an aerosol is performed two or more times prior to the step of raising the temperature of the heating element (90) to a second temperature, higher than the first temperature, to thermally liberate organic materials adhered to or deposited on the heating element (90).
 7. A method of using an aerosol-generating device (10) according to any preceding claim in which the step of raising the temperature of the heating element (90) to a second temperature, higher than the first temperature, to thermally liberate organic materials adhered to or deposited on the heating element, occurs automatically when the aerosol-forming substance (30) is removed from contact with the heating element (90).
 8. A method of using an aerosol-generating device (10) according to any of claims 1 to 6 in which the step of raising the temperature of the heating element to a second temperature, higher than the first temperature, to thermally liberate organic materials adhered to or deposited on the heating element, occurs in response to a trigger actuated by a user.
 9. A method of using an aerosol-generating device according to any of claims 1 to 6 in which the aerosol-generating device (10) is couplable to a docking station, in which the step of raising the temperature of the heating element (90) to a second temperature, higher than the first temperature, to thermally liberate organic materials adhered to or deposited on the heating element occurs when the aerosol-generating device (10) is coupled to the docking station.
 10. An aerosol-generating device (10) comprising a heating element (90) coupled to a controller (19), in which the controller (19) is programmed to actuate the heating element (90) through a first thermal cycle in which the temperature of the heating element is raised to a first temperature lower than about 375 degrees centigrade to form an aerosol from an aerosol-forming substrate (30) disposed in proximity to the heating element (90), and in which the controller (19) is programmed to actuate the heating element (90) through a second thermal cycle in which the temperature of the heating element (90) is raised to a second temperature higher than about 430 degrees centigrade to thermally liberate organic material adhered to or deposited on the heating element (90).
 11. An aerosol-generating device (10) according to claim 10 in which the average first temperature is between 80 degrees centigrade and 375 degrees centigrade with a maximum localized temperature of 420 degrees centigrade.
 12. An aerosol-generating device (10) for performing a method as defined in any of claims 1 to 9.
 13. A kit comprising an aerosol-generating device (10) for receiving a smoking article (20) and instructions to clean a heating element (90) of the aerosol-generating device (10) by heating the heating element (90) to a temperature sufficient to thermally liberate organic material adhered to or deposited on the heating element (90).
 14. A kit according to claim 13 further comprising one or more smoking articles (20).
 15. A kit according to claim 14 comprising instructions to perform a method as defined in any of claim 1 to 9.

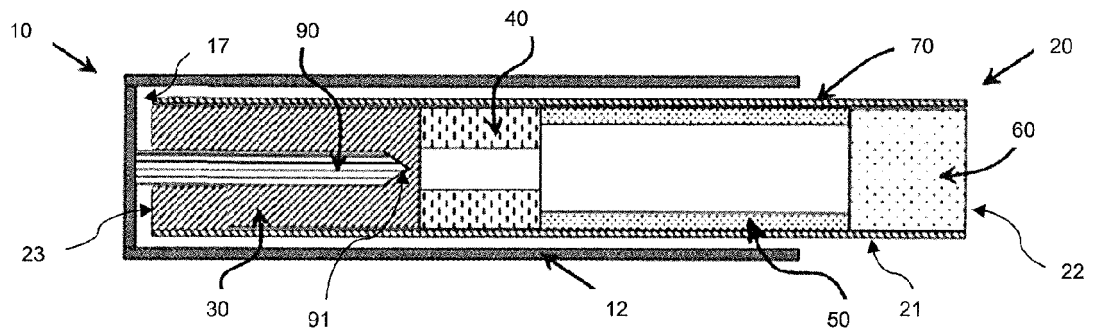


Figure 1

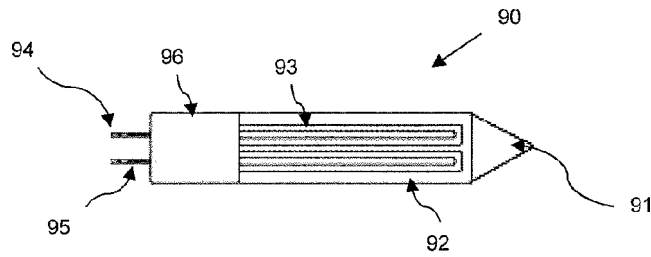


Figure 2



Figure 3

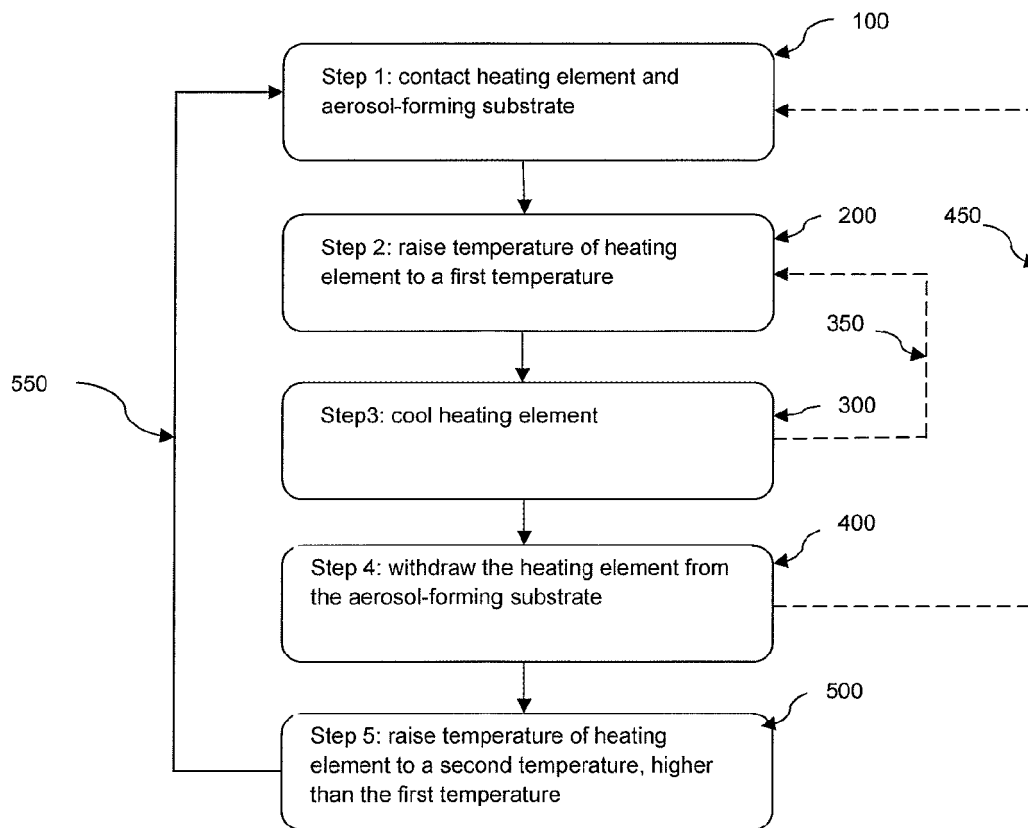


Figure 4

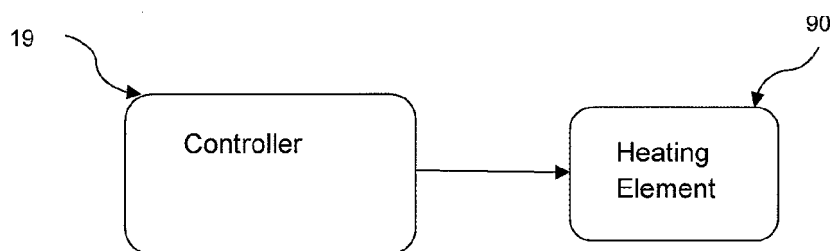


Figure 5

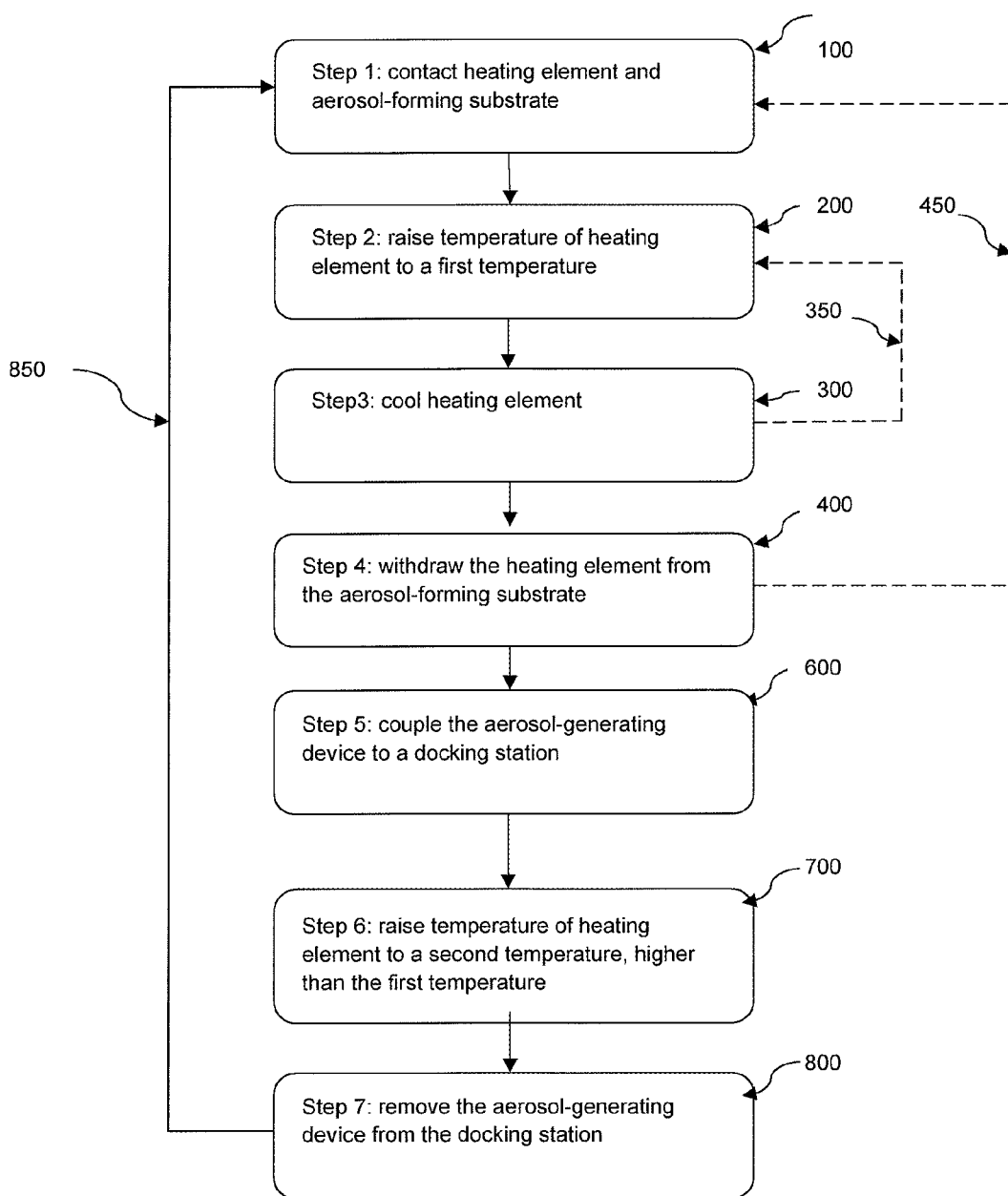


Figure 6



EUROPEAN SEARCH REPORT

 Application Number
 EP 11 19 6235

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 23 May 2012	Examiner Kock, Søren
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 11 19 6235

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㉑ Título: **Dispositivo para evaporar o sublimar productos balsámicos, odoríficos o similares.**

㉒ Resumen:

Dispositivo para evaporar o sublimar productos balsámicos, odoríficos o similares.

El dispositivo comprende un cuerpo (8), adaptado para ser soportado sobre una superficie horizontal y dotado en su parte superior de una cavidad (13) cuyas paredes y/o fondo están provistos de unos medios calefactores (14). La cavidad (13) está adaptada para recibir amoviblemente una cápsula (1), que contiene el producto (2) a evaporar o sublimar, dotada de una configuración semejante a la de la cavidad (13) para encajar ajustadamente en ella, en contacto con paredes y fondos.

Los medios calefactores (14) están constituidos por una resistencia eléctrica (14) que circunda exteriormente las paredes de la cavidad (13).

La cápsula (1) está protegida por una tapa amovible (6), que la cierra herméticamente, para proteger el producto (2) del aire ambiente antes de su utilización.

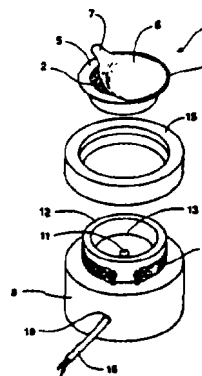


FIG. 1

ES 2 118 034 A1

Venta de fascículos: Oficina Española de Patentes y Marcas. C/Panamá, 1 - 28036 Madrid

DESCRIPCION

Dispositivo para evaporar o sublimar productos balsámicos, odoríficos o similares.

Sector técnico de la invención

La presente invención se refiere a un dispositivo para evaporar o sublimar productos balsámicos, odoríficos o similares, que encuentra su principal aplicación en los campos de la farmacia o la perfumería, entre otros.

Antecedentes de la invención

Algunos productos que en su estado sólido o líquido son inertes, al evaporarse o sublimarse tienen propiedades balsámicas, odoríficas o antiinsecticidas. Los dispositivos actuales para la administración de este tipo de productos sirven bien para evaporar líquidos exclusivamente o bien para sublimar sólidos exclusivamente, lo cual constituye un primer inconveniente.

Actualmente son conocidos aparatos y dispositivos evaporadores de productos balsámicos, odoríficos, insecticidas y similares que comprenden un recipiente para el alojamiento del producto en su estado líquido, y unos medios calefactores, normalmente constituidos por una resistencia eléctrica, para favorecer la evaporación de dicho producto.

Por la solicitud de modelo de utilidad U9501706 se conoce un aparato evaporador de perfumes e insecticidas de sobremesa que está compuesto por un recipiente contenedor de la sustancia a evaporar, almacenada en su estado líquido, por una mecha introducida en dicho recipiente y por unos medios calefactores que son atravesados por ésta, y que además comprende un disco de mando para gobernar la altura de la mecha. En este dispositivo conocido, la mecha se impregna del producto líquido a evaporar que, al contacto con el aire y al ser calentado, se evapora.

Sin embargo, este tipo de dispositivos conocidos adolecen del inconveniente adicional de que el contenedor debe cambiarse mediante una operación relativamente engorrosa y de que el mismo es normalmente apto para cantidades relativamente grandes de producto, y por lo tanto voluminoso.

La aplicación de productos que son efectivos en su estado vaporoso a partir de su estado sólido, es decir por sublimación, debe realizarse igualmente mediante la adición de calor. Así, por ejemplo, ciertos productos balsámicos se subliman al contactar con la piel humana, normalmente a una temperatura superior, que son administrados desde recipientes de tipo convencional, de vidrio o plástico. Este tipo de aplicación presenta el inconveniente de que debe aplicarse manualmente e impregnan la piel, obligando a un lavado posterior.

La presente invención tiene por objeto un dispositivo, de novedoso diseño y funcionalidad, cuya finalidad principal es solucionar los inconvenientes citados, y que además goza de otras ventajas adicionales.

Explicación de la invención

En esencia, el dispositivo para evaporar o sublimar productos balsámicos, odoríficos o similares objeto de la presente invención se caracteriza porque comprende un cuerpo, adaptado para ser

soportado sobre una superficie horizontal y dotado en su parte superior de una cavidad cuyas paredes y/o fondo están provistos de unos medios calefactores, y estando adaptada dicha cavidad para recibir amoviblemente una cápsula, que contiene el producto a evaporar o sublimar, dotada de una configuración semejante a la de la cavidad para encajar ajustadamente en ella, en contacto con sus paredes y fondos.

La cápsula es fácilmente recambiable y permite la administración de dosis exactas y el dispositivo es portátil, de un tamaño global poco voluminoso y compacto.

Según otra característica de la invención, los medios calefactores están constituidos por una resistencia eléctrica que circunda exteriormente las paredes de la cavidad.

Preferiblemente, la cápsula está protegida por una tapa amovible, que la cierra herméticamente, para proteger el producto del aire ambiente antes de su utilización.

El dispositivo de la presente invención proporciona la ventaja de que es apto para respirar vahos de algún producto balsámico sin necesidad de tener que calentar agua.

Breve descripción de los dibujos

Para mejor comprensión de cuanto se explica en ella, la presente descripción se acompaña de unos dibujos, dados meramente a modo de ejemplo no limitativo, en los cuales se representa un modo de realización de la presente invención.

En dichos dibujos:

la Fig. 1 es una vista en perspectiva y en explosión que muestra un dispositivo según la invención; y

la Fig. 2 es una vista en alzado, parcialmente seccionado, del dispositivo de la Fig. 1.

Descripción detallada de los dibujos

En las figuras se puede apreciar una realización preferida del dispositivo de la presente invención, adecuado para evaporar o sublimar productos 2 balsámicos, odoríficos o similares, que pueden ser administrados en las dosis adecuadas, contenidos en su fase líquida o sólida en unas cápsulas 1, preferentemente de un solo uso.

El dispositivo comprende un cuerpo 8, cuya base inferior 9 es preferiblemente plana y que en todo caso está adaptado para ser soportado sobre una superficie horizontal, de modo que en conjunto constituye un dispositivo evaporador o sublimador de sobremesa.

En el extremo superior del cuerpo 9 está dispuesta una cavidad 13, adaptada para alojar en su interior encajadamente las cápsulas 1 provistas del producto 2 a evaporar o sublimar.

La forma de dicha cavidad 13, y por lo tanto de las citadas cápsulas 1 puede ser cualquiera, por ejemplo de planta poligonal, aunque preferiblemente tiene la forma de un tronco de cono invertido, cerrado por su base inferior 3 y abierto por su base superior 4. La altura de la cápsula 1 es pequeña en comparación con la dimensión de su base, en concreto con respecto a los radios de sus dos bases 3 y 4, en la realización troncocónica mostrada.

Preferiblemente, la cápsula 1 tiene, dispuesta alrededor de su base superior 4, un reborde anular 5 exterior perpendicular al eje del tronco de

cono. Este reborde 5 sirve para la fijación de una tapa 6 de cierre hermético, que puede estar adherida al mismo, por ejemplo mediante pegado, protegiendo así al producto 2 del aire ambiente previamente a su utilización conjuntamente con el dispositivo. En esta realización, la tapa 6 es arrancable y desechable, y está provista de una lengüeta 7 para facilitar la abertura de la cápsula 1, que es preferiblemente de un solo uso.

En la realización mostrada la cavidad 13 está delimitada por una proyección anular 12, alrededor de cuya pared externa se disponen unos medios calefactores 14, que circundan exteriormente a la cavidad 13 y que alternativamente podrían estar dispuestos en el fondo de dicha cavidad 13. Las paredes que delimitan interiormente la cavidad 13 son convergentes hacia el fondo, adaptándose así a la forma externa de la cápsula 1 para que esta última 1 pueda encajar ajustada y amoviblemente en la primera 13, con sus respectivas paredes y fondos en contacto mutuo.

Según la realización preferida del dispositivo mostrada en los dibujos, tales medios calefactores 14 están constituidos por una resistencia eléctrica 14 en forma de cinta anular arrollada alrededor de las paredes que delimitan la cavidad 13. Unos cables 16 se conectan por sus respectivos primeros extremos a sendos extremos de la resistencia 14 y por sus respectivos segundos extremos (no mostrados), a una fuente de alimentación de corriente (no mostrada). Los cables 16 salen del cuerpo 8, por ejemplo a través de un orificio lateral 19 provisto en éste.

La alimentación eléctrica de los medios calefactores 14 puede hacerse también, por ejemplo mediante una pila incorporada de un modo con-

veniente en el propio cuerpo 8, de forma que los cables 16 no sobresalgan del dispositivo y que, junto con la pila, queden protegidos del exterior. En este caso, la pila puede ser una pila de tipo conocido de bajo consumo, por ejemplo de 1,5 y la potencia necesaria para su correcto funcionamiento puede ser muy baja.

Como puede apreciarse, una pieza anular externa 15, desmontable del cuerpo 8, cubre a la resistencia 14 y la protege. En la realización troncocónica mostrada en las figuras, la pieza anular externa 15 tiene un radio externo sensiblemente igual al radio externo del cuerpo 8 y sobre ella se apoya el reborde anular 5 de la cápsula 1 una vez alojada ésta en la cavidad 13.

En la realización mostrada, el fondo de la cavidad 13 comprende ventajosamente un orificio central 11, destinado a eliminar el posible efecto de adherencia por vacío entre el fondo de la cápsula 1 y el fondo de la cavidad 13, que dificultaría la extracción de la primera para su recambio.

Descrita suficientemente la naturaleza de la presente invención, así como la manera de ponerla en práctica, se hace constar que cuanto no altere, cambie o modifique su principio fundamental puede quedar sometido a variaciones de detalle.

Así, por ejemplo, alternativamente a estar adherida a un reborde anular 5 de la cápsula 1, la tapa 6 podría consistir en una tapa de cierre por ajuste hermético, fabricada por ejemplo de un material plástico, sin por ello salirse del ámbito del concepto inventivo.

Lo principal y por lo que se solicita patente de invención, por veinte años, es lo que queda resumido en las siguientes reivindicaciones.

REIVINDICACIONES

1. Dispositivo para evaporar o sublimar productos balsámicos, odoríficos o similares (2), **caracterizado** porque comprende un cuerpo (8), adaptado para ser soportado sobre una superficie horizontal y dotado en su parte superior de una cavidad (13) cuyas paredes y/o fondo están provistos de unos medios calefactores (14), estando adaptada dicha cavidad para recibir amoviblemente una cápsula (1), que contiene el producto (2) a evaporar o sublimar, dotada de una configuración semejante a la de la cavidad (13) para

encajar ajustadamente en ella, en contacto con paredes y fondos.

2. Dispositivo según la reivindicación 1, **caracterizado** porque los medios calefactores (14) están constituidos por una resistencia eléctrica (14) que circunda exteriormente las paredes de la cavidad (13).

3. Cápsula (1) según reivindicación 1, **caracterizado** porque está protegida por una tapa amovible (6), que la cierra herméticamente, para proteger el producto (2) del aire ambiente antes de su utilización.

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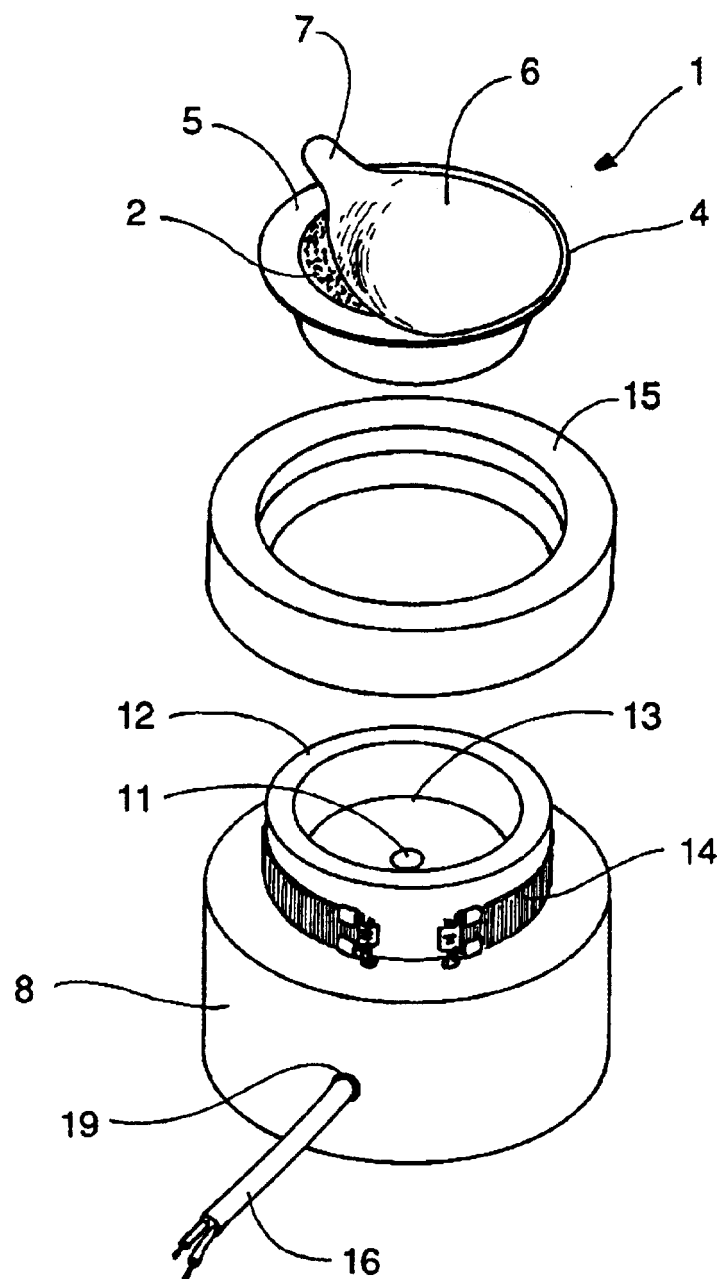


FIG. 1

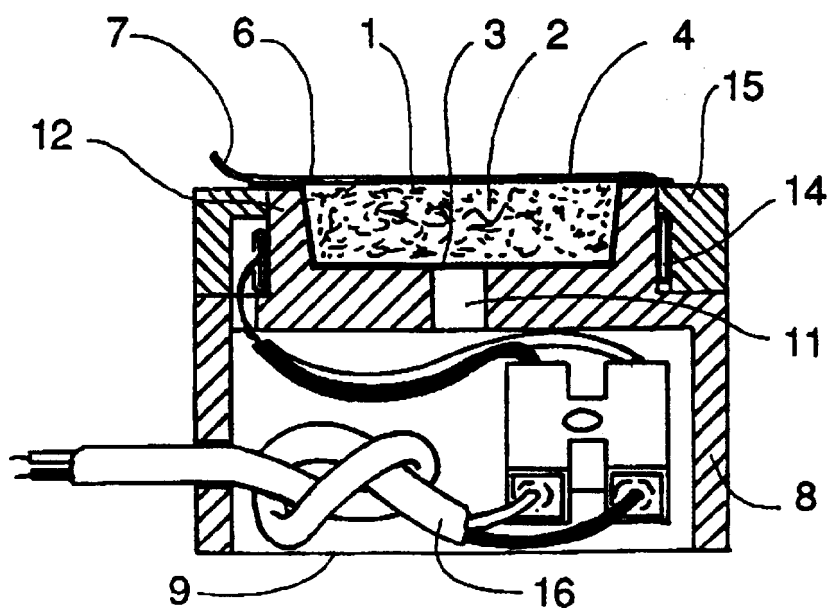


FIG. 2



INFORME SOBRE EL ESTADO DE LA TÉCNICA

⑮ Int. Cl.⁶: A61L 9/03

DOCUMENTOS RELEVANTES

Categoría	Documentos citados	Reivindicaciones afectadas
X	GB-2080111-A (EDGAR JENKINSON) 03.02.82 * Página 1, líneas 5-15; página 1, línea 112 - página 2, línea 3; figura 2 *	1.2
X	ES-2043621-T (S.C. JOHNSON & SON, INC.) 01.01.94	1
Y	* Columna 3, líneas 44-49; columna 4, líneas 8-22, 41-43; columna 10, líneas 22-29; figuras 1.4 *	3
A		2
Y	ES-2029872-T (S.C. JOHNSON & SON, INC.) 01.10.92 * Columna 3, líneas 9-28; figuras 1.8 *	3
A	GB-2279010-A (KUAN HUA PU) 21.12.94	
Categoría de los documentos citados X: de particular relevancia Y: de particular relevancia combinado con otro/s de la misma categoría A: refleja el estado de la técnica O: referido a divulgación no escrita P: publicado entre la fecha de prioridad y la de presentación de la solicitud E: documento anterior, pero publicado después de la fecha de presentación de la solicitud		
El presente informe ha sido realizado ☒ para todas las reivindicaciones ☐ para las reivindicaciones nº:		
Fecha de realización del informe 25.06.98	Examinador F. Díaz Suero	Página 1/1

Patent/Publication: ES2118034A1

Bibliography

DWPI Title

Evaporation and sublimation device comprises covered capsule heated in shape matched cavity

English Title

Device for evaporating or sublimating balsamic (balm- type, balsam-type), sweet-smelling or similar products

Assignee/Applicant

Standardized: NUGAR BOBINAJES SL

Inventor

GARCIA NUNEZ GINES JORGE,

Publication Date (Kind Code)

1998-09-01 (A1)

Application Number / Date

ES1996430A / 1996-02-23

Priority Number / Date / Country

ES1996430A / 1996-02-23 / ES

Abstract

Abstract

The device comprises a body 8 adapted so as to be supported on a horizontal surface equipped in its upper part with a cavity 13 whose walls and/or base are provided with heating means 14. The cavity 13 is adapted to removably receive a capsule 1, containing the product 2 to be evaporated or sublimated, having a configuration similar to that of the cavity 13 in order to fit tightly therein, in contact with walls and bases. The heating means 14 consist of an electrical resistance element 14 which surrounds the walls of the cavity 13 on the outside. The capsule 1 is protected by a removable lid 6, which closes it hermetically, in order to protect the product 2 from the ambient air prior to its use.

PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventor: FRED HASLAM

1025.630

1025.630



Date of filing Complete Specification March 10, 1965.

Application Date March 19, 1964.

No. 11738/64.

Complete Specification Published April 14, 1966.

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Index at acceptance: —A2 MB5; A2 C(1A1, 1A8)

Int. Cl.: —A 24 b 13/00//A 24 c

COMPLETE SPECIFICATION

Improvements relating to Tobacco Charges for Pipes

We, BRITISH-AMERICAN TOBACCO COMPANY LIMITED, of Westminster House, 7, Millbank, London, S.W.1., a Company incorporated under the laws of Great Britain, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns improvements relating to tobacco charges for tobacco smoking pipes.

The smoking of tobacco in pipes rather than in the form of cigarettes or cigars involves certain inconveniences which deter some smokers. Among these is the difficulty of packing the loose tobacco into the pipe to give an even density so that it will, on smoking, draw evenly and remain alight during intervals between puffs. Also it is distasteful to many smokers to remove the residue of ash and partially charred tobacco after smoking and to scrape out the pipe bowl with some instrument. An object of this invention is to reduce such difficulties.

According to the present invention, in a wrapped tobacco cartridge adapted for being inserted and smoked, inside its wrapper, in the bowl of a pipe, the wrapper is formed from thin aluminium or alloyed aluminium foil and contains tobacco packed evenly to give good puffing and smouldering characteristics. After smoking, the aluminium foil, which resists the heat of the glowing tobacco, can be cleanly and easily rejected with its content of ash and any other residual material. Such pre-formed charges or cartridges have the further advantage that they can be produced economically on a continuous-rod cigarette-making machine of conventional design.

These cartridges can be made in a variety of sizes, but suitably with a circumference of

between 20 and 60 mm. and a length of between 10 and 30 mm. Particularly for larger sizes of cartridge, the tobacco employed is preferably a coarse-cut pipe blend of a fineness of about 20 to 30 cuts per inch, but for smaller cartridges use may be made of a cigarette blend, which may be cut as fine as 80 cuts per inch. The tobacco should be packed in the cartridge to an even density dependent upon the type of tobacco. For finer-cut cigarette tobacco, suitably, the density is not more than 0.35 gm. per c.c. For coarser-cut pipe tobacco, the density is preferably between 0.25 and 0.45 gm. per c.c. and should not be less than 0.21 or more than 0.83 gm. per c.c.

If the cartridges are to be produced on continuous machinery, the thickness of the foil must be such as can be shaped on such machinery. Commercially available lined aluminium foil with a thickness of 0.008 or 0.009 mm. is suitable. The foil may have a hard or soft temper and may be dull or bright and plain or embossed with a pattern or trademark. Preferably it has a thin lining of paper-tissue attached by means of a starch- or casein-based adhesive. The lining, which forms the inner surface of the wrapper, may be bleached, or may contain charcoal powder or powdered meerschaum. The aluminium foil may also be coloured by anodising techniques and/or printed. The seam may be sealed with a starch- or casein-based adhesive.

Examples of ways of carrying the invention into effect will now be more fully described with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic vertical perspective view of a conventional cigarette-making machine modified for the production of pipe cartridges,

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Figure 2 is an axial section through such a cartridge to a larger scale, and

Figure 3 a diagrammatic section through another form of apparatus which can be used for the production of cartridges.

EXAMPLE I:

A blend of tobacco similar to a commercially available cigarette-tobacco blend is cut to a fineness of 50 to 70 cuts per inch and its moisture content is adjusted to within the range of 18 to 20%. This tobacco is fed from the hopper 1 of the continuous-rod machine illustrated in Figure 1 on to a band 2 supplied from a reel 3 and travelling along the bottom of a trough 4. The band 2 is made of aluminium foil, of width 42 mm. and thickness 0.009 mm., to which is bonded a paper-tissue liner. The rate of tobacco feed and the linear speed of the band are adjusted to give a final average tobacco density of packing of 0.295 gm. per c.c. At the end of the trough 4, the stream of tobacco is compressed by a pressing wheel 5 and passed on an endless tape 6 into a garniture to cause the foil band to be wrapped around the tobacco and to form a continuous rod 7 with a circumference of 40 mm. This garniture may be similar in principle to that of a conventional cigarette-making machine. The rod 7 then passes through a suction device 8 which removes dust particles from the vicinity of the edges of the foil band. Adhesive with a starch or casein base is applied at the said edges by a pasting wheel 9 and the band is then heat sealed by a heater 10, using equipment of a type which is conventional for cigarette manufacture. The sealed rod is cut by a conventional cut-off device 11 into 20 mm. long cartridges 12. A rate of production of 3,000 cartridges per minute can be achieved in this fashion.

Figure 2 illustrates the cylindrical shape of cartridge produced.

EXAMPLE II:—

Using the same method and kind of machine as in Example I, larger cartridges of 55 mm. circumference and 20 mm. long are made from a commercially available blend of pipe tobacco of a fineness of 30 cuts per inch and moisture content of 20%. The tissue-lined foil is 58 mm. wide and 0.009 mm. thick. The tobacco feed and machine speed are adjusted to give an average final density of 0.415 gm. per c.c. A rate of production of 250 cartridges per minute can be attained.

EXAMPLE III:—

Aluminium foil 0.008 mm. thick lined with paper tissue containing a filling of powdered meerschaum is shaped on a mandrel and sealed using a casein-based glue to form hollow cylinders 55 mm. in circumference and 20 mm. long. These are hand filled with a pipe-tobacco blend, of a fineness of 20 cuts per

inch and a moisture content of 20%, to an average density of packing of 0.415 gm. per c.c.

EXAMPLE IV:

A band 2 of aluminium foil 0.009 mm. thick with a paper-tissue lining is fed from a reel 3 (Fig. 3) across the face of a wheel 13 arranged to be indexed by a horizontal shaft 14. A press tool 15, operated at one station in timed relation with the indexing of the wheel 13, transfers a portion of the foil 2 to one of a ring of shaped die cavities 16 in the said wheel. At a later station, a supply of tobacco similar to that used in Example III is fed, also in timed relation with the indexing of the wheel 13, by a plunger 17, through a feed-tube 18 of a diameter similar to that of the cavities 16, into the foil-lined cavity to give an average density of packing of 0.415 gm. per c.c. A push rod 19 also operated in timed relation with the wheel 13, but from the opposite side of the said wheel, serves to eject the completed cartridge for collection or packaging. A bell-shaped cartridge 12' is produced.

A cartridge produced in accordance with one of the above Examples can be inserted into the bowl of a ceramic, meerschaum or wooden pipe, in which it forms a close-fitting plug. If desired, a ceramic, meerschaum or other liner may be used in a wooden pipe. During insertion of the cartridge, the curvature of the lower portion of the pipe-bowl or liner deforms the foil wrapper inwardly to produce a cupped formation which will ensure a tight seal during smoking, will extinguish the final portion of the tobacco charge, and will permit easy removal of the residue after smoking.

WHAT WE CLAIM IS:—

1. A wrapped tobacco cartridge adapted for being inserted and smoked, inside its wrapper, in the bowl of a pipe, wherein the wrapper is formed from thin aluminium or alloyed aluminium foil and contains tobacco packed evenly to give good puffing and smouldering characteristics.

2. A tobacco cartridge as claimed in claim 1, wherein the foil is 0.008 to 0.009 mm. thick.

3. A tobacco cartridge as claimed in claim 1 or 2, wherein the foil is lined with paper tissue.

4. A tobacco cartridge as claimed in any one of claims 1 to 3, wherein the tobacco is a coarse-cut tobacco, cut to 20 to 30 cuts per inch and packed to a density between 0.25 and 0.45 gm. per c.c.

5. A tobacco cartridge as claimed in any one of claims 1 to 3, wherein the tobacco is a fine-cut tobacco, cut to a fineness of up to 80 cuts per inch and packed to a density of not more than 0.35 gm. per cc.

6. A tobacco cartridge substantially as hereinbefore described.

7. A tobacco cartridge as claimed in any one of claims 1 to 5 when produced upon a continuous-rod machine.
- 5 8. A method of producing a tobacco cartridge as claimed in any one of claims 1 to 5, substantially as hereinbefore described in Example I or II and with reference to Figures 1 and 2 of the accompanying drawings.
9. A method of producing a tobacco cartridge as claimed in any one of claims 1 to 5, substantially as hereinbefore described in Example IV and with reference to Fig. 3 of the accompanying drawings.

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77, Chancery Lane,
London, W.C.2,
Chartered Patent Agents.

Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1966.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2. from which copies may be obtained.

FIG.3

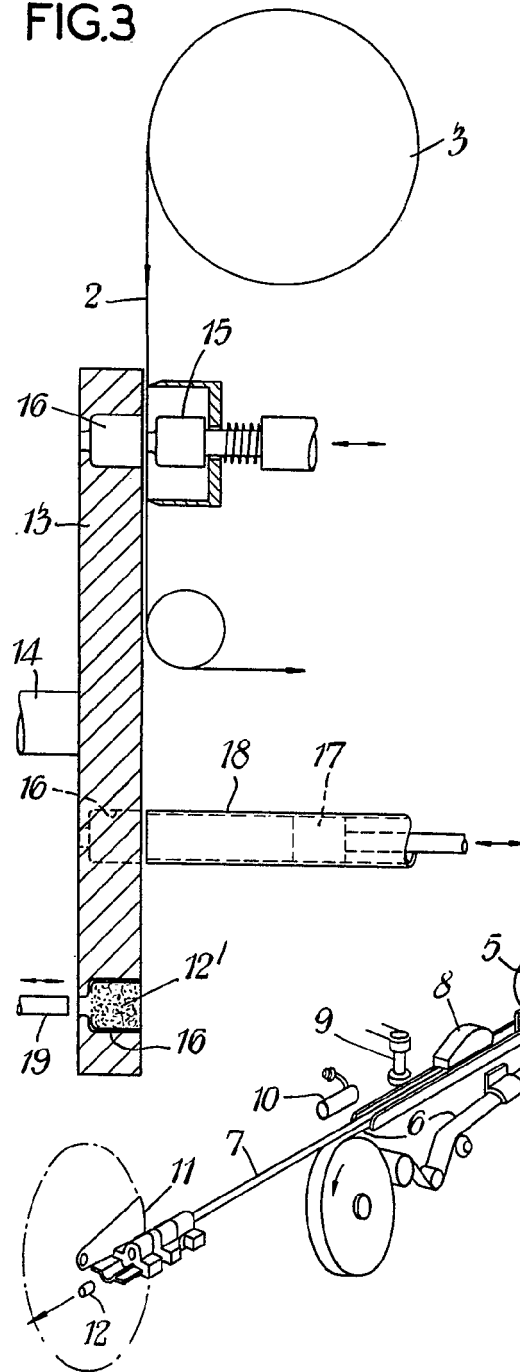
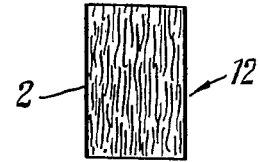


FIG.2

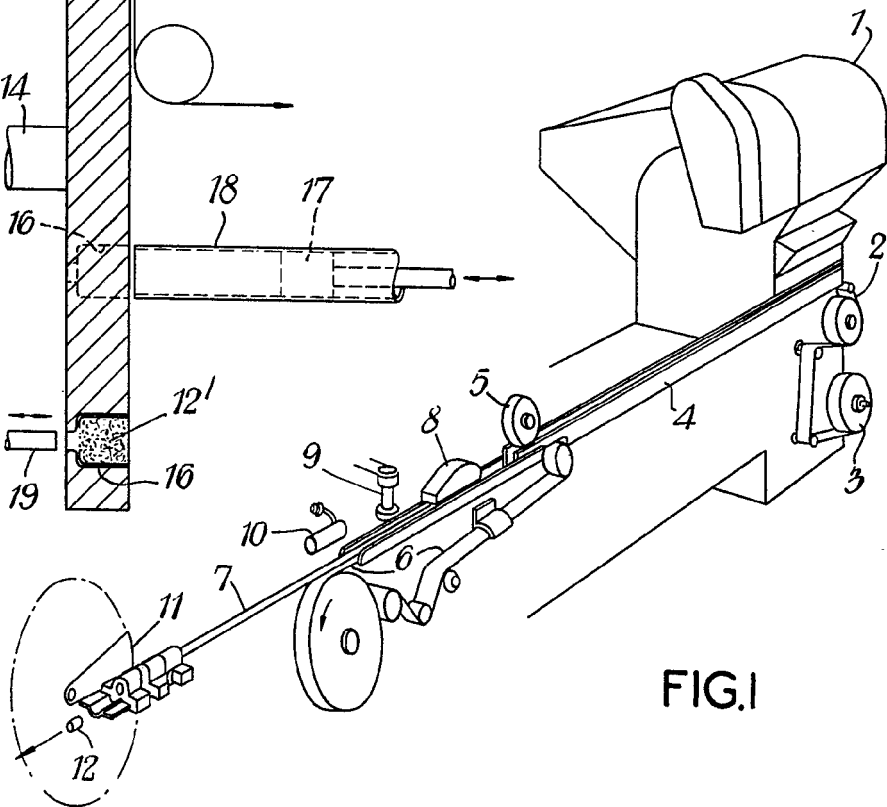


FIG.1

DRAWINGS ATTACHED.

Inventor:—EDGAR CUTHBERT BUCKINGHAM.

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COMPLETE SPECIFICATION.

Smoking Elements and Devices.

We, SUPER-TEMP CORPORATION, a Corporation organized under the laws of the State of California, United States of America, of 11008 Norwalk Boulevard, Santa Fe Springs, California, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to smoking elements, especially smoking pipes, and is particularly concerned with a bowl liner and bowl for such pipes.

It is well known that smoking pipes having bowls made or lined of conventional materials require a breaking-in smoking period to establish a carbonaceous surface or a "coke" liner in the bowl of the pipe, for best results. However, even when such a carbonaceous surface is formed within the bowl, the exterior surface of the pipe bowl becomes quite hot during smoking due to considerable heat transfer through the bowl from the burning tobacco within the bowl. This relatively great heat transfer through the bowl renders the temperature of the burning tobacco non-uniform, and also causes the combustion to cease frequently, requiring frequent relighting of the pipe. Also, in pipe bowls of conventional pipes, moisture undesirably tends to accumulate in the lower portion of the bowl, and also unburned, and partially burned residue formed in the bottom of the bowl often adheres tenaciously to the interior surface of the bowl and is difficult to remove. Further, materials of which conventional pipe bowls are formed are relatively porous so that moisture is absorbed by the bowl during combustion of the tobacco. The result is

that normally a drying out period is usually required between uses.

Pipe bowls having ordinary carbon liners are known. However, liners of this type do not materially reduce the undesirable heat transfer through the pipe bowl, with its attendant disadvantages noted above, and ordinary carbon liners are porous.

The smoking elements, particularly the bowl or the bowl liner for smoking pipes, of this invention have properties which reduce and preferably avoid substantially all of the above noted disadvantages of conventional smoking pipes having bowls or bowl liners formed of conventional materials.

More particularly, the present invention provides a smoking pipe bowl element having an internal surface and comprising a crucible for receiving tobacco and being composed of pyrolytic graphite, said pyrolytic graphite having carbon atoms orientated in laminae, the laminae of said pyrolytic graphite being orientated substantially parallel to the surface of said crucible, and being apertured adjacent the bottom of the crucible to permit outward passage of tobacco smoke from said crucible.

A further provision of the invention is a smoking pipe which comprises a tobacco receiving bowl and a hollow stem, said bowl being connected to one end of said stem, said bowl being apertured adjacent the bottom thereof to provide communication between said bowl and said hollow stem, said bowl having an internal surface and composed of pyrolytic graphite, said pyrolytic graphite having carbon atoms orientated in laminae, the laminae of said pyrolytic graphite being orientated substantially parallel to the surface of said bowl.

A further provision of the invention is a

[Price 4s. 6d.]

smoking pipe which comprises a tobacco receiving bowl and a hollow stem, said bowl being connected to one end of said stem, said bowl being apertured adjacent the bottom thereof to provide communication between said bowl and said hollow stem, a liner in the form of a crucible fitted within said bowl in snug engagement with the wall thereof, said crucible having an internal surface and composed of pyrolytic graphite, said pyrolytic graphite having carbon atoms orientated in laminae, the laminae of said pyrolytic graphite being orientated substantially parallel to the surface of said crucible, said crucible having an aperture adjacent the bottom thereof in registry with the aperture in said bowl, and providing communication between said crucible and said hollow pipe stem.

It has been found that a smoking pipe bowl or bowl liner composed of pyrolytic graphite, produces results which are greatly superior to those produced from pipes having bowls formed or lined of conventional materials, and avoids substantially all of the problems described above which are inherent in conventional smoking pipes.

The pyrolytic graphite referred to above is an anisotropic material formed by the high temperature pyrolysis of hydrocarbons, for example, methane, passed over a hot surface at approximately 4,000°F. The carbon atoms are deposited in laminar form on such surface, and deposit so that the direction of high thermal conductivity is always parallel to the deposition surface, or to the plane of the laminate. Thus, the material deposits so that it is always a heat insulator perpendicular to the deposition surface and a good heat conductor parallel to such surface.

Pyrolytic graphite can be produced in the form of a crucible of a desired size and shape so as to form the bowl of a smoking pipe, or to be inserted into and to fit within the bowl of a particular smoking pipe as a liner therefor, such crucible containing an opening adjacent the bottom for connecting with the stem of the pipe. The thickness of such crucible can vary, and can range, for example, from about 0.010 up to about 0.350 inch, and when employed as a bowl liner, the thickness generally ranges from about 0.010 to about 0.100 inch. In order to make a particular shape of pyrolytic graphite crucible, the deposition of the pyrolytic graphite is carried out on the surface of a mandrel of the required shape. This crucible can be attached to the stem of a smoking pipe in any suitable manner to function as the pipe bowl, or it can be incorporated in the bowl of the smoking pipe by any suitable means such as by bonding or by a mechanical fastener to function as a liner for the bowl.

The term "bowl element" employed herein is intended to denote either the bowl of a smoking pipe or a liner therefor.

The advantage of the pyrolytic graphite bowl element of the invention are essentially due to the unique properties of this material. As deposited in the bowl shape, that as in the shape of a small crucible forming the pipe bowl or as a liner for insertion into the pipe bowl, as previously indicated, the pyrolytic graphite material formed has high thermal conductivity along the bowl surface and is a heat insulator through its thickness. Also, such pyrolytic graphite is a highly dense substantially non-porous material.

Thus, since the pyrolytic graphite bowl element of the invention is an insulator through its thickness, the external surfaces of the pipe bowl will operate at a lower temperature and will be cooler, as compared to the bowl of conventional smoking pipes. Also, the burning tobacco in the pipe is maintained at a more uniform and elevated temperature so that the necessity to relight the pipe at frequent intervals is greatly reduced. Since the pyrolytic graphite is a conductor of heat along the inside surface of the bowl element or crucible, heat is maintained within and carried down into the lower bowl area of the pipe and moisture evaporates more readily than in the case of conventional pipes, thus providing a drier and cooler smoke. Further, since the heat is carried more uniformly down into the bowl area, there is considerably less tendency for an unburned or partially burned residue remaining in the bottom of the pipe, and which normally is difficult to remove.

It is also particularly noteworthy that since pyrolytic graphite is substantially 100% carbon, it is not necessary to establish a carbonaceous or "coke" surface on the bowl by a breaking-in smoking period as is normal with pipes made or lined of conventional materials. Further, no moisture is absorbed by the pyrolytic graphite bowl element of the invention during the smoking process, due to the essentially non-porous nature of pyrolytic graphite, thus permitting the pipe to be used extensively without interruption for the drying-out periods between uses necessary with conventional pipes.

The pyrolytic graphite pipe bowl element or crucible of the invention can be made in various shapes and sizes as desired, and such element is thus not limited to any particular smoking pipe design. Moreover, since the pyrolytic graphite bowl element of the invention is a separate element or insert, it can be replaced if either cracked, broken, or worn out without discarding the entire pipe.

The invention will be understood more

readily by reference to the description below of certain illustrative embodiments of the invention, taken in connection with the accompanying drawing wherein:

5 Figure 1 shows a cross-section of a smoking pipe embodying a bowl liner according to the invention principles;

Figure 2 shows a section in elevation of the bowl liner of the pipe of Figure 1;

10 Figure 3 is a plan view taken on line 3—3 of Figure 2;

Figure 4 is a cross-section of a smoking pipe having a bowl constructed according to the invention; and

15 Figure 5 is an enlarged detail showing the orientation of the pyrolytic graphite laminae in the bowl or bowl liner of the invention.

Referring to the drawing, numeral 10 is a pipe according to the invention, which comprises a bowl 12 of a conventional material connected to a hollow stem 14, one side of the bottom of bowl 12 being apertured at 16 for communication of the interior of bowl 12 with the smoke passage 18 in the stem.

20 Snugly inserted in the pipe bowl 12 is a pyrolytic graphite bowl liner or crucible 20 according to the invention and described above. Such bowl liner is formed by depositing the carbon in the pyrolysis process described above on a suitably shaped mandrel (not shown) so that the laminae are formed substantially parallel to or along the surface of the crucible, as indicated at "X" in Figure 5. The bowl liner 20 is maintained fixed in position in the pipe bowl 12 by any suitable means, as by bonding between the exterior wall of the liner and the adjacent interior wall of the bowl, or by providing a friction fit between the liner and the bowl, or by a suitable mechanical fastening means. One side of the liner adjacent the bottom thereof is provided with a small hole or opening 22 which registers with the aperture 16 in the bowl 12, to provide communication via aperture 16, between the interior of the liner 20 and the smoke passage 18 in the pipe stem 14. The wall 24 of the liner or crucible 20 can be of a thickness, e.g., about 0.040 inch, and the wall 26 of the pipe bowl 12 can be of conventional thickness or can be made thinner than in conventional pipes, so that the overall thickness of the walls 24 and 26 of the liner and pipe bowl is not substantially greater than the bowl thickness of the conventional smoking pipe.

It will be seen that the pyrolytic graphite crucible 20 is a heat insulator through its thickness in a direction perpendicular to the laminae X, and is a conductor along its inside surface parallel to the laminae "X". These properties, together with the high density non-porous characteristics of the pyro-

lytic graphite, are essentially responsible for the advantages of the smoking pipe of the invention over conventional smoking pipes having bowls or liners formed of conventional materials, as pointed out above.

70 In Figure 4 there is shown a modification of the invention in the form of a smoking pipe, indicated at 30, composed of a bowl 32 attached to the hollow stem 34. The bowl 32 is formed of pyrolytic graphite and produced by depositing the carbon in the pyrolysis process previously described, on a suitably shaped mandrel so that the laminae are formed substantially parallel to the surface of the bowl, as in the case of the bowl liner 20 described above. The bowl 32 has a thickness of the order of about 0.250 inch and is provided with an aperture 36 in its bottom for communication of the interior of the bowl with the smoke passage 38 in the stem 34. The bowl 32 is mounted on the end of the stem 34 by any suitable fastening means such as spring clips, indicated at 40, so that if desired, the bowl 32 is removable from the pipe stem.

90 It will be understood, as previously indicated, that the pyrolytic graphite bowl element of the invention, e.g. the bowl liner 20 or the bowl 32, can be formed of any desired shape to fit the design and shape of a particular pipe. Thus, for example, such element can have a cylindrical surface as illustrated by bowl liner 20, or a curved surface as illustrated by the pipe bowl 32.

WHAT WE CLAIM IS:—

1. A smoking pipe bowl element having an internal surface and comprising a crucible for receiving tobacco and being composed of pyrolytic graphite, said pyrolytic graphite having carbon atoms orientated in laminae, the laminae of said pyrolytic graphite being orientated substantially parallel to the surface of said crucible, and being apertured adjacent the bottom of the crucible to permit outward passage of tobacco smoke from said crucible.

2. A smoking pipe bowl element according to claim 1, wherein said crucible comprises a smoking pipe bowl liner adapted to fit within the bowl of a smoking pipe.

3. A smoking pipe bowl element according to claim 1 or 2, wherein said crucible has a thickness in the range of 0.010 to 0.350 inch.

4. A smoking pipe which comprises a tobacco receiving bowl and a hollow stem, said bowl being connected to one end of said stem, said bowl being apertured adjacent the bottom thereof to provide communication between said bowl and said hollow stem, said bowl having an internal surface and composed of pyrolytic graphite, said pyrolytic graphite having carbon atoms

orientated in laminae, the laminae of said pyrolytic graphite being orientated substantially parallel to the surface of said bowl.

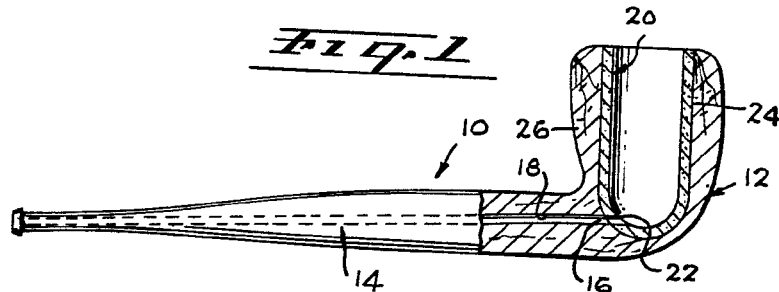
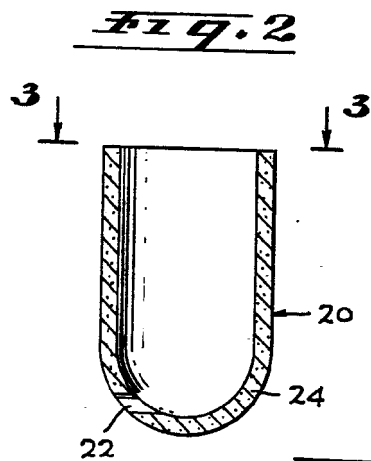
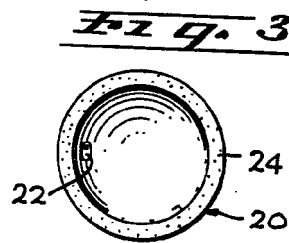
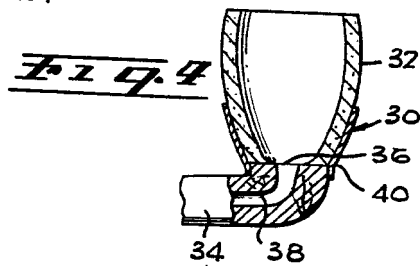
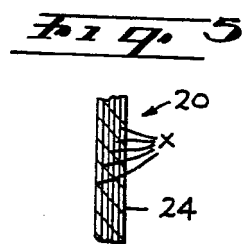
- 5 5. A smoking pipe which comprises a tobacco receiving bowl and a hollow stem, said bowl being connected to one end of said stem, said bowl being apertured adjacent the bottom thereof to provide communication between said bowl and said hollow stem, a liner in the form of a crucible fitted within said bowl in snug engagement with the wall thereof, said crucible having an internal surface and composed of pyrolytic graphite, said pyrolytic graphite having car-
- 10

bon atoms oriented in laminae, the laminae of said pyrolytic graphite being orientated substantially parallel to the surface of said crucible, said crucible having an aperture adjacent the bottom thereof in registry with the aperture in said bowl, and providing communication between said crucible and said hollow pipe stem.

15 20

STEVENS, LANGNER, PARRY &
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Agents for the Applicants.

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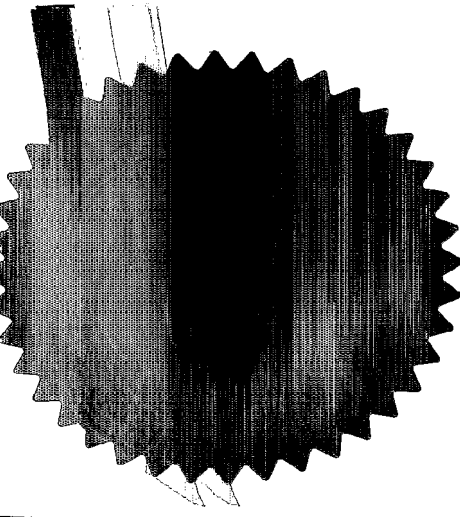
I HEREBY CERTIFY that annexed hereto is a true copy of documents filed in connection with the following patent application:

Application No. S2005/0051

Date of Filing 2 February 2005

Applicant
OGLESBY & BUTLER RESEARCH &
DEVELOPMENT LIMITED, an Irish company of
Industrial Estate, Dublin Road, Carlow, Ireland.

Dated this 9 day of February 2006.



An officer authorised by the
Controller of Patents, Designs and Trademarks.

FORM NO. 1

REQUEST FOR THE GRANT OF A PATENT

PATENTS ACT, 1992

The Applicant(s) named herein hereby request(s)

☐

the grant of a patent under Part II of the Act

☒

the grant of a short-term patent under Part III of the Act

on the basis of the information furnished hereunder.

1. Applicant(s)NameOGLESBY & BUTLER RESEARCH
& DEVELOPMENT LIMITEDAddress

Industrial Estate, Dublin Road, Carlow, Ireland.

Description/Nationality

An Irish company.

2. Title of Invention

"Apparatus for vaporising vaporisable matter"

3. Declaration of Priority on basis of previously filed application(s) for same invention (Sections 25 & 26)Previous filing dateCountry in or for which
filedFiling No.**4. Identification of Inventor(s)**Name(s) of person(s) believedby Applicant(s) to be the inventor(s)

ALFRED PETER OGLESBY and JOHN PAUL OGLESBY

AddressA British subject of Castle Hill, Carlingford, County Louth, Ireland; and
A British subject of Anneville, Shrute, Carlow, Ireland.

5. **Statement of right to be granted a patent (Section 17 (2) (b))**

The applicant has derived the right to be granted a Patent from the inventors by virtue of a Deed of Assignment dated February 1, 2005.

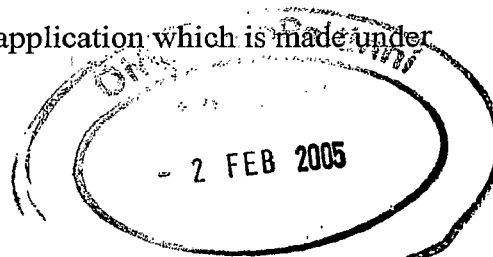
6. **Items accompanying this request – tick as appropriate**

- (i) ☒ Prescribed filing fee (€60.00)
- (ii) ☐ Specification containing a description and claims
- ☒ Specification containing a description only
- ☒ Drawings referred to in description or claims
- (iii) ☐ An abstract
- (iv) ☐ Copy of previous application(s) whose priority is claimed
- (v) ☐ Translation of previous application whose priority is claimed
- (vi) ☐ Authorisation of Agent (this may be given at 8 below if this Request is signed by the Applicant(s))

7. **'Divisional Application(s)**

The following information is applicable to the present application which is made under Section 24 –

Earlier Application No:
Filing Date:



8. **Agent**

The following is authorised to act as agent in all proceedings connected with the obtaining of a patent to which this request relates and in relation to any patent granted –

<u>Name</u>	<u>Address</u>
-------------	----------------

F.F. GORMAN & CO.

15 Clanwilliam Square,
Dublin 2,
Ireland.

9. **Address for Service (if different from that at 8)**

F.F. GORMAN & CO., at its address as recorded for the time being in the Register of Patent Agents.

Signed

F.F. GORMAN & CO., Authorised Patent Agents

BY: _____

EXECUTIVE

Date

February 2, 2005

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1

"Apparatus for vaporising vaporisable matter"

The present invention relates to apparatus for vaporising vaporisable matter for facilitating inhaling of the vaporised matter. For example, the apparatus is suitable
5 for vaporising vaporisable matter which comprises one or more of flavour components, medicinal components and psychoactive components, such as tobacco, mullein, passion flower, cloves, yohimbe, mint, tea, eucalyptus, camomile, cannabis and other such herbs and plant matter. The invention also relates to a device for providing a hot gaseous fluid for delivering to the vaporisable material for
10 vaporising thereof.

Herbs, for example, tobacco, cannabis and the like are smoked by burning, in order to release psychoactive compounds, which are then inhaled. The psychoactive compounds are released into the fumes of combustion, which are then inhaled.
15 However, burning of such herbs as well as producing psychoactive compounds also produces toxins, which largely result from the actual combustion process. Such toxins are known to be carcinogenic, and also can result in lung and heart disease. Thus, the smoking of such herbs and other such plant matter is hazardous and undesirable. An alternative to releasing flavour, medicinal and psychoactive
20 compounds from such herbs and plant matter by smoking is to raise the temperature of the herb to an appropriate temperature for causing the vaporisable constituent or constituents to be vaporised, and then inhale the vaporised constituent or constituents. However, the temperature range at which such compounds can be vaporised in herbs and plant matter ranges from approximately 130°C to 250°C. If

the temperature is below 150°C, in general, vaporisation does not occur. However, if the temperature to which the herb or plant matter is heated exceeds 300°C, combustion of the herb or plant matter may commence. Thus, in order to satisfactorily vaporise flavour, medicinal and psychoactive constituents in herbs and plant matter, the temperature at which the herb or plant matter is maintained for producing the vaporised compounds must be controlled within reasonably tight tolerances.

It is known to provide apparatus for vaporising desirable constituents from herbs by electrically heating the herb. However, due to the energy requirements of such apparatus, a mains electricity supply is required to power the apparatus, and thereby the apparatus is not portable when in use. This thus renders a person immobile when using such apparatus. An alternative device for vaporising vaporisable constituents in herbs and plant matter is disclosed in U.S. published Patent Application Specification No. 2004/0031495 of Steinberg. Steinberg discloses a pipe which is substantially similar to a smoking pipe in which the herb, typically, tobacco to be vaporised is located in a bowl portion of the pipe. A heat resistant and porous flame filter is located in the bowl above the herb, and a flame from a match or cigarette lighter is used to heat the porous filter while air is being drawn through the pipe. Thus, a mixture of air and the products of combustion from the flame are mixed in the porous filter and drawn through the herb in the bowl for heating the herb for in turn vaporising desirable constituents in the herb. The mixture of air, the products of combustion and the vaporised constituent are then drawn through a mouthpiece of the pipe and inhaled. However, due to the fact that the flame is

played on the heat resistant porous flame filter, there is a danger of the flame being drawn through the filter and thus causing combustion of the herb in the bowl of the pipe. However, even where the herb does not combust, the products of combustion of the flame are inhaled along with the vaporised constituent. This is undesirable.

5

There is therefore a need for apparatus for vaporising vaporisable matter which overcomes this problem, and there is also a need for a device for providing a hot gaseous fluid for use in the vaporisation of vaporisable matter.

10 The present invention is directed towards providing such an apparatus and device.

According to the invention there is provided a device for providing a hot gaseous fluid for delivery to a vaporisation chamber containing vaporisable matter for vaporising thereof, the device comprising a combustion chamber within which fuel
15 gas is converted to heat, a heat exchanger co-operating with the combustion chamber for transferring heat from the combustion chamber to a gaseous fluid for heating thereof, a fuel gas supply means for supplying fuel gas to the combustion chamber for conversion to heat therein, and a coupling means for coupling the heat exchanger to the vaporisation chamber for delivering the hot gaseous fluid thereto
20 for vaporising the vaporisable matter.

In one embodiment of the invention a gaseous fluid accommodating means is provided for accommodating the gaseous fluid through the heat exchanger for heating thereof.

In another embodiment of the invention the gaseous fluid accommodating means comprises a gaseous fluid passageway extending through the heat exchanger, the gaseous fluid passageway extending between an upstream fluid inlet for receiving
5 gaseous fluid into the gaseous fluid passageway, and a downstream fluid outlet through which the hot gaseous fluid is delivered.

In another embodiment of the invention the coupling means comprises an engagement means for engaging the vaporisation chamber, and preferably, the
10 engagement means extends from the heat exchanger.

In one embodiment of the invention the gaseous fluid outlet is located in the engagement means for delivering the gaseous fluid directly into the vaporisation chamber.
15

In another embodiment of the invention an exhaust gas port is provided from the combustion chamber for exhausting exhaust gases therefrom.

Preferably, an exhaust gas passageway extends through the heat exchanger from
20 the exhaust gas port, and terminates in an exhaust gas outlet from which exhaust gases are discharged, the exhaust gas passageway being separated from the gaseous fluid for preventing mixing of the exhaust gas with the gaseous fluid.

Advantageously, the exhaust gas passageway and the gaseous fluid passageway

are located adjacent each other, and preferably, are located for facilitating contra-flow between the exhaust gas in the exhaust gas passageway and the gaseous fluid in the gaseous fluid passageway.

- 5 Preferably, a gas catalytic combustion element is located in the combustion chamber for converting fuel gas to heat by catalytic reaction.

In one embodiment of the invention a flame ignition chamber is located adjacent the combustion chamber for facilitating initial flame ignition of the fuel gas for in turn
10 raising the temperature of the gas catalytic combustion element to its ignition temperature, and ideally, the flame ignition chamber is located adjacent the combustion chamber so that as the gas catalytic combustion element is raised to its ignition temperature by the flame ignition, the flame is starved of fuel gas and is extinguished.

15

Ideally, an ignition means is provided for igniting the fuel gas to initially burn with a flame, and preferably, the ignition means comprises at least one electrode for generating a spark for igniting the fuel gas to burn with a flame in the flame ignition chamber.

20

Preferably, the exhaust gas port extends from the flame ignition chamber.

In one embodiment of the invention the combustion chamber is located within the heat exchanger, and preferably, the flame ignition chamber is located within the heat

exchanger.

In one embodiment of the invention an inspection port is provided through the heat exchanger to the flame ignition chamber for facilitating inspection of the flame
5 ignition chamber, and advantageously, the inspection port extends through the heat exchanger to the combustion chamber for facilitating inspection of the gas catalytic combustion element.

In another embodiment of the invention a thermal mass is located in the combustion
10 chamber associated with the catalytic combustion element for temporarily maintaining at least a portion of the gas catalytic combustion element at or above its ignition temperature during temporary disruptions of fuel gas to the combustion chamber.

15 In another embodiment of the invention a thermostatically responsive valve is provided for controlling the flow of fuel gas to the combustion chamber, and preferably, the thermostatically responsive valve is in direct or indirect heat conducting engagement with the heat exchanger. Advantageously, the thermostatically responsive valve defines a valving chamber, and a bi-metal disc
20 located in the valving chamber, the bi-metal disc co-operating with one of a valve inlet and a valve outlet to the valving chamber for controlling the flow of fuel gas through the valving chamber in response to temperature. Ideally, the bi-metal disc is of the type which transitions from one state to another state, which are mirror images of each other, as the temperature of the disc exceeds a predetermined transition

temperature, and the disc is constrained within the valving chamber to prevent transitioning of the disc from one of said states to the other.

In one embodiment of the invention the thermostatically responsive valve is suitable
5 for controlling the temperature of the heat exchanger so that the temperature of the gaseous fluid being delivered from the device is at a temperature which lies in the range of 100°C to 500°C.

In another embodiment of the invention the thermostatically responsive valve is
10 suitable for controlling the temperature of the heat exchanger so that the temperature of the gaseous fluid being delivered from the device is at a temperature which lies in the range of 125°C to 400°C.

In a further embodiment of the invention the thermostatically responsive valve is
15 suitable for controlling the temperature of the heat exchanger so that the temperature of the gaseous fluid being delivered from the device is at a temperature which lies in the range of 130°C to 300°C.

In a still further embodiment of the invention the thermostatically responsive valve is
20 suitable for controlling the temperature of the heat exchanger so that the temperature of the gaseous fluid being delivered from the device is at a temperature which lies in the range of 150°C to 250°C.

In another embodiment of the invention a temperature responsive fuel gas cut-out

means is provided for isolating the combustion chamber from a fuel gas supply in the event of the temperature of the heat exchanger exceeding a predetermined safe maximum temperature. Preferably, the fuel gas cut-out means comprises a temperature sensitive member located in a fuel gas passageway through which fuel gas is delivered to the combustion chamber, the temperature sensitive member having a melt temperature which is a function of the predetermined safe maximum temperature, so that when the temperature of the heat exchanger reaches the predetermined safe temperature, the temperature sensitive member melts, thus blocking the fuel gas passageway. Ideally, the temperature sensitive member is located adjacent a porous filter so that on melting of the temperature sensitive member the melting material of the temperature sensitive member blocks the porous filter.

In one embodiment of the invention the heat exchanger comprises an inner body member within which the combustion chamber is formed. An intermediate body member extending around the inner body member, and an outer body member extending around the intermediate body member, so that the intermediate body member is sandwiched between the inner and outer body members.

Preferably, one of the gaseous fluid and exhaust gas passageways is formed between the inner body member and the intermediate body member, and the other of the gaseous fluid and exhaust gas passageways is formed between the intermediate body member and the outer body member.

Preferably, the body member formed between the inner body member and the intermediate body member extend around the inner body member, and advantageously, the passageway formed between the outer body member and the intermediate body member extends around the intermediate body member.

5

In one embodiment of the invention each passageway is of helical shape.

Alternatively, each passageway is formed by a plurality of annular chambers extending around the heat exchanger, with adjacent annular chambers

communicating through at least one communicating groove extending from one

10 annular chamber to its next adjacent annular chamber, and preferably, the communicating grooves communicating adjacent annular chambers are staggered from annular chamber to annular chamber.

In one embodiment of the invention one or more heat exchange fins extends from

15 the inner body member and sealably engage the intermediate body member for forming the annular chambers between the inner body member and the intermediate body member.

In another embodiment of the invention one or more heat exchange finds extends

20 from the intermediate body member and sealably engages the outer body member for forming the passageway formed between the outer body member and the intermediate body member.

Ideally, the exhaust gas passageway is formed between the outer body member and

the intermediate body member, and the gaseous fluid passageway is formed between the inner body member and the intermediate body member.

5 Ideally, the inner body member, the intermediate body member and the outer body member are of cylindrical construction, and each defines a central geometrical axis, and preferably, the central geometrical axes of the respective inner, intermediate and outer body members coincide. Ideally, the combustion chamber defines a central geometrical axis which coincides with the central geometrical axis defined by the inner, intermediate and outer body members.

10

Ideally, the intermediate body member terminates in the engagement means for engaging the vaporisation chamber.

15

In one embodiment of the invention a fuel gas reservoir is provided for supplying fuel gas to the fuel gas supply means, and preferably, the fuel gas reservoir is coupled to the housing.

20

Ideally, the fuel gas supply means comprises a control means for controlling the supply of fuel gas from the fuel gas reservoir to the combustion chamber, and preferably, the fuel gas supply means comprises a mixing means for mixing the fuel gas with air for delivery to the combustion chamber.

Ideally, the device is adapted for heating the gaseous fluid when the gaseous fluid is air.

The invention also provides apparatus for vaporising vaporisable matter, the apparatus comprising a holder having a vaporisation chamber therein, for holding the vaporisable material, and the device according to the invention for providing a hot gaseous fluid to the vaporisation chamber, the holder comprising a receiving means for receiving the coupling means of the device for coupling the device to the holder for providing the hot gaseous fluid to the vaporisation chamber, so that the hot gaseous fluid is delivered to the vaporisation chamber for heating the vaporisable material therein to a temperature for vaporising thereof.

10

In one embodiment of the invention a vapour outlet is provided from the vaporisation chamber for accommodating the vapour of the vaporisable matter therefrom.

Preferably, the holder forms a mouthpiece communicating with the vaporisation chamber for facilitating drawing of the vapour of the vaporisable material from the vaporisation chamber.

Advantageously, the vaporisation chamber defines a central geometrical axis, which coincides with the longitudinal axis of the device for providing the hot gaseous fluid.

20

In one embodiment of the invention the mouthpiece defines a longitudinally extending geometrical axis, and the mouthpiece is located relative to the vaporisation chamber so that the longitudinal axis defined by the vaporisation chamber coincides with the longitudinal axis of the mouthpiece.

Alternatively, the mouthpiece is disposed relative to the vaporisation chamber with the longitudinal axis of the mouthpiece located at an angle of approximately 90° to the longitudinal axis defined by the vaporisation chamber.

5

The invention will be more clearly understood from the following description of and embodiment thereof, which is given by way of example only, with reference to the accompanying drawings, in which:

10

Fig. 1 is a side elevational view of apparatus according to the invention for vaporising vaporisable matter,

15

Fig. 2 is a transverse cross-sectional side elevational view of a device also according to the invention for providing a hot gaseous fluid for vaporising the vaporisable matter for use in the apparatus of Fig. 1,

20

Fig. 3 is a transverse cross-sectional side elevational view of a portion of the apparatus of Fig. 1,

Fig. 4 is a transverse cross-sectional side elevational view of a detail of the device of Fig. 2, and

Fig. 5 is a transverse cross-sectional side elevational view of a portion of a device according to another embodiment of the invention for providing a hot

gaseous fluid for vaporising vaporisable matter for use in the apparatus of Fig. 1.

Referring to the drawings and initially to Figs. 1 to 4, there is illustrated apparatus according to the invention, indicated generally by the reference numeral 1, for vaporising vaporisable matter 2, typically from tobacco, cannabis, and other herbs or oils for providing vaporised flavour compounds, medicinal compounds and/or vaporised psychoactive compounds, suitable for inhaling by an individual. The apparatus 1 comprises a holder 5 for holding the vaporisable matter, in this case tobacco 2, and a device also according to the invention and indicated generally by the reference numeral 8 for delivering a hot gaseous fluid, namely, hot air to the holder 5 for vaporising the tobacco 2 therein for inhaling. The holder 5 is of cylindrical construction, and is symmetrical about a longitudinally extending central axis 9, and forms a vaporisation chamber 10 within which the tobacco 2 is vaporised. A mouthpiece 11 extends axially from the vaporisation chamber 10, and a bore 12 extends through the mouthpiece 11 from the vaporisation chamber 10 for accommodating vaporised compounds vaporised from the tobacco 2 for inhaling. A gauze screen 14 in the vaporisation chamber 10 prevents particles of the tobacco 2 being drawn into the bore 12 when the vaporised compounds are being inhaled. The holder 5 is not much bigger than a conventional cigarette holder.

The device 8 is also of cylindrical construction and is symmetrical about a geometric central axis 17, and when the device 8 is coupled to the holder 5 as will be described below, the central axis 17 of the device 8 coincides with the central axis 9 of the

holder 5 so that the device 8 and the holder 5 are in alignment with each other. The device 8 comprises a housing 19 of heat conducting material, typically, aluminium, which forms a heat exchanger 20 within which the hot air to be delivered to the vaporisation chamber 10 of the holder 5 is heated by a gas burner 18 which is

5 located within the heat exchanger 20. The housing 19 comprises an inner body member 21 which is located within an intermediate body member 22, which in turn is located within an outer body member 23. The inner body member 21, the intermediate body member 22 and the outer body member 23 are of cylindrical construction, with the intermediate body member 22 extending around the inner

10 body member 21 and the outer body member extending around the intermediate body member 22.

The burner 18 comprises a combustion chamber 25 which is formed in the inner body member 21, and a gas catalytic combustion element 26 of metal and of hollow

15 cylindrical construction is located in the combustion chamber 25 for converting a mixture of fuel gas and air to heat. The fuel gas/air mixture is supplied to the combustion chamber 25 by a fuel gas supply means which comprises a fuel gas supply control system 27 which is described in more detail below. A flame ignition chamber 29 is located adjacent and communicates with the combustion chamber 25

20 for initially combusting the fuel gas/air mixture in a flame to raise the temperature of the gas catalytic combustion element 26 to its ignition temperature. An end plug 28 closes the flame ignition chamber 29. The initial ignition of the fuel gas/air mixture will be described in more detail below.

An exhaust port 30 extending from the flame ignition chamber 29 accommodates exhaust gases from the flame ignition chamber 29 and the combustion chamber 25, which are delivered into a tortuous exhaust gas passageway 32 formed between the outer body member 23 and the intermediate body member 22. The exhaust gas passageway 32 is formed by a plurality of annular chambers 33 defined by a plurality of corresponding circumferential heat exchange fins 34 extending from the intermediate body member 22 and sealably engaging the outer body member 23. Longitudinally extending communicating grooves 35 extend through the fins 34 for communicating adjacent annular chambers 33. The grooves 35 through the fins 34 are staggered relative to the bores of the adjacent fins 34 for forming the tortuous exhaust gas passageway 32 in conjunction with the annular chambers 33. The exhaust gas passageway 32 terminates in a downstream exhaust gas outlet 37 through which exhaust gases are exhausted to atmosphere. A gauze panel 38 extends across the exhaust port 30 to act as a flame trap in order to prevent the flame in the flame ignition chamber 29 extending into the exhaust gas passageway 32.

A gaseous fluid accommodating means comprising a tortuous gaseous fluid passageway, namely, an air passageway 40 accommodates air through the heat exchanger 20 for heating thereof for supply to the vaporisation chamber 10. The air passageway 40 is located between the inner body member 21 and the intermediate body member 22, and is formed by a plurality of annular chambers 41 which are formed by a plurality of corresponding circumferential heat exchange fins 42 which extend from the inner body member 21 and sealably engage the intermediate body

member 22. A plurality of longitudinally extending communicating grooves 43 extend through the heat exchange fins 42 for communicating adjacent annular chambers 41 to form the air passageway 40. The communicating grooves 43 of adjacent fins 42 are staggered for forming the air passageway 40 as a tortuous air passageway. The air passageway 40 terminates in an upstream air inlet 45 and a downstream air outlet 46 through which hot air is delivered into the vaporisation chamber 10 for vaporising the tobacco 2 therein.

Accordingly, the air passageway 40 and the exhaust gas passageway 32 are located adjacent each other, and are arranged so that the exhaust gases in the exhaust gas passageway 32 and the air in the air passageway 40 are separated from each other and flow in the respective passageways 32 and 40 in contra-flow relative to each other. Arranging the respective passageways 32 and 40 in contra-flow relative to each other maximises the efficiency with which heat can be recovered from the exhaust gases.

The intermediate body member 22 terminates in an engagement means, namely, an engagement plug 48 for engaging in an upstream receiving portion 49 of the vaporisation chamber 10 of the holder 5. An O-ring seal 50 located in an annular groove 51 extending around the plug 48 sealably engages the receiving portion 49 of the vaporisation chamber 10. The downstream outlet 46 from the air passageway 40 terminates in a central bore 52 of the intermediate body member 22 so that hot air from the downstream air outlet 46 is accommodated into the vaporisation chamber 10 through the central bore 52. A gauze screen 53 is located across the

central bore 52 for preventing particles of the tobacco 2 entering the air passageway 40.

The inner body member 21 terminates at its end opposite to the engagement plug 48
5 in a mounting means, namely, a mounting plug 55 for receiving a reservoir 56 for
storing fuel gas in liquid form for supply to the fuel gas supply control system 27.
Fuel gas from the reservoir 56 is delivered to a fuel gas supply pipe 60 of the fuel
gas supply control system 27. The fuel gas is delivered from the fuel gas supply
pipe 60 into a temperature responsive fuel gas cut-out valve 61. Fuel gas from the
10 cut-out valve 61 is supplied through a thermostatically responsive valve 62 to a
nozzle outlet 63. The temperature responsive cut-out valve 61 and the
thermostatically responsive valve 62 are described in more detail below. A venturi
mixer 65 formed in the inner body member 21 receives fuel gas from the nozzle
outlet 63 and mixes the fuel gas with air. An air inlet 66 accommodates air to the
15 venturi mixer 65. The fuel gas/air mixture from the venturi mixer 65 is delivered
through an elongated central bore 67 extending from the venturi mixer 65 into the
combustion chamber 25.

An electrode 70 extends into the flame ignition chamber 29 and is powered by a
20 piezo-electric igniter (not shown) for igniting the fuel gas/air mixture initially to burn in
a flame in the flame ignition chamber 29. The electrode 70 terminates in a tip (not
shown) which is spaced apart from the end plug 28 to define a spark gap, across
which a spark jumps on activation of the piezo-electric igniter (not shown) for igniting
the fuel gas/air mixture to burn in a flame. The flame ignition chamber 29 is located

relative to the combustion chamber 25 so that the root of the flame sits adjacent the catalytic combustion element 26 for raising the temperature of the catalytic combustion element 26 to its ignition temperature. Thus, when the catalytic combustion element 26 is raised to its ignition temperature and commences to
5 convert fuel gas to heat, the flame is starved of fuel gas and is automatically extinguished.

An inspection port 71 extends through the inner, intermediate and outer body members 21, 22 and 23 into the flame ignition chamber 29 and the combustion
10 chamber 25 for facilitating inspection of the flame and the gas catalytic combustion element.

A thermal mass 72 is attached to the catalytic combustion element 26 for retaining the catalytic combustion element 26 adjacent the thermal mass 72 at its ignition
15 temperature for temporary periods during temporary interruption of fuel gas/air mixture to the combustion chamber 25, resulting from control of the supply of fuel gas to the combustion chamber 25 by the thermostatically responsive valve 62 for controlling the temperature of the heat exchanger 20. The thermal mass 72 may be provided by any suitable mass which has a relatively high capacity to store and
20 conduct heat. For example, the thermal mass may comprise a relatively small block of metal secured to the catalytic combustion element 26, and a particularly suitable thermal mass would be a screw with a relatively large head secured to the catalytic combustion element 26 by a nut such that the head, nut and screw would act as the thermal mass.

Returning now to the temperature responsive cut-out valve 61 and the thermostatically responsive valve 62, both valves 61 and 62 are substantially similar to a safety cut-out valve and a thermostatically responsive valve which are described in detail in PCT Published Patent Application Specification No. WO 02/48591 A1. Briefly, referring now to Fig. 4, the temperature responsive cut-out valve 61 comprises a housing 75 through which a fuel gas accommodating bore 76 extends from the pipe 60. A porous filter member 77 is located in the bore 76 for filtering fuel gas passing therethrough. A temperature sensitive member 78 is also located in the bore 76. The temperature sensitive member 78 is of plastics material impregnated with glass fibre particles. The plastics material of the member 78 has a melt temperature which is a function of the maximum temperature over which the heat exchanger 20 should not exceed, so that should the temperature of the heat exchanger 20 exceed the maximum temperature, the plastics material of the temperature sensitive member 78 melts, and the melting plastics material with the glass fibre particles block the filter member 77, thus isolating the fuel gas supply control system 27 from the fuel gas supply from the reservoir 56.

The thermostatically responsive valve 61 comprises a housing 79 from which the housing 75 extends, and the housing 79 defines a valving chamber 80 within which a bi-metal circular temperature responsive disc 81 is located. The fuel gas accommodating bore 76 through the housing 75 terminates in a fuel gas inlet 82 to the valving chamber 80 for accommodating fuel gas into the fuel gas chamber 80. The disc 81 carries a valving member 84, which co-operates with the inlet 82 for

varying the flow rate of fuel gas through the inlet 82 in response to the temperature of the heat exchanger 20. The bi-metal disc 81 is of the type described in PCT Published Application Specification No. WO 02/48591 A1, which when unconstrained transitions between two states which are mirror images of each other at a respective upper transition temperature and a lower transition temperature. However, the bi-metal disc 81 is constrained within the valve chamber 80 to prevent such transitioning, so that the bi-metal disc 81 operates the valving member 84 for controlling the flow of fuel gas through the valve inlet 82 with an analogue type action. This is described in detail in PCT Published Application Specification No. WO 02/48591.

The bi-metal disc 81 of the thermostatically responsive valve 62 is selected to control the supply of fuel gas to the combustion chamber 26, so that the heat exchanger 20 is maintained at an appropriate temperature for heating the air being delivered to the vaporisation chamber within a temperature range which is suitable for vaporising the vaporisable components of the tobacco to be vaporised. In this embodiment of the invention the air temperature is maintained at a temperature in the range of 130°C to 250°C. However, it is important that the temperature of the air delivered to the vaporisation chamber 10 should be sufficient to vaporise the compounds to be vaporised, but should be such as to avoid releasing carcinogens from the tobacco.

The housings 75 and 79 are of heat conductive material, and are in heat conducting relationship with each other. The housing 79 of the thermostatically responsive valve 62 is in direct heat conducting engagement with the inner body member 21 so

that the housings 79 and 75 are maintained at a temperature substantially similar to the temperature of the inner body member 21. A circlip 85 is located in an annular internal groove 86 formed in a central bore 87 of the inner body member 21, and a spring 88 acting between the circlip 85 and the housing 79 of the thermostatically responsive valve 62 urges the housing 79 of the valve 62 into tight heat conducting engagement with the heat exchanger 20. If there is a temperature drop between the housings 75 and 79 and the inner body member 21, this is taken account of by appropriately selecting the melt temperature of the plastics material of the temperature sensitive member 78 of the temperature responsive cut-out valve 61 and appropriately selecting the bi-metal disc 81 of the thermostatically responsive valve 62.

Additional fuel gas control mechanisms, for example, an on/off switch and a fuel gas flow control switch, as well as a fuel gas pressure regulator may also be provided, and these, typically, will be located between the fuel gas reservoir 56 and the device 8.

A groove 89 is formed in the outer body member 23 adjacent the engagement plug 48 for engaging corresponding toggle clasps (not shown) extending from the holder 5 for securing the device 8 to the holder 5. A groove 90 is provided in the inner body member 21 adjacent the mounting plug 55 for engaging corresponding toggle clasps (also not shown) extending from the fuel gas reservoir 56 for securing the fuel gas reservoir 56 to the device 8.

An outer cylindrical casing 92 is provided around the outer body member 23 in order to avoid any danger of a user coming in contact with the heat exchanger 20.

In use, the tobacco 2 in flake form to be vaporised is placed in the vaporisation
5 chamber 10 in the holder 5, and the device 8 is then secured to the holder 5 with the
engagement plug 48 engaged in the upstream portion 49 of the vaporisation
chamber 10, and the device 8 is then secured by the toggle clamps (not shown) to
the holder 5. Initially the fuel gas supply from the fuel gas reservoir 56 is switched
on, and by operating the piezo-electric igniter (not shown) a spark which arcs
10 between the electrode 70 and the end plug 28 ignites the fuel gas/air mixture from
the venturi mixer 65 to burn in the flame ignition chamber 29 with a flame. The flame
rapidly raises the catalytic combustion element 26 to its ignition temperature, which
in turn commences to convert the fuel gas/air mixture to heat by catalytic reaction,
thus starving the flame of fuel gas which is extinguished. Thereafter the heat
15 exchanger 20 is heated by catalytic conversion of the fuel gas/air mixture to heat by
the catalytic combustion element 26.

In order to inhale vaporised compounds from the tobacco 2, a user draws on the
mouthpiece, which in turn draws air through the air passageway 40, which is heated
20 by the heat exchanger 20, and in turn is drawn into the vaporisation chamber 10.
The hot air is drawn through the tobacco 2, thereby vaporising the components
therein to be vaporised. The air with the vaporised components entrained therein is
drawn through the mouth piece 11 and inhaled by the individual. Each time the
individual draws on the mouthpiece 11, hot air with the vaporised components

entrained therein is drawn and can thus be inhaled.

The advantages of the apparatus according to the invention are many. The main advantage of the invention is that only air and vaporised components from the tobacco are drawn by the individual. There is no danger of any products of combustion being drawn through the mouthpiece, since the air passageway 40 is separated from the exhaust gas passageway 37. Thus, a person using the device according to the invention to vaporise vaporisable matter placed in the vaporisation chamber is not subjected to any products of combustion, and in particular, is not subjected to carcinogenic products of combustion.

Referring now to Fig. 5, there is illustrated an engagement plug indicated by the reference numeral 95 for use with a device (not shown) according to another embodiment of the invention for providing a hot gaseous fluid, namely, air, for vaporising the vaporisable matter in the vaporisation chamber 10 of apparatus (also not shown) according to this embodiment of the invention. The device and the apparatus according to this embodiment of the invention are substantially similar to the device 8 and the apparatus 1 described with reference to Figs. 1 to 4, with the exception of the engagement plug 95. The engagement plug 95 is used in place of the engagement plug 48 for closing the flame ignition chamber 29 of the device 8 of Fig. 2. However, additionally, as well as acting to close the flame ignition chamber 29, the engagement plug 95 also acts to distribute the hot air from the air passageway 40 to the central bore 52. The engagement plug 95 comprises a pair of spaced apart discs, namely, an inner disc 96 and an outer disc 97 which are joined

by a central core 98, and when located in the inner body member 21, the discs 96 and 97 define with the inner body member 21 and the central core 98 an annular air chamber 99. Bores 100 extending through the inner disc 96 align with the downstream outlet 46 from the air passageway 40 for accommodating hot air from the downstream outlet 46 into the annular air chamber 99. A plurality of circumferentially and radially spaced apart outlet bores 101 through the outer disc 97 accommodate hot air from the annular air chamber 99 for distributing the hot air into the central bore 52 for in turn distributing the hot air evenly throughout the vaporisation chamber 10.

10

An earthed electrode 104 extends centrally from the inner disc 96 into the flame ignition chamber 29 and defines with the tip (not shown) of the electrode 70 a spark gap across which a spark arcs on activation of the piezo-electric igniter for in turn igniting the fuel gas to burn with a flame in the flame ignition chamber 29.

15

Otherwise, the engagement plug 95 acts to close off the flame ignition chamber 29, and the bores 100 are appropriately located in the inner disc 96 to avoid any danger of the products of combustion in the flame ignition chamber 29 mixing with the hot air being delivered from the downstream air outlet 46 into the bores 100 in the inner disc 96.

20

The remainder of the device and the apparatus according to this embodiment of the invention is similar to the device 8 and apparatus 1 described with reference to Figs. 1 to 4, and its use is also similar.

While the exhaust gas passageway and the air passageway have been described as being formed by a plurality of respective adjacent communicating annular chambers, it is envisaged that any suitably shaped passageways may be provided, for example, in certain cases, it is envisaged that the exhaust gas and air passageways may be of helical construction.

Additionally, it will be appreciated that while the apparatus according to the invention has been described with the holder and the device for producing the hot air being arranged in axial alignment with each other, so that the construction of the apparatus according to the invention is substantially similar to that of a cigarette holder, it is envisaged in certain cases that the apparatus according to the invention may be constructed to be of shape substantially similar to a tobacco smoking pipe, and in which case, it is envisaged that the vaporisation chamber would extend substantially perpendicularly from the mouthpiece, and the device for providing the hot air to the vaporisation chamber would be aligned in substantially straight or axial alignment with the vaporisation chamber. Needless to say, many other constructions, shapes and configurations of the device are envisaged, which will be readily apparent to those skilled in the art.

20

While the apparatus according to the invention has been described for vaporising vaporisable components in tobacco, it will be readily apparent to those skilled in the art that the apparatus may be used for vaporising vaporisable components in any herb, plant matter, essential oils, or, indeed, any other matter which is vaporisable,

or comprises components which may be vaporised. Where the apparatus is to be used for vaporising essential oils, or other liquid matter, the vaporisation chamber will be appropriately shaped and arranged for retaining the liquid matter so that the hot air passes over the liquid surface of the liquid matter.

5

While the means for igniting the fuel gas/air mixture to burn with a flame in the flame ignition chamber has been described as a piezo-electric igniter which delivers a charge to an electrode for causing a spark to arc in the flame ignition chamber, any other suitable ignition means may be used. Indeed, in certain cases, an electrically powered hot wire element may be used, and indeed, in certain cases, a flint ignition mechanism may be used. It is also envisaged that the catalytic combustion element may be raised to its ignition temperature by means other than a flame, for example, by an electrically powered heating element, or by any other suitable means.

Needless to say, it will be appreciated that the ignition means may be dispensed with, and ignition of the fuel gas/air mixture to initially burn in a flame for raising the temperature of the catalytic combustion element to its ignition temperature may be initiated manually by a match, a flint spark, or by other suitable means.

While the heat exchange fins extending from the inner body member have been described as being in sealable engagement with the intermediate body member, and the heat exchange fins extending from the intermediate body member have been described as being in sealable engagement with the outer body member, it is envisaged in certain cases, that the heat exchange fins need not be in sealable engagement with the corresponding intermediate and outer body member. In certain

cases, it is envisaged that a small clearance may be provided between the heat exchange fins and the corresponding intermediate or outer body member.

Needless to say, while the combustion chamber has been described as being
5 coaxial with the housing which forms the heat exchanger, the combustion chamber may be located in any orientation relative to the heat exchanger, and indeed, in certain cases, the combustion chamber may be formed externally of the heat exchanger but in heat conductive engagement with the heat exchanger. For example, in certain cases, it is envisaged that the combustion chamber may be
10 located adjacent the heat exchanger, and the combustion chamber may define a central axis which would extend substantially parallel to the central axis of the heat exchanger.

While the gaseous fluid accommodating means for accommodating the gaseous
15 fluid through the heat exchanger for heating thereof has been described as comprising a tortuous gaseous fluid passageway, it is envisaged that the gaseous fluid accommodating means may be provided as a porous filter, which would be located in the heat exchanger through which the air or other gaseous fluid to be heated would be drawn. Preferably, the porous filter would be of a heat conductive
20 material for enhancing heat transfer to the air being drawn through the filter, and advantageously, it is envisaged that the filter may be a sintered filter. Where a porous filter is provided for accommodating the gaseous fluid therethrough, it is envisaged that the porous filter may be in the form of an annular filter, which would extend around the inner body member and would be located between the inner body

member and the intermediate body member in heat conducting engagement with both the inner and the intermediate body members. Alternatively, the porous filter may be located in a bore extending through the heat exchanger. Needless to say, other suitable arrangement, construction and location of a porous filter in the heat exchanger may be used without departing from the scope of the invention.

While the exhaust gases from the combustion chamber have been described as being directed through an exhaust gas passageway for facilitating recovery of heat from the exhaust gases, while this is advantageous, it is not essential, and in certain cases, it is envisaged that the exhaust gases may be directly outputted to atmosphere from the combustion chamber.

It is also envisaged that a control valve may be provided for controlling the rate at which air can be drawn through the air passageway.

While an O-ring has been described for sealing between the engagement plug extending from the intermediate body member, and the vaporisation chamber, in certain cases, it is envisaged that the O-ring may be omitted.

While the thermostatically responsive valve for controlling the flow of fuel gas to the venturi mixer has been described, any other suitable thermostatically responsive valves may be used. For example, in certain cases, it is envisaged that a battery in an electrically powered self-latching relay may be used, which may be powered, for example, by a relatively small battery. Needless to say, any other suitable

thermostatically responsive valves may be used.

Additionally, it is envisaged that an on/off switch provided for switching the fuel gas on and off to the device from the reservoir may be coupled to the ignition means for
5 igniting the fuel gas to burn with a flame in the flame ignition chamber. For example, it is envisaged that the fuel gas on/off switch may be coupled to the piezo-electric igniter for activating the piezo-electric igniter to deliver a burst of electrical energy to the electrode in the flame ignition chamber each time the on/off switch is switched on.

10

It is also envisaged that an evaporator may be provided in an outlet from the reservoir for evaporating fuel gas as it exits the reservoir outlet, and in certain cases, it is envisaged that the evaporator may be provided by a sintered filter, which may, for example, be of the type which would permit a flow rate of the order of 9gms to
15 30gms per hour from the reservoir.

The invention is not limited to the embodiment hereinbefore described, which may be varied in construction and detail.

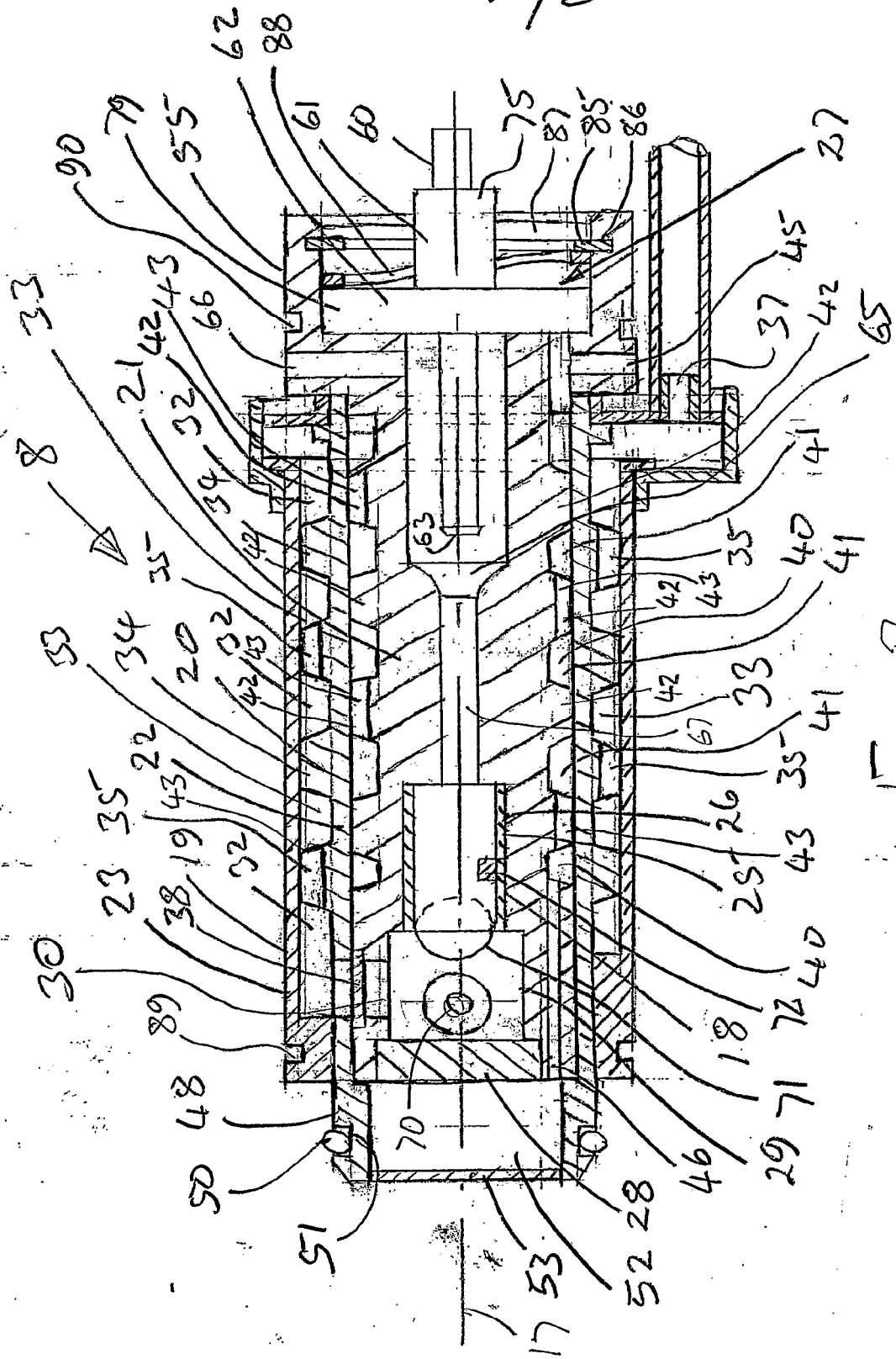
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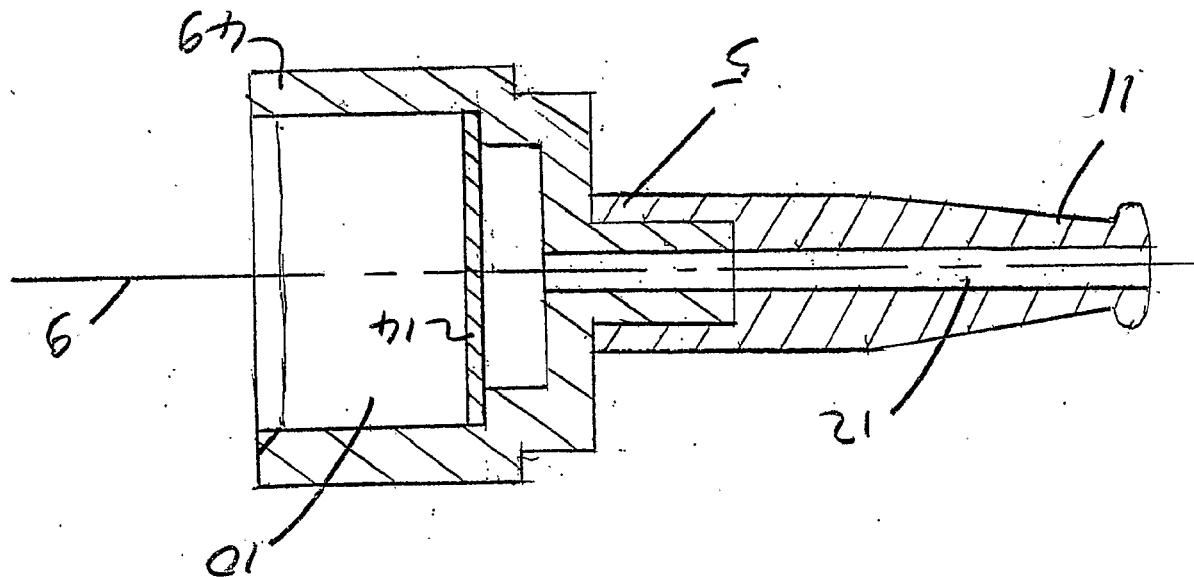


FIG 3

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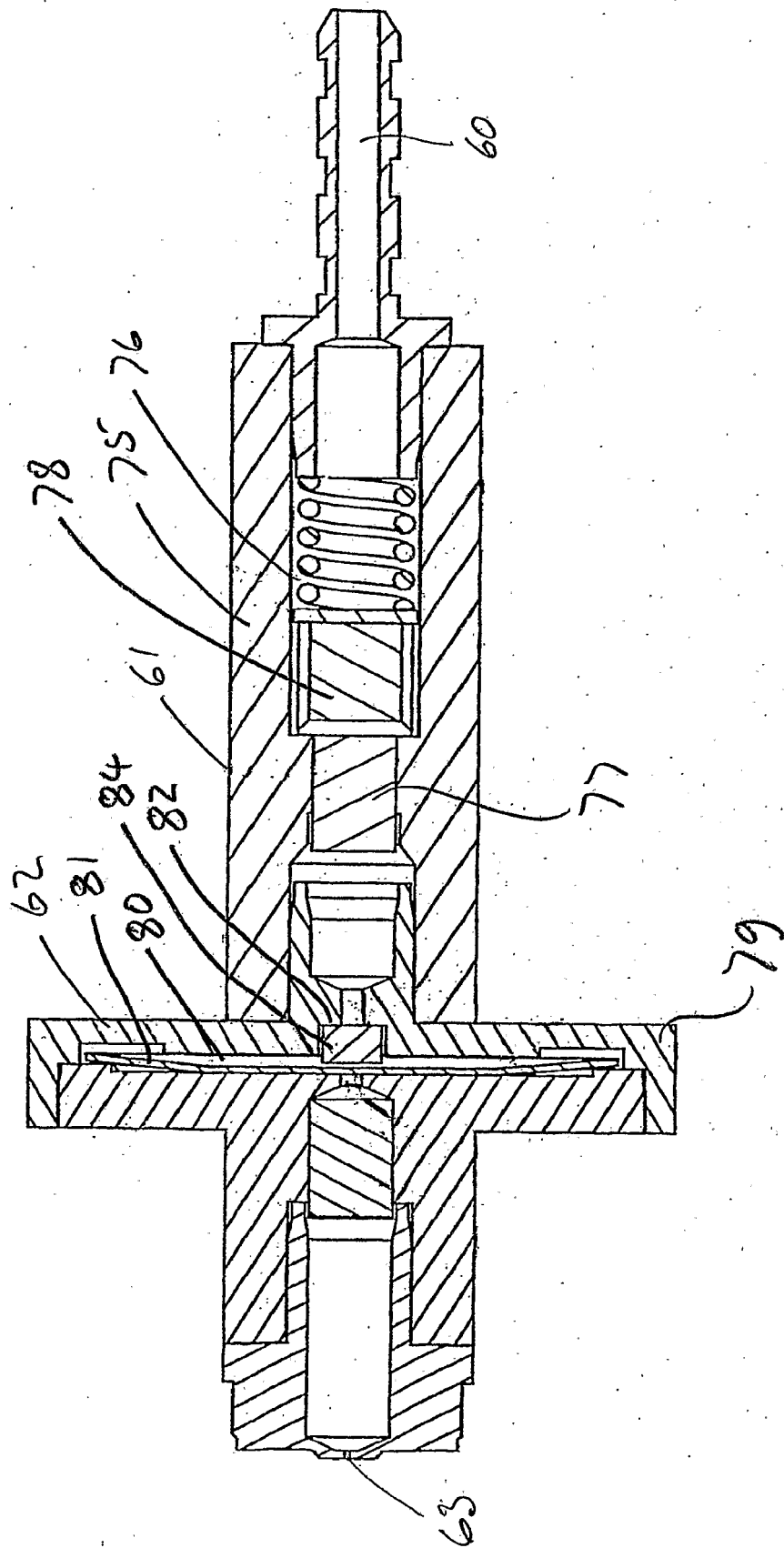


FIG 4

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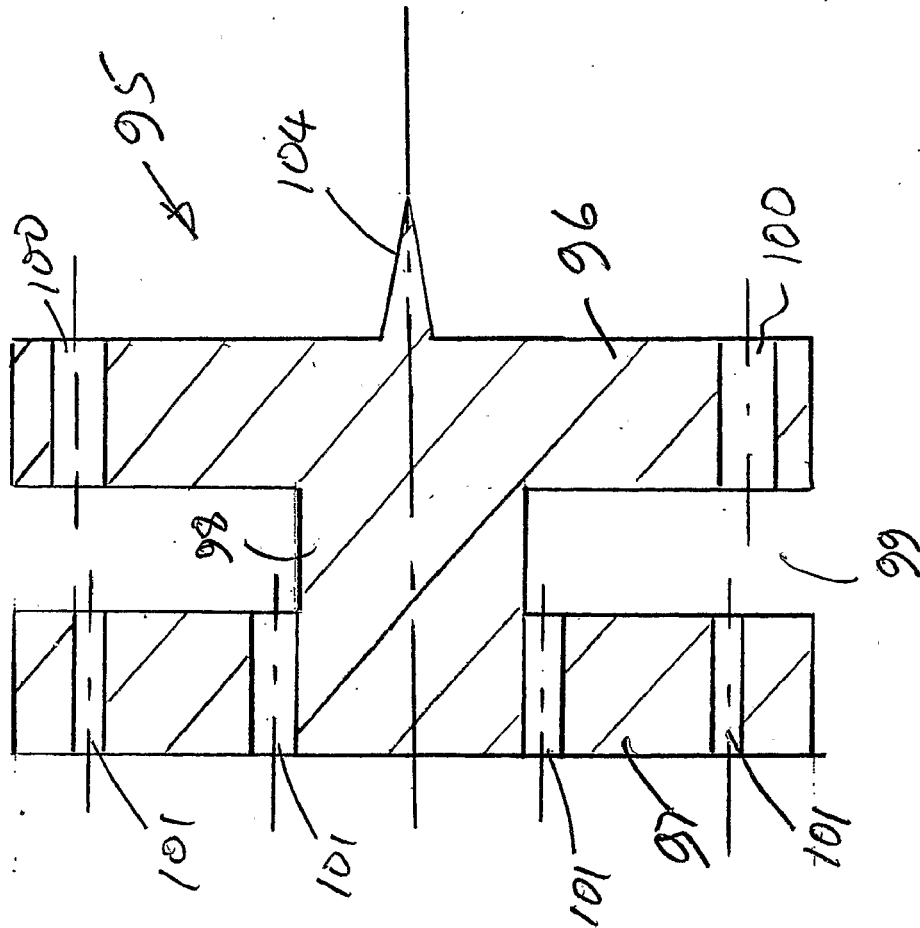


FIG 5

Document made available under the Patent Cooperation Treaty (PCT)

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International filing date: 02 February 2006 (02.02.2006)

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Number: S2005/0563
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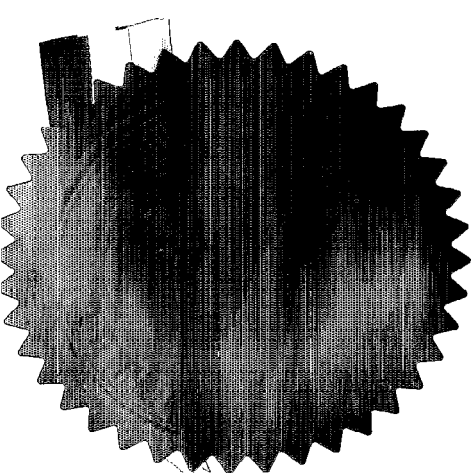
I HEREBY CERTIFY that annexed hereto is a true copy of documents filed in connection with the following patent application:

Application No. S2005/0563

Date of Filing 24 August 2005

Applicant OGLESBY & BUTLER RESEARCH & DEVELOPMENT, an Irish company of Industrial Estate, Dublin Road, Carlow, Ireland.

Dated this 9 day of February 2006.



An officer authorised by the
Controller of Patents, Designs and Trademarks.

REQUEST FOR THE GRANT OF A PATENT

PATENTS ACT, 1992

The Applicant(s) named herein hereby request(s)

☐

the grant of a patent under Part II of the Act

☒

the grant of a short-term patent under Part III of the Act

on the basis of the information furnished hereunder.

1. Applicant(s)

Name

OGLESBY & BUTLER RESEARCH
& DEVELOPMENT LIMITED

Address

Industrial Estate, Dublin Road, Carlow, Ireland.

Description/Nationality

An Irish company.

2. Title of Invention

"A device for vaporising vaporisable matter"

**3. Declaration of Priority on basis of previously filed
application(s) for same invention (Sections 25 & 26)**

Previous filing date

Country in or for which
filed

Filing No.

4. Identification of Inventor(s)

Name(s) of person(s) believed

by Applicant(s) to be the inventor(s)

ALFRED PETER OGLESBY and JOHN PAUL OGLESBY

Address

A British subject of Castle Hill, Carlingford, County Louth, Ireland; and
A British subject of Anneville, Shrulue, Carlow, Ireland.

5. Statement of right to be granted a patent (Section 17 (2) (b))

The applicant has derived the right to be granted a Patent from the inventors by virtue of a Deed of Assignment dated August 23. 2005.

6. Items accompanying this request – tick as appropriate

- (i) ☒ Prescribed filing fee (€60.00)
- (ii) ☐ Specification containing a description and claims
- ☒ Specification containing a description only
- ☒ Drawings referred to in description or claims
- (iii) ☐ An abstract
- (iv) ☐ Copy of previous application(s) whose priority is claimed
- (v) ☐ Translation of previous application whose priority is claimed
- (vi) ☐ Authorisation of Agent (this may be given at 8 below if this Request is signed by the Applicant(s))

7. Divisional Application(s)

The following information is applicable to the present application which is made under Section 24 –

Earlier Application No:

Filing Date:

24 AUG 2005

8. Agent

The following is authorised to act as agent in all proceedings connected with the obtaining of a patent to which this request relates and in relation to any patent granted –

Name

Address

F.F. GORMAN & CO.

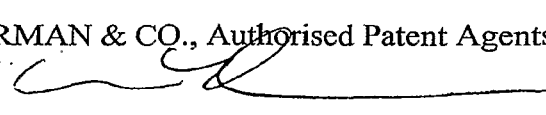
15 Clanwilliam Square,
Dublin 2,
Ireland.

9. Address for Service (if different from that at 8)

F.F. GORMAN & CO., at its address as recorded for the time being in the Register of Patent Agents.

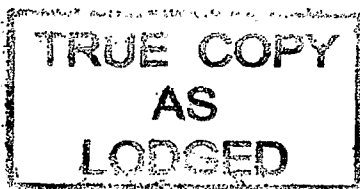
Signed

F.F. GORMAN & CO., Authorised Patent Agents

BY:  EXECUTIVE

Date

August 24. 2005



S05 / 9563

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"A device for vaporising vaporisable matter"

The present invention relates to a device for vaporising vaporisable matter for facilitating inhaling of the vaporised matter. For example, the device is suitable for vaporising vaporisable matter which comprises one or more of flavour components, medicinal components and psychoactive components, such as tobacco, mullein, passion flower, cloves, yohimbe, mint, tea, eucalyptus, camomile and other such herbs and plant matter.

Herbs, for example, tobacco and the like are smoked by burning, in order to release psychoactive compounds, which are then inhaled. The psychoactive compounds are released into the fumes of combustion, which are then inhaled. However, burning of such herbs as well as producing psychoactive compounds also produces toxins, which largely result from the actual combustion process. Such toxins are known to be carcinogenic, and also can result in lung and heart disease. Thus, the smoking of such herbs and other such plant matter is hazardous and undesirable. An alternative to releasing flavour, medicinal and psychoactive compounds from such herbs and plant matter by smoking is to raise the temperature of the herb to an appropriate temperature for causing the vaporisable constituent or constituents to be vaporised, and then inhale the vaporised constituent or constituents. However, the temperature range at which such compounds can be vaporised in herbs and plant matter ranges from approximately 130°C to 250°C. If the temperature is below 130°C, in general, vaporisation does not occur. However, if the temperature to which the herb or plant matter is heated exceeds 300°C, combustion of the herb or

plant matter may commence. Thus, in order to satisfactorily vaporise flavour, medicinal and psychoactive constituents in herbs and plant matter, the temperature at which the herb or plant matter is maintained for producing the vaporised compounds must be controlled within reasonably tight tolerances.

5

It is known to provide apparatus for vaporising desirable constituents from herbs by electrically heating the herb. However, due to the energy requirements of such apparatus, a mains electricity supply is required to power the apparatus, and thereby the apparatus is not portable when in use. This thus renders a person immobile

10 when using such apparatus. An alternative device for vaporising vaporisable constituents in herbs and plant matter is disclosed in U.S. published Patent Application Specification No. 2004/0031495 of Steinberg. Steinberg discloses a pipe which is substantially similar to a smoking pipe in which the herb, typically, tobacco to be vaporised is located in a bowl portion of the pipe. A heat resistant and porous

15 flame filter is located in the bowl above the herb, and a flame from a match or cigarette lighter is used to heat the porous filter while air is being drawn through the pipe. Thus, a mixture of air and the products of combustion from the flame are mixed in the porous filter and drawn through the herb in the bowl for heating the herb for in turn vaporising desirable constituents in the herb. The mixture of air, the

20 products of combustion and the vaporised constituent are then drawn through a mouthpiece of the pipe and inhaled. However, due to the fact that the flame is played on the heat resistant porous flame filter, there is a danger of the flame being drawn through the filter and thus causing combustion of the herb in the bowl of the pipe. However, even where the herb does not combust, the products of combustion

of the flame are inhaled along with the vaporised constituent. This is undesirable.

There is therefore a need for a device for vaporising vaporisable matter which overcomes this problem.

5

The present invention is directed towards providing such a device.

According to the invention there is provided a device for vaporising vaporisable matter, the device comprising a vaporising chamber for the vaporisable matter, a
10 combustion chamber within which fuel gas is converted to heat, a heat transfer means for transferring heat from the combustion chamber to the vaporising chamber for vaporising the vaporisable matter therein.

In one embodiment of the invention the device comprises a body member of heat
15 conducting material, and the combustion chamber is formed in the body member, the vaporising chamber being coupled to the body member and being in heat conducting engagement therewith so that the body member acts as the heat transfer means.

20 Preferably, the vaporising chamber is releasably coupleable to the body member.

In another embodiment of the invention at least one heat transfer member extends into the vaporising chamber for engaging the vaporisable matter for heating thereof. Advantageously, a plurality of spaced apart heat transfer members extend into the

vaporising chamber, and ideally, each heat transfer member is an elongated heat transfer member.

In one embodiment of the invention an outlet is provided from the vaporising
5 chamber for drawing vapour from the vaporisable matter from the vaporising
chamber, and preferably, the outlet terminates in a mouthpiece for facilitating
drawing the vaporisable matter into the mouth.

In another embodiment of the invention an air inlet is provided to the vaporising
10 chamber for facilitating air being drawn into the vaporising chamber as the vapour
from the vaporisable matter is being drawn through the outlet therefrom.

Additionally or alternatively, a heat exchange means is provided for co-operating
with the combustion chamber for transferring heat from the combustion chamber to a
15 heat transfer gaseous fluid for heating thereof and the heat transfer gaseous fluid
acts as the heat transfer means for transferring heat from the combustion chamber
to the vaporising chamber.

Preferably, the heat exchange means communicates with the vaporising chamber for
20 delivering the heated gaseous fluid into the vaporising chamber for heating the
vaporisable matter therein.

Preferably, a portion of the vaporisable chamber is perforated for accommodating
the heated gaseous fluid from the heat exchange means to the vaporising chamber.

In one embodiment of the invention the heat exchange means is located in the body member.

- 5 Preferably, an exhaust gas chamber is formed in the body member, and an exhaust port from the combustion chamber communicates exhaust gases from the combustion chamber to the exhaust gas chamber. Ideally, a heat exchange chamber is located in the body member, and the heat exchange means comprises a heat exchanger, which is located in the heat exchange chamber. In one
- 10 embodiment of the invention an air inlet is provided to the heat exchange chamber for accommodating air thereto, and an air outlet is provided from the heat exchange chamber for delivering heated air from the heat exchanger chamber to the vaporising chamber.
- 15 In one embodiment of the invention the body member terminates at one end in a coupling member for coupling the vaporising chamber to the body member.

Preferably, a gas catalytic combustion element is located in the combustion chamber for converting fuel gas to heat by catalytic reaction.

20

In one embodiment of the invention a flame ignition chamber is located adjacent the combustion chamber for facilitating initial flame ignition of the fuel gas for in turn raising the temperature of the gas catalytic combustion element to its ignition temperature, and ideally, the flame ignition chamber is located adjacent the

combustion chamber so that as the gas catalytic combustion element is raised to its ignition temperature by the flame ignition, the flame is starved of fuel gas and is extinguished.

- 5 Ideally, an ignition means is provided for igniting the fuel gas to initially burn with a flame, and preferably, the ignition means comprises at least one electrode for generating a spark for igniting the fuel gas to burn with a flame in the flame ignition chamber.
- 10 In another embodiment of the invention a thermostatically responsive valve is provided for controlling the flow of fuel gas to the combustion chamber, and preferably, the thermostatically responsive valve is in direct or indirect heat conducting engagement with the body member. Advantageously, the thermostatically responsive valve defines a valving chamber, and a bi-metal disc
- 15 located in the valving chamber, the bi-metal disc co-operating with one of a valve inlet and a valve outlet to the valving chamber for controlling the flow of fuel gas through the valving chamber in response to temperature. Ideally, the bi-metal disc is of the type which transitions from one state to another state, which are mirror images of each other, as the temperature of the disc exceeds a predetermined transition
- 20 temperature, and the disc is constrained within the valving chamber to prevent transitioning of the disc from one of said states to the other.

In one embodiment of the invention the thermostatically responsive valve is suitable for controlling the temperature of the heat exchanger so that the temperature of the

vaporisable matter in the vaporising chamber lies in the range of 100°C to 500°C.

In another embodiment of the invention the thermostatically responsive valve is suitable for controlling the temperature of the heat exchanger so that the
5 temperature of the vaporisable matter in the vaporising chamber lies in the range of 125°C to 400°C.

In a further embodiment of the invention the thermostatically responsive valve is suitable for controlling the temperature of the heat exchanger so that the
10 temperature of the vaporisable matter in the vaporising chamber lies in the range of 130°C to 300°C.

In a still further embodiment of the invention the thermostatically responsive valve is suitable for controlling the temperature of the heat exchanger so that the
15 temperature of the vaporisable matter in the vaporising chamber lies in the range of 150°C to 250°C.

In another embodiment of the invention a temperature responsive fuel gas cut-out means is provided for isolating the combustion chamber from a fuel gas supply in the
20 event of the temperature of the heat exchanger exceeding a predetermined safe maximum temperature. Preferably, the fuel gas cut-out means comprises a temperature sensitive member located in a fuel gas passageway through which fuel gas is delivered to the combustion chamber, the temperature sensitive member having a melt temperature which is a function of the predetermined safe maximum

temperature, so that when the temperature of the body member reaches the predetermined safe temperature, the temperature sensitive member melts, thus blocking the fuel gas passageway. Ideally, the temperature sensitive member is located adjacent a porous filter so that on melting of the temperature sensitive member the melting material of the temperature sensitive member blocks the porous filter.

In one embodiment of the invention a fuel gas supply means is provided in the body member for supplying fuel gas to the combustion chamber.

10

In another embodiment of the invention a fuel gas reservoir is provided for supplying fuel gas to the fuel gas supply means, and preferably, the fuel gas reservoir is coupled to the housing.

15 Ideally, the fuel gas supply means comprises a mixing means for mixing the fuel gas with air for delivery to the combustion chamber.

The invention will be more clearly understood from the following description of some embodiments thereof, which are given by way of example only, with reference to the accompanying drawings, in which:

20

Fig. 1 is a perspective view of a device according to the invention for vaporising vaporisable matter,

Fig. 2 is a cutaway perspective view of the device of Fig. 1,

Fig. 3 is a side elevational view of the device of Fig. 1,

5 Fig. 4 is an end view in the direction of the arrow A of the device of Fig. 3,

Fig. 5 is a transverse cross-sectional side elevational view of the device of Fig. 1 on the line V-V of Fig. 3,

10 Fig. 6 is a transverse cross-sectional side elevational view of the device of Fig. 1 on the line VI-VI of Fig. 3,

Fig. 7 is a transverse cross-sectional end elevational view of the device of Fig. 1 on the line VII-VII of Fig. 3,

15 Fig. 8 is a transverse cross-sectional side elevational view of the device of Fig. 1 on the line VIII-VIII of Fig. 3,

Fig. 9 is a perspective view of a portion of the device of Fig. 1,

20

Fig. 10 is a side elevational view of the portion of Fig. 9 of the device of Fig. 1,

Fig. 11 is an end elevational view of the portion of Fig. 9 of the device of Fig.

1,

Fig. 12 is a top plan view of the portion of Fig. 9 of the device of Fig. 1,

5 Fig. 13 is a transverse cross-sectional side elevational view of the portion of Fig. 9 on the line XIII-XIII of Fig. 10 of the device of Fig. 1,

Fig. 14 is a plan view of a device according to another embodiment of the invention for vaporising vaporisable matter, and

10

Fig. 15 is a transverse cross-sectional side elevational view of a portion of the apparatus of Fig. 14 on the line XV-XV of Fig. 14.

Referring to the drawings, and initially to Figs. 1 to 13, there is illustrated a device according to the invention, indicated generally by the reference numeral 1, for vaporising vaporisable matter, typically, tobacco and other herbs or oils for providing vaporised flavour compounds, medicinal compounds and/or vaporised psychoactive compounds, suitable for inhaling by an individual. The device 1 comprises a body member 2 of heat conductive material, in this embodiment of the invention brass, 15 within which a combustion chamber 3 is formed. A gas catalytic combustion element 5 of cylindrical construction is located within the combustion chamber 3 for converting a mixture of fuel gas and air to heat. An exhaust gas chamber 7 is also formed in the body member 2, and an exhaust port 8 communicates the combustion 20 chamber 3 with the exhaust gas chamber 7 for delivering exhaust gases from the

combustion chamber 3 to the exhaust gas chamber 7. A heat exchange chamber 10 also formed in the body member 3 accommodates a heat exchange means, namely, a heat exchanger 12 for heating a heat transfer gaseous fluid, namely, air. The conversion of the fuel gas/air mixture to heat in the combustion chamber 3 and the exhaust gas from the combustion chamber 3 in the exhaust gas chamber 7 act to heat the body member 2, and in turn the heat exchanger 12 for heating air as it passes therethrough.

A vaporising chamber 15 of heat conductive material, namely, brass, is releasably coupled to the body member 2, as will be described below, for the vaporisable matter which is to be vaporised. The vaporising chamber 15 comprises a cylindrical side wall 16 and a perforated end wall 17 which is perforated with holes 18 for accommodating heated air from the heat exchanger 12, as will be described below, for heating the vaporisable matter in the vaporising chamber 15. The body member 2 terminates in a coupling member 19 for releasably coupling the vaporising chamber 15 to the body member, and a receiving chamber 20 formed in the coupling member 19 for receiving the vaporising chamber 15 therein communicates directly with an air outlet 21 from the heat exchanger 12 for accommodating heated air from the heat exchanger 12 into the vaporising chamber 15 through the holes 18 in the perforated end wall 17. The coupling member 19 is of heat conducting material, namely, brass, and is in heat conducting engagement with the body member 2 and the vaporising chamber 15 for conducting heat from the body member 2 to the vaporising chamber 15. The vaporising chamber 15 is releasably coupled to the coupling member 19 by a bayonet coupling mechanism 23, although any other

suitable releasable coupling may be used, for example, a magnetic coupling. Indeed, in certain cases the vaporising chamber 15 may be coupled to the body member by a non-releasable coupling. A plurality of spaced apart elongated heat transfer members 25 extend from the end wall 17 of the vaporising chamber 15 into the vaporising chamber 15 for engaging the vaporisable matter for transferring heat thereto for heating thereof.

The device 1 is portable, and is supplied with fuel gas from a fuel gas reservoir (not shown) which is coupled to the body member 2 by a coupling spigot 27 extending from the body member 2. A bore 28 extending through the spigot 27 delivers fuel gas from the reservoir (not shown) in series through a safety cut-out valve 29 and a temperature responsive valve 30 and in turn through a fuel gas supply means, comprising a venturi mixer 31 for mixing the fuel gas with air. The fuel gas/air mixture is delivered from the venturi mixer 31 into the combustion chamber 3 through a nozzle 32, where it is converted to heat by catalytic conversion by the catalytic combustion element 5.

A flame combustion chamber 33 is located in the body member 2 downstream of the combustion chamber 3 for initially igniting the fuel gas/air mixture to burn in a flame for raising the temperature of the gas catalytic combustion element 5 to its ignition temperature. The flame combustion chamber 33 and the combustion chamber 3 as well as the catalytic combustion element 5 are located relative to each other so that when the combustion element 5 is raised to its ignition temperature by the flame, the flame is rapidly starved of fuel gas/air mixture and extinguished, so that conversion

of the fuel gas/air mixture to heat is carried out exclusively by the catalytic reaction in the gas catalytic combustion element 5. An electrode (not shown) which is powered by a piezo-electric ignition device (also not shown) generates a spark in the flame combustion chamber 33 for igniting the fuel gas to initially burn in a flame.

5

Returning now to the safety cut-out valve 29 and the temperature responsive valve 30, both the cut-out valve 29 and the temperature responsive valve 30 are in heat conducting engagement with the body member and are similar to the safety cut-out valve and the thermostatically responsive valve which are both described in detail in

10 PCT published Patent Application Specification No. WO 02/48591 A1, and further description should not be required here.

15

The heat exchanger 12 comprises an elongated heat exchanging member 35 which is located in the heat exchange chamber 10. A plurality of axially spaced apart

15 circumferentially extending flanges 37 extend circumferentially around the heat exchanging member 35, which substantially sealably engage an inner surface 38 of the heat exchange chamber 10. When engaged in the heat exchange chamber 10 the heat exchanging member 35 defines a plurality of axially spaced apart annular chambers 39. An axially extending groove 40 extends axially through each groove

20 37 for communicating adjacent pairs of annular chambers 39. The axial grooves 40 are angularly staggered around the heat exchanging member 37 from flange 37 to flange 37 for defining with the annular chambers 39 a tortuous passageway for the air through the heat exchange chamber 10 for heating thereof.

An air inlet 41 through the body member 2 accommodates air into the heat exchange chamber 10, which in turn is directed through the tortuous passageway defined by the axial grooves 40 and the annular chambers 39, and in turn through an air port 42 communicating one of the annular chambers 39 with an axially extending bore 43, which extends through the heat exchanger 12. Heated air is accommodated through an air outlet 44 defined by an end 45 of the bore 43, and is delivered through a connecting member 47 from the outlet 44 of the heat exchanger 12 to the receiving chamber 20 of the coupling member 19, for in turn delivery into the vaporising chamber 15 through the perforated end wall 17.

10

An outlet 49 from the vaporising chamber 15 terminates in a mouthpiece (not shown) for facilitating drawing of the vapour from the vaporisable matter in the vaporising chamber 15 into the mouth. A typical mouthpiece is described below with reference to the embodiment of the invention described with reference to Figs. 14 and 15. An air inlet 51 to the vaporising chamber 15 accommodates ambient air into the vaporising chamber 15. An annular sleeve (not shown) extending around the vaporising chamber 15 is axially slideable for varying the size of the inlet 51 for controlling the rate at which ambient air is drawn into the vaporising chamber 15 as the vapour from the vaporisable matter is being drawn through the mouthpiece 50.

20

In use, vaporisable matter to be vaporised is placed in the vaporising chamber 15 with the heat transfer members 25 extending through the vaporisable matter for transferring heat from the body member 2 to the vaporisable matter. Fuel gas from the fuel gas reservoir (not shown) is supplied through the safety cut-out valve 29, the

temperature responsive valve 30 and a venturi mixer 31 where air is mixed with the fuel gas. The fuel gas/air mixture is delivered into the combustion chamber 3 through the nozzle 32. The piezo-electric igniter (not shown) is operated for igniting the fuel gas/air mixture to burn with a flame in the flame combustion chamber 33 for

5 raising the temperature of the gas catalytic combustion element 5 to its ignition temperature. On the gas catalytic combustion element 5 reaching its combustion temperature, the fuel gas/air mixture is converted to heat by catalytic reaction in the catalytic combustion element 5, and the flame is starved of the fuel gas/air mixture, and thus extinguished. Heat from the combustion chamber 3 and exhaust in the

10 exhaust gas chamber 7 rapidly heat the body member 2, which in turn heats the air in the heat exchange chamber 10 for in turn heating the vaporisable matter in the vaporising chamber 15. Additionally, heat is transferred from the body member 2 through the coupling member 19 and in turn through the heat transfer members 25 to the vaporisable matter. As the vaporisable matter commences to heat as a result

15 of heat transfer from the heat transfer members 25, vapours are released therefrom. By drawing on the mouthpiece (not shown), vapour released from the vaporisable matter is drawn from the vaporising chamber 15. The drawing on the mouthpiece (not shown) draws heated air from the heat exchanger 12 into the vaporising chamber 15 for further heating the vaporisable matter. As the vaporisable matter is

20 heated, the temperature of the vaporisable matter can be controlled by controlling the amount of ambient air being drawn through the inlet 51 by appropriately adjusting the position of the sleeve (not shown) around the vaporising chamber 15.

The temperature responsive valve 30 is set in order to control the temperature of the

body member 2 such that the temperature of the vaporisable matter in the vaporising chamber 15 is kept within a temperature range of approximately 140°C to 190°C, which is a suitable temperature range for vaporising tobacco. However, needless to say, the temperature at which the vaporisable matter is to be maintained will be determined by the actual vaporisable matter, and it is envisaged that devices according to the invention will be provided to operate within different predetermined ranges of temperatures to suit different vaporisable matter. This would be achieved by appropriately selecting the temperature responsive valve for controlling the temperature within the desired temperature range. In general, each temperature range would have a 50°C range between the maximum and minimum temperatures of the temperature range. Typical temperature ranges would be from 130°C to 180°C, to 180°C to 230°C.

Referring now to Figs. 14 and 15, there is illustrated a device according to another embodiment of the invention, indicated generally by the reference numeral 55 for vaporising vaporisable matter. The device 55 comprises a body member 56 of circular transverse cross-section, within which a combustion chamber 58, also of circular transverse cross-section is located for housing a catalytic combustion element 59 for converting fuel gas to heat, for heating the body member 56. A vaporising chamber 60 for the vaporisable matter, and within which the vaporisable matter is vaporised is releasably engageable with a receiving socket 62 formed in the body member 56, and is in heat conducting engagement with the body member 56 for transferring heat from the combustion chamber 58 to the vaporising chamber 60, as will be described below. A mouthpiece 64 extending from the vaporising

chamber 60 is provided for facilitating drawing vapour vaporised from the vaporisable matter from the vaporising chamber 60.

A fuel gas reservoir 65 for storing fuel gas in liquid form is coupled to a safety cut-out valve 66 by a coupling tube 67 for delivering fuel gas in gaseous form to the cut-out valve 66. The cut-out valve 66 is similar to the safety cut-out valve 29 of the device 1 described with reference to Figs. 1 to 13. An isolating valve 68 at an outlet end 69 of the reservoir 65 selectively controls the supply of fuel gas to the cut-out valve 66. A pressure reduction valve (not shown) is also located at the outlet end 69 of the reservoir 65 for vaporising the fuel gas as it exits from the reservoir to the isolating valve 68.

Fuel gas from the isolating valve 68 is delivered to a temperature responsive valve 70, which is similar to the temperature responsive valve 30 of the device 1 described with reference to Figs. 1 to 13. The temperature responsive valve controls the supply of fuel gas to the combustion chamber 58 in order to control the temperature of the body member 56, so that the temperature of the body member 56 produces a temperature in the vaporising chamber 60 within the desirable temperature range. A venturi mixer 71 receives fuel gas from the temperature responsive valve 70, where the fuel gas is mixed with air drawn into the venturi mixer 71 through air inlet ports 72. The venturi mixer 71 is formed in the body member 56, and the body member 56 also forms part of the housing of the temperature responsive valve 70. Fuel gas/air mixture from the venturi mixer 71 is delivered into the combustion chamber 58 through a nozzle 74 and a diffuser 75 which diffuses the fuel gas/air mixture from

the nozzle 74 into the combustion chamber 58.

In this embodiment of the invention the gas catalytic combustion element 59 is of hollow cylindrical shape of wire mesh coated with a suitable precious metal, and
5 converts the fuel gas/air mixture by a catalytic reaction. A thermal mass 77 provided by a small brass block or steel block is secured to the gas catalytic combustion element 59 for retaining heat for in turn maintaining the temperature of at least a portion of the gas catalytic combustion element adjacent the thermal mass 77 at or above its ignition temperature during periods while the fuel gas may be interrupted
10 by the temperature responsive valve 70 as a result of the controlling action of the temperature responsive valve 70 in controlling the temperature of the body member 56, for in turn controlling the temperature in the vaporising chamber 60. In this embodiment of the invention the thermal mass 77 comprises a steel screw which is secured to the catalytic combustion element 59 by a steel nut (not shown), such that
15 the catalytic combustion element 59 is tightly clamped between the head of the screw and the nut.

The combustion chamber 58 terminates at its downstream end in a flame combustion chamber 78 within which the fuel gas/air mixture is initially ignited to
20 burn in a flame for raising the temperature of the catalytic combustion element 59 to its ignition temperature. An electrical insulator comprising a ceramic plug 79 extends through a bore 80 in the body member 56 for accommodating an electrode (not shown) through a bore 81 in the ceramic plug 79 into the flame combustion chamber 78 for igniting the fuel gas/air mixture to initially burn in a flame. A piezo-electric

- igniter 82 which is secured to the reservoir 65 is provided for applying a high voltage EMF to the electrode (not shown) for causing an arc between the electrode (not shown) and an inner surface of the body member 56 defining the flame combustion chamber 78 for igniting the fuel gas/air mixture to burn in a flame. An actuating
- 5 plunger 85 extends into the piezo-electric igniter 82 for operating the piezo-electric igniter 82 for applying the high volt EMF to the electrode (not shown). The flame combustion chamber 78 and the combustion chamber 58 as well as the gas catalytic combustion element 59 are located and arranged so that the flame raises the temperature of the gas catalytic combustion element 59 to its ignition temperature
- 10 relatively rapidly, and on reaching its ignition temperature, the gas catalytic combustion element 59 commences to convert the fuel gas/air mixture to heat by the catalytic reaction, thereby starving the flame of fuel gas/air mixture and thus extinguishing the flame.
- 15 Inspection ports 73 and 76 which are closed by glass lenses are provided for facilitating inspection of the flame combustion chamber 78 and the combustion chamber 58, respectively in order to facilitate visual monitoring of the operation of the device 55.
- 20 An exhaust gas chamber 83 is located downstream of the flame combustion chamber 78 and exhaust gases from the combustion chamber 58 and the flame combustion chamber 78 are delivered into the exhaust gas chamber 83 through a flame retention mesh 84. The flame retention mesh 84 is such as to retain the flame in the flame combustion chamber 78, and to avoid the flame extending into the

exhaust gas chamber 83. Exhaust gases from the exhaust gas chamber 83 are delivered therefrom through exhaust ports 86 in the body member 56. A transversely extending end wall 87 closes the exhaust gas chamber 83.

5 A heat transfer means, namely, a heat transfer member 88, is secured in and extends through a bore 89 in the end wall 87 into the exhaust gas chamber 83 for transferring heat from the exhaust gases in the exhaust gas chamber 83 and from the body member 56 through the end wall 87 by heat conduction into the vaporising chamber 60. The heat transfer member 88 extends through a perforated disc 90 into
10 the receiving socket 82, and in turn into the vaporising chamber 60. The perforated disc 90 defines with the end wall 87 a heating chamber 92 for heating air prior to the air being drawn into the vaporising chamber 60 as vapour from the vaporising chamber 60 is drawn through the mouthpiece 64. An air inlet 93 accommodates air into the heating chamber 92. Bores 94 through the perforated disc 90 accommodate
15 air from the heating chamber 92 through a metal mesh disc 95 into the receiving socket 62, and in turn into the vaporising chamber 60.

The vaporising chamber 60 comprises a cylindrical side wall 96 which extends from an end wall 97 and is shaped at 98 to form a relatively tight sliding fit into the
20 receiving socket 62 for facilitating ease of removal and insertion of the vaporising chamber 60 into the receiving socket 62. A bore 99 through the end wall 97 accommodates vapours drawn from the vaporising chamber into an outlet tube 100 which terminates in the mouthpiece 64. A metal mesh disc 91 in the vaporising chamber 60 adjacent the end wall 97 prevents the vaporisable matter being drawn

through the bore 99 as the vapours are being drawn therethrough. Annular heat exchange fins 101 extend around the vaporising chamber 60 for assisting in controlling the temperature of the vaporising chamber 60.

- 5 A heat sink means, in this embodiment of the invention a heat sink element 103 of brass is located in a bore 104 of the outlet tube 100 for cooling the vapours being drawn from the vaporising chamber 60. The heat sink element 103 comprises a central solid core 105 having a plurality of spaced apart annular flanges 106 extending circumferentially around the core 105 for defining with the outlet tube 100
- 10 a plurality of annular chambers 107 which are interconnected by axially extending grooves formed in the respective annular flanges 106. The grooves 108 are staggered from flange 106 to flange 106 in order to present the vapours being drawn from the vaporising chamber 60 with a tortuous path to maximise heat transfer from the vapours to the heat sink element 103. Additionally, it has been found that tar
- 15 and other undesirable compounds entrained in the vapours being drawn from the vaporising chamber 60 condense on the heat sink element 103, and can be periodically removed by removing the heat sink element 103 at appropriate intervals for cleaning thereof.
- 20 In use, with the vaporising chamber 60 removed from the receiving socket 62, the vaporising matter to be vaporised is placed in the vaporising chamber 60, and the vaporising chamber 60 is re-engaged with the receiving socket 62. The vaporising matter may be any suitable matter, for example, tobacco, and may be in loose form, or may be in a pre-packaged form, for example, in a sachet of paper or mesh.

Where in a sachet of paper or mesh, it is envisaged that the sachet or paper would be punctured by the heat transfer member 88 as the vaporising chamber 60 is being inserted in the receiving socket 62. In this embodiment of the invention the heat transfer member 88 terminates in a point at its distal end, which would function to
5 puncture such a sachet. Puncturing the sachet would allow the vapours from the vaporisable matter to be released into the vaporising chamber 60 when heated.

With the vaporisable matter in the vaporising chamber 60, and the vaporising chamber 60 located in the receiving chamber 62, the isolating valve 68 is operated
10 for delivering fuel gas from the reservoir 65 to the safety cut-out valve 66, which in turn is mixed with air in the venturi mixer 71 and delivered into the combustion chamber 58. The actuating plunger 85 of the piezo-electric igniter 82 is operated for generating a spark in the flame combustion chamber 78 for igniting the fuel gas/air mixture to burn in a flame. As the flame raises the temperature of the gas catalytic
15 combustion element 59 to its ignition temperature, the fuel gas/air mixture is converted to heat by the catalytic reaction in the gas catalytic combustion element 59, thus extinguishing the flame in the flame combustion chamber 78. Heat from the combustion chamber 58 is conducted through the body member 56, and in turn the receiving socket 62 into the vaporising chamber 60. Heat is also conducted from the
20 body member 56 and the exhaust gases in the exhaust gas chamber 83 through the heat transfer member 88 into the vaporising chamber 60. As the vaporisable matter in the vaporising chamber 60 commences to heat, vapours are released therefrom, and can thus be drawn from the vaporising chamber 60 through the mouthpiece 64.

As the vapours are drawn from the vaporising chamber 60 through the mouthpiece 64, air to replace the vapours is drawn into the vaporising chamber 60 through the air inlet 93 and in turn through the heating chamber 92 to the vaporising chamber 60. The air being drawn through the heating chamber 92 is heated by heat conduction,
5 radiation and convection from the body member, and thus, further assists in maintaining the temperature in the vaporising chamber 60 at the desired vaporising temperature.

The vapours, being drawn from the vaporising chamber 60 are cooled in the heat
10 sink element 103, and any tar or other undesirable compounds in the vapours drawn from the vaporising chamber 60 are condensed on the heat sink element 103 to be removed periodically by removing and cleaning the heat sink element 103 at appropriate intervals.

15 The main difference between the device 55 and the device 1 is that the majority of heat transferred from the body member 56 to the vaporising chamber 60 is by heat conduction, rather than by heat convection by heated air.

While the device 55 has been described as comprising a single heat transfer
20 member 88, it is envisaged in certain cases that more than one heat transfer member 88 may be provided extending into the receiving socket 62 for transferring heat into the vaporising chamber 60.

A particularly important advantage of the invention is that the heat transfer to the

vaporisable matter through the heat transfer members 25 and 88 initially heats the vaporisable matter for initiating vaporising thereof. Further and additional heating of the vaporisable matter is achieved by the heated air from the heat exchanging chamber 10 of the device 1 as the heated air is drawn into the vaporising chamber 15 as the mouthpiece (not shown) is drawn on, however, in the device 55 a greater proportion of the heat is transferred into the vaporising chamber 60 by heat conduction through the heat transfer member 88 and the direct contact between the vaporising chamber 60 and the receiving socket 62. A particularly important advantage of the invention is that the vaporisable matter is heated gradually in the vaporising chamber 15 so that the vaporisable components in the vaporisable matter are gradually released over a period of time, rather than all being released substantially simultaneously.

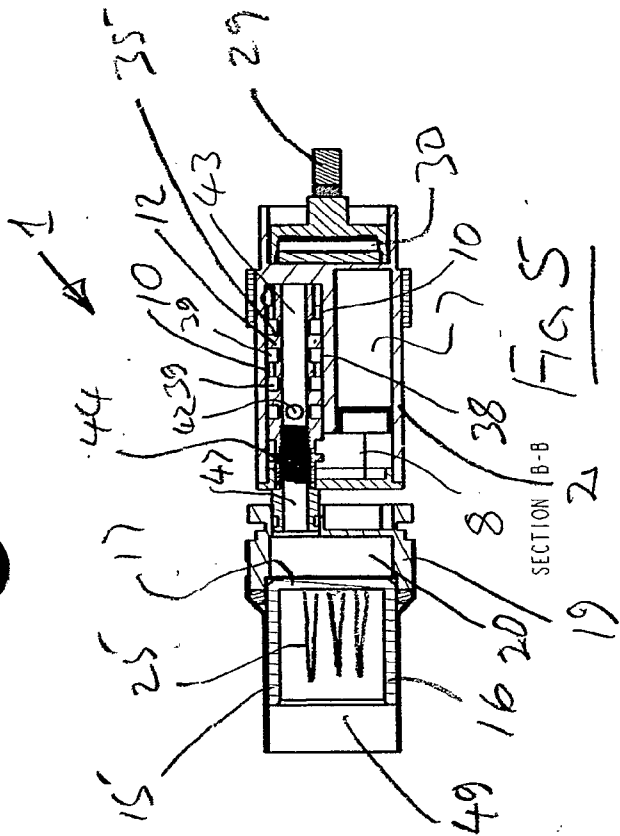
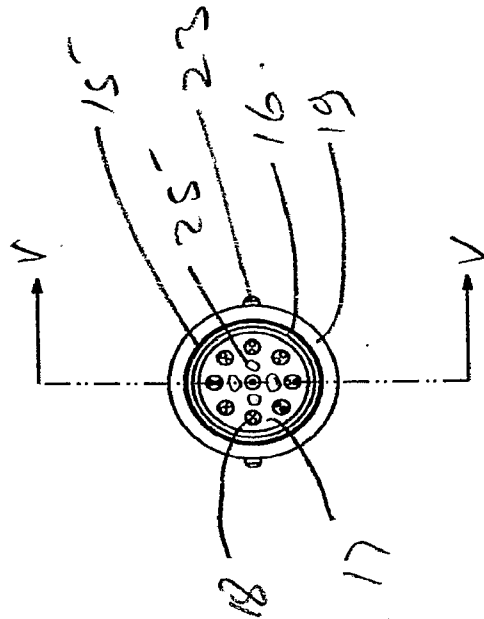
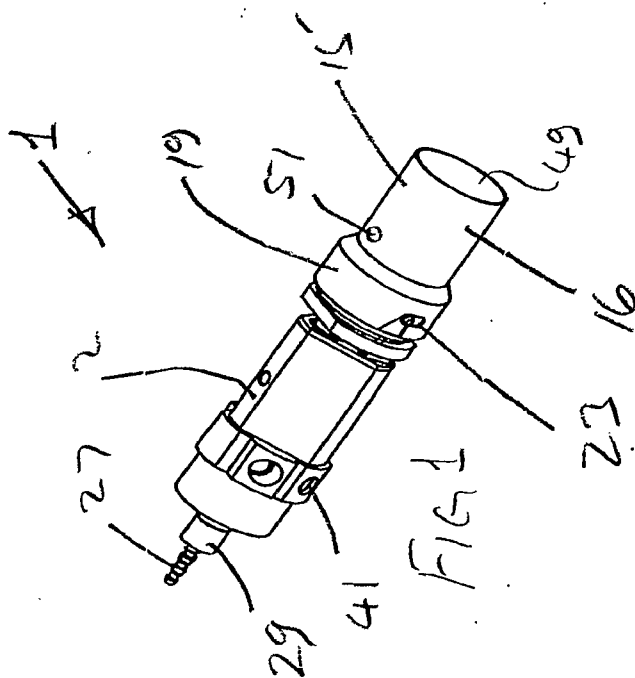
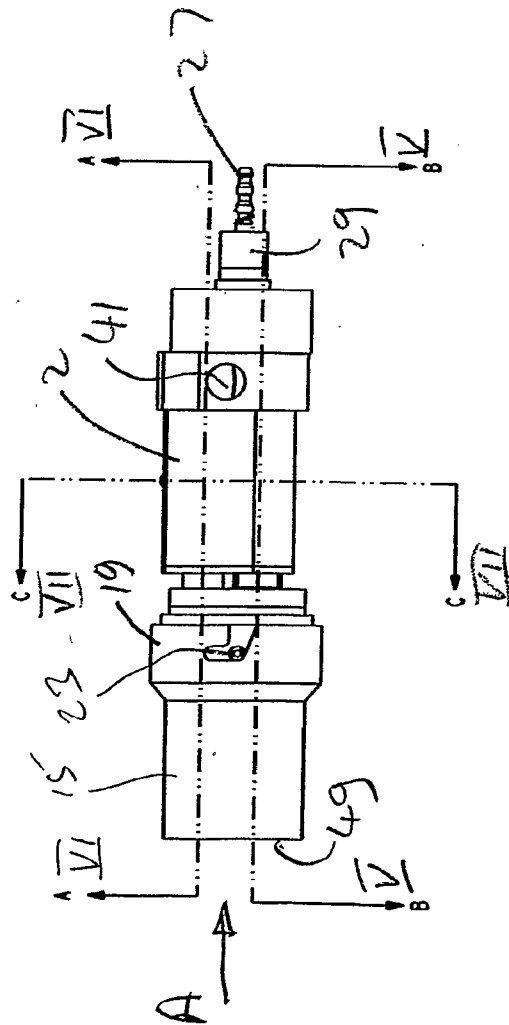
While the devices according to the invention have been described as comprising heat transfer to the vaporisable matter by both temperature conduction through the body member, the coupling member and the heat transfer members and also by heat transfer through the heated air, in certain cases, it is envisaged that the device according to the invention may be provided with only one form of heat transfer for transferring heat to the vaporisable matter. In which case, heat transfer would either be through direct heat conduction through the body member, the coupling member and vaporising chamber, or through heat transfer by air from the heat exchange chamber to the vaporising chamber. In which case, where heat transfer is by heat conduction only, the heat exchange chamber of the device 1 and the heating chamber 92 of the device 55 would be omitted, and where heat transfer is to be

mainly through air heat transfer, the heat transfer members would be omitted from the vaporising chamber.

The invention is not limited to the embodiments hereinbefore described, which may
5 be varied in construction and detail.

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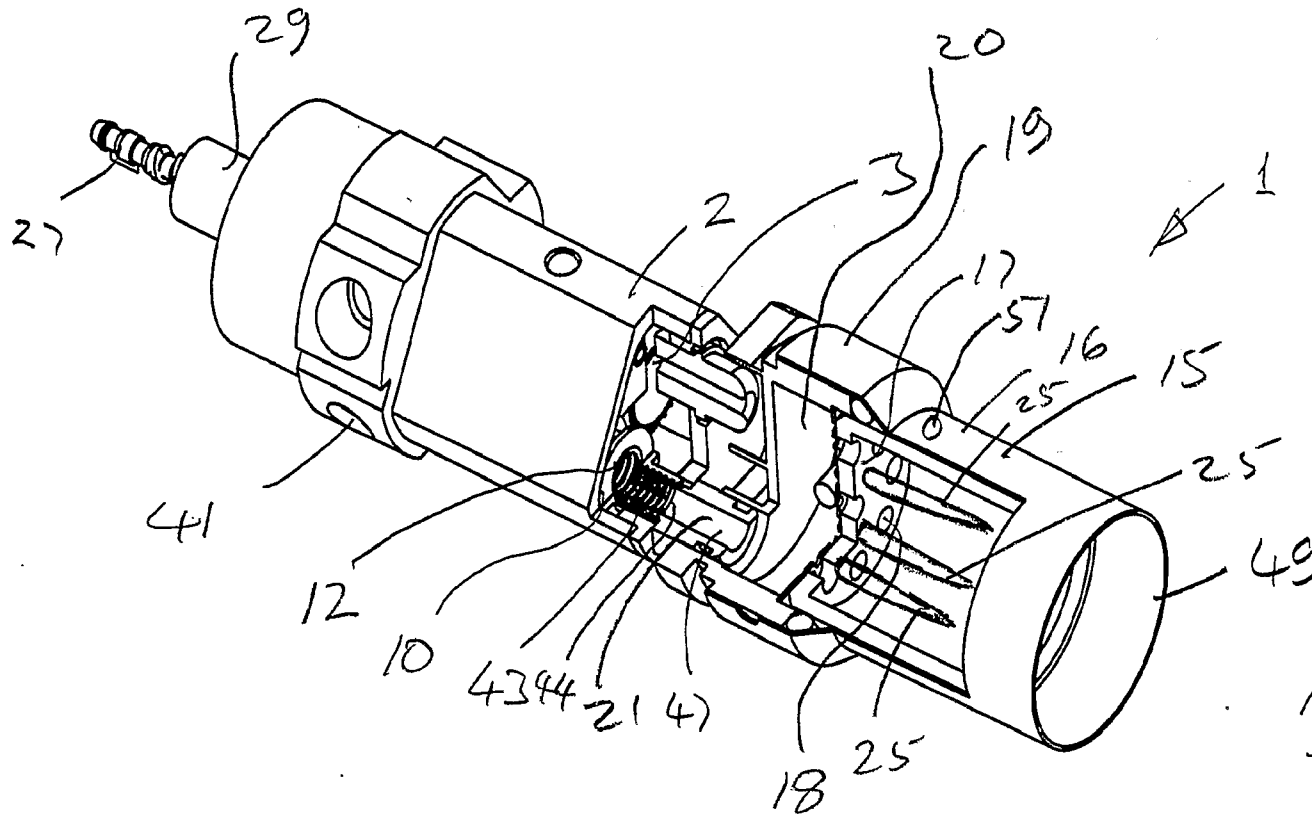


FIG 2

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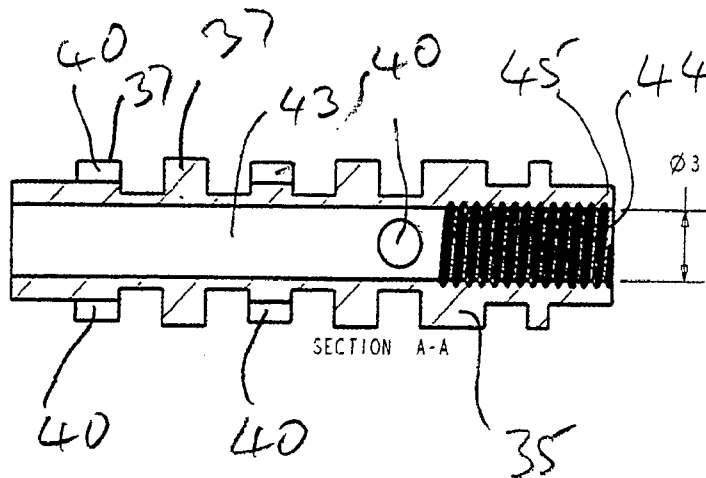


FIG 13
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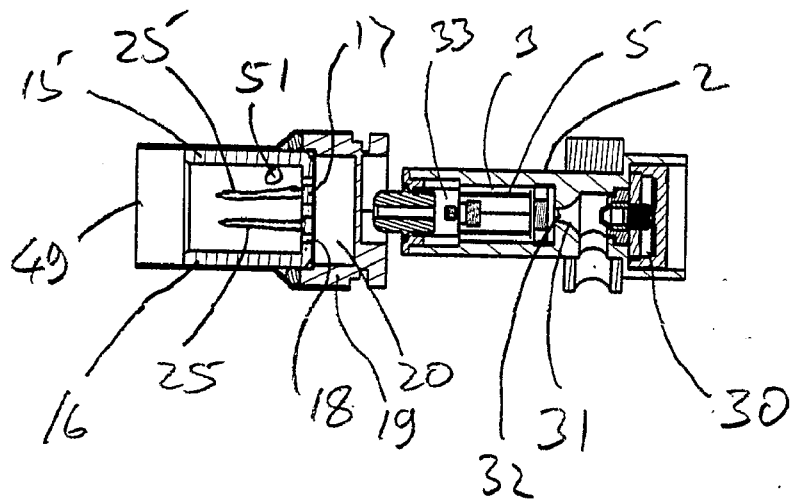
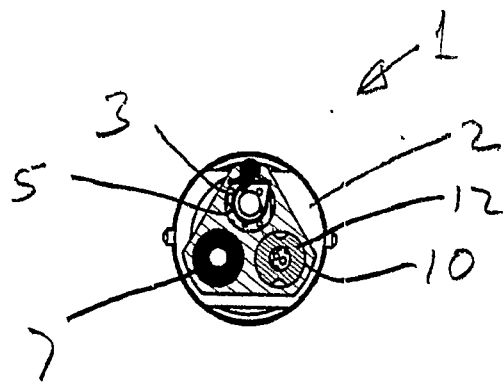


FIG 6



SECTION C-C

FIG 7

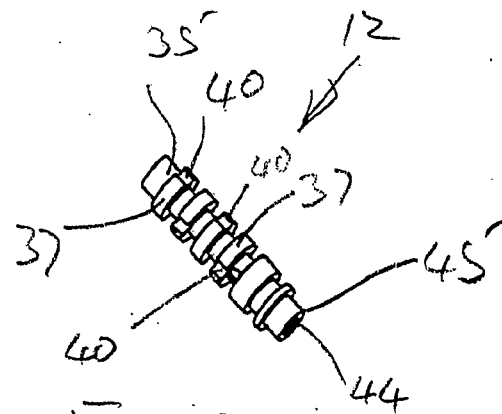


FIG 9

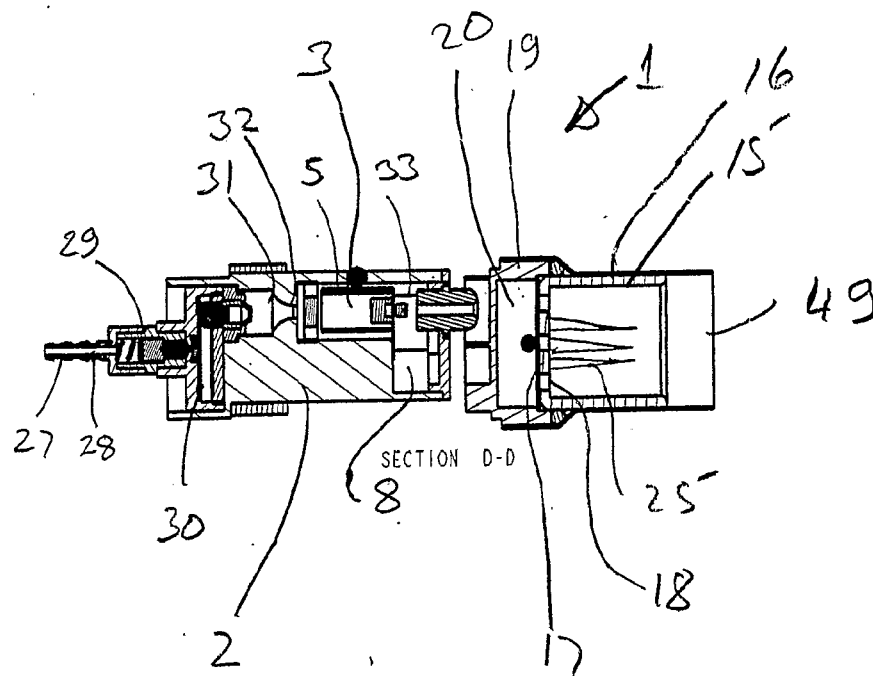


FIG 8

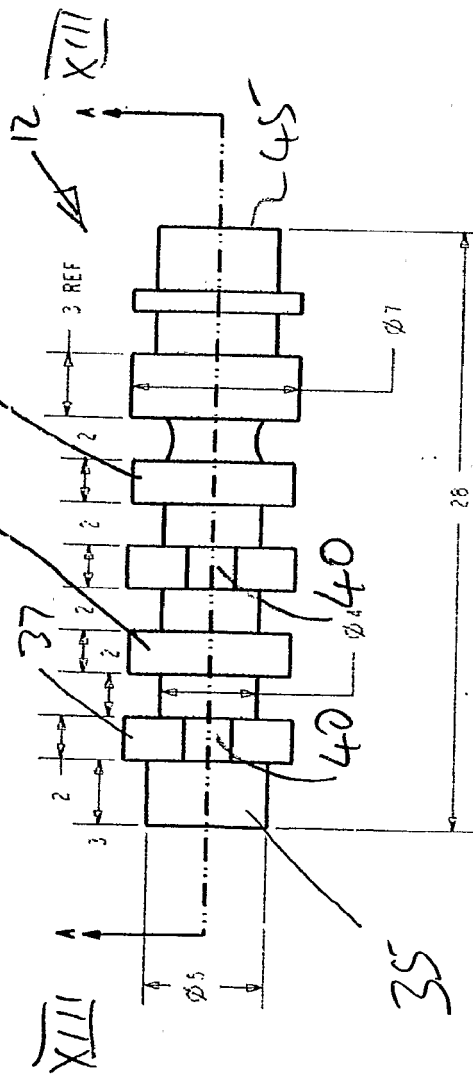


FIG 10

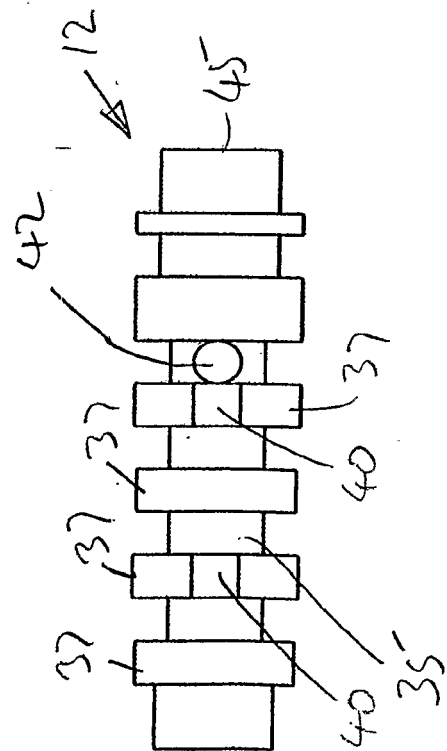


FIG 12

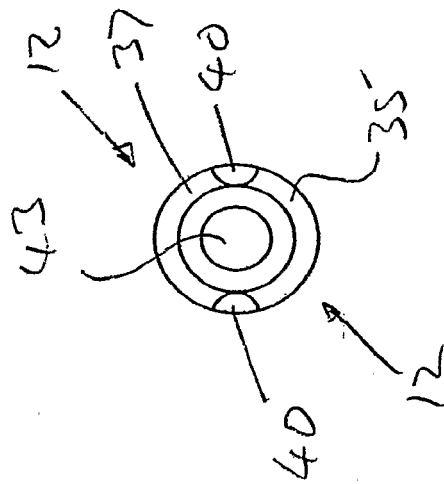
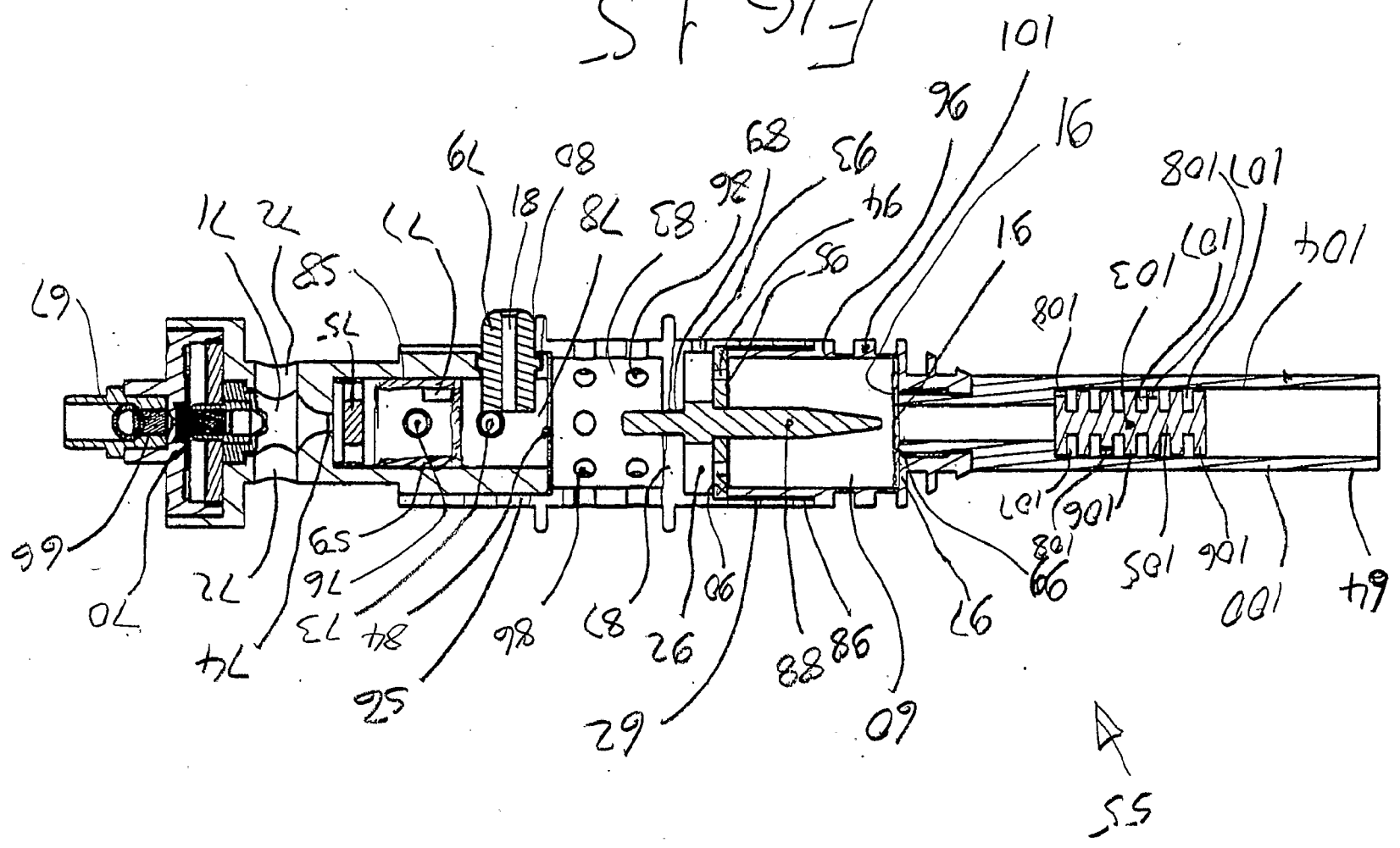


FIG 11

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FIG 15

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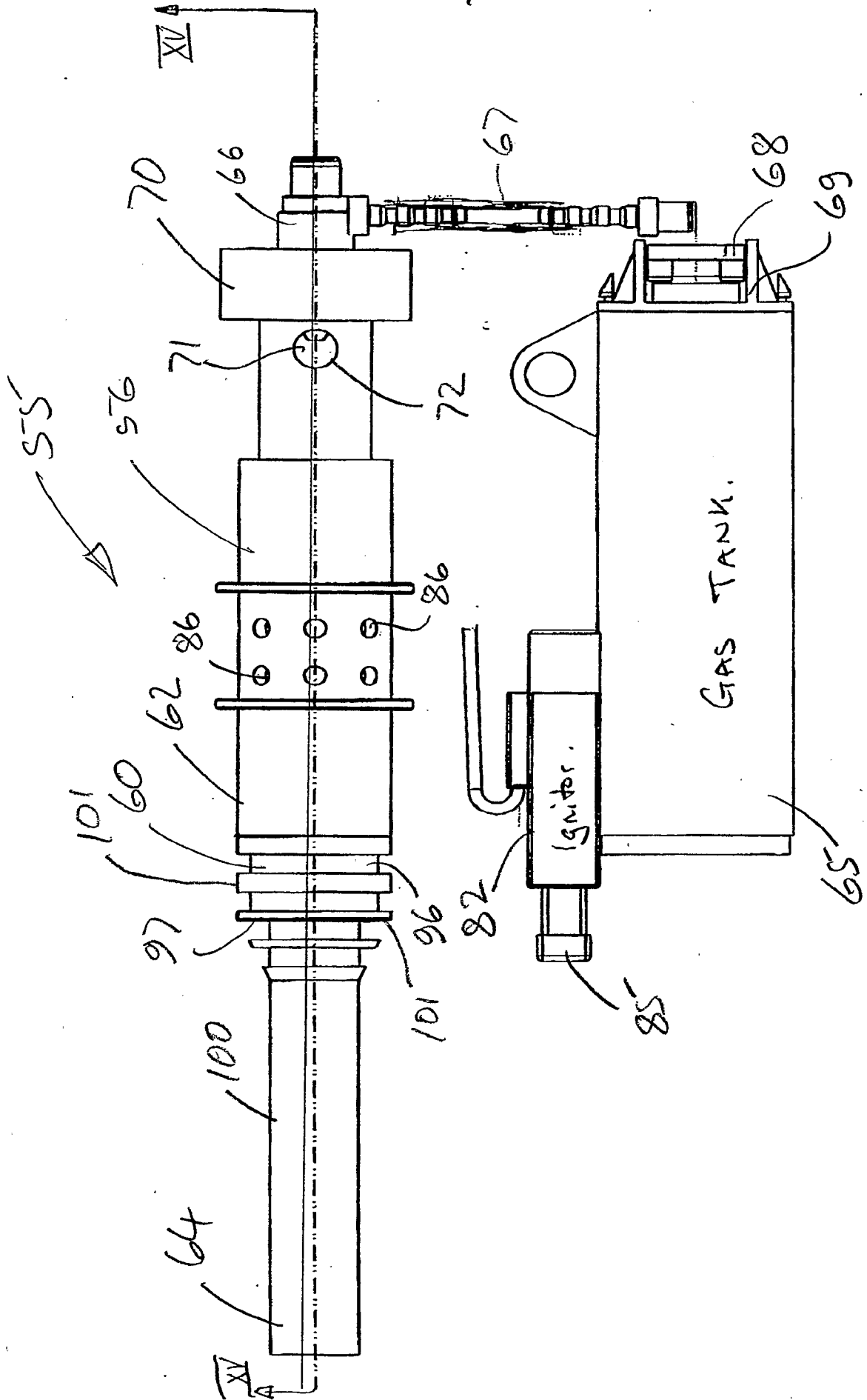


FIG 14

Document made available under the Patent Cooperation Treaty (PCT)

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International filing date: 02 February 2006 (02.02.2006)

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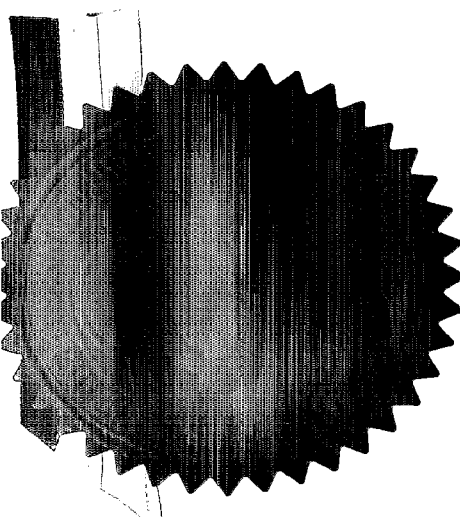
I HEREBY CERTIFY that annexed hereto is a true copy of documents filed in connection with the following patent application:

Application No. S2005/0615

Date of Filing 19 September 2005

Applicant OGLESBY & BUTLER RESEARCH & DEVELOPMENT, an Irish company of Industrial Estate, Dublin Road, Carlow, Ireland.

Dated this 9 day of February 2006.



An officer authorised by the
Controller of Patents, Designs and Trademarks.

FORM NO. 1

REQUEST FOR THE GRANT OF A PATENT

PATENTS ACT, 1992

The Applicant(s) named herein hereby request(s)

☐

the grant of a patent under Part II of the Act

☒

the grant of a short-term patent under Part III of the Act

on the basis of the information furnished hereunder.

1. Applicant(s)NameOGLESBY & BUTLER RESEARCH
& DEVELOPMENT LIMITEDAddress

Industrial Estate, Dublin Road, Carlow, Ireland.

Description/Nationality

An Irish company.

2. Title of Invention

"A device for vaporising vaporisable matter"

3. Declaration of Priority on basis of previously filed application(s) for same invention (Sections 25 & 26)Previous filing dateCountry in or for which
filedFiling No.**4. Identification of Inventor(s)**Name(s) of person(s) believedby Applicant(s) to be the inventor(s)

ALFRED PETER OGLESBY and JOHN PAUL OGLESBY

AddressA British subject of Castle Hill, Carlingford, County Louth, Ireland; and
A British subject of Anneville, Shrute, Carlow, Ireland.

5. **Statement of right to be granted a patent (Section 17 (2) (b))**

The applicant has derived the right to be granted a Patent from the inventors by virtue of a Deed of Assignment dated September 16. 2005.

6. **Items accompanying this request – tick as appropriate**

- (i) ☒ Prescribed filing fee (€60-00)
- (ii) ☐ Specification containing a description and claims
- ☒ Specification containing a description only
- ☒ Drawings referred to in description or claims
- (iii) ☐ An abstract
- (iv) ☐ Copy of previous application(s) whose priority is claimed
- (v) ☐ Translation of previous application whose priority is claimed
- (vi) ☐ Authorisation of Agent (this may be given at 8 below if this Request is signed by the Applicant(s))

7. **Divisional Application(s)**

The following information is applicable to the present application which is made under Section 24 –

Earlier Application No:

Filing Date:

1 9 SEP 2005

8. **Agent**

The following is authorised to act as agent in all proceedings connected with the obtaining of a patent to which this request relates and in relation to any patent granted –

Name

Address

F.F. GORMAN & CO.

15 Clanwilliam Square,
Dublin 2,
Ireland.

9. **Address for Service (if different from that at 8)**

F.F. GORMAN & CO., at its address as recorded for the time being in the Register of Patent Agents.

Signed

F.F. GORMAN & CO., Authorised Patent Agents

BY: _____

EXECUTIVE

Date

September 19. 2005

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"A device for vaporising vaporisable matter"

The present invention relates to a device for vaporising vaporisable matter for facilitating inhaling of the vaporised matter. For example, the device is suitable for vaporising vaporisable matter which comprises one or more of flavour components, medicinal components and psychoactive components, such as tobacco, mullein, passion flower, cloves, yohimbe, mint, tea, eucalyptus, camomile and other such herbs and plant matter.

Herbs, for example, tobacco and the like are smoked by burning, in order to release psychoactive compounds, which are then inhaled. The psychoactive compounds are released into the fumes of combustion, which are then inhaled. However, burning of such herbs as well as producing psychoactive compounds also produces toxins, which largely result from the actual combustion process. Such toxins are known to be carcinogenic, and also can result in lung and heart disease. Thus, the smoking of such herbs and other such plant matter is hazardous and undesirable. An alternative to releasing flavour, medicinal and psychoactive compounds from such herbs and plant matter by smoking is to raise the temperature of the herb to an appropriate temperature for causing the vaporisable constituent or constituents to be vaporised, and then inhale the vaporised constituent or constituents. However, the temperature range at which such compounds can be vaporised in herbs and plant matter ranges from approximately 130°C to 250°C. If the temperature is below 130°C, in general, vaporisation does not occur. However, if the temperature to which the herb or plant matter is heated exceeds 300°C, combustion of the herb or

plant matter may commence. Thus, in order to satisfactorily vaporise flavour, medicinal and psychoactive constituents in herbs and plant matter, the temperature at which the herb or plant matter is maintained for producing the vaporised compounds must be controlled within reasonably tight tolerances.

5

It is known to provide apparatus for vaporising desirable constituents from herbs by electrically heating the herb. However, due to the energy requirements of such apparatus, a mains electricity supply is required to power the apparatus, and thereby the apparatus is not portable when in use. This thus renders a person immobile

10 when using such apparatus. An alternative device for vaporising vaporisable constituents in herbs and plant matter is disclosed in U.S. published Patent Application Specification No. 2004/0031495 of Steinberg. Steinberg discloses a pipe which is substantially similar to a smoking pipe in which the herb, typically, tobacco to be vaporised is located in a bowl portion of the pipe. A heat resistant and porous

15 flame filter is located in the bowl above the herb, and a flame from a match or cigarette lighter is used to heat the porous filter while air is being drawn through the pipe. Thus, a mixture of air and the products of combustion from the flame are mixed in the porous filter and drawn through the herb in the bowl for heating the herb for in turn vaporising desirable constituents in the herb. The mixture of air, the

20 products of combustion and the vaporised constituent are then drawn through a mouthpiece of the pipe and inhaled. However, due to the fact that the flame is played on the heat resistant porous flame filter, there is a danger of the flame being drawn through the filter and thus causing combustion of the herb in the bowl of the pipe. However, even where the herb does not combust, the products of combustion

of the flame are inhaled along with the vaporised constituent. This is undesirable.

There is therefore a need for a device for vaporising vaporisable matter, which preferably is portable, and overcomes the problems of prior art devices.

5

The present invention is directed towards providing a device for vaporising vaporisable matter, which addresses at least some of the problems of prior art devices.

- 10 According to the invention there is provided a device for vaporising vaporisable matter, the device comprising a vaporising chamber for the vaporisable matter, a heating means for heating the vaporisable matter for vaporising thereof, an outlet from the vaporising chamber through which vapour from the vaporisable matter is drawn, and an air inlet to the vaporising chamber for accommodating air into the
- 15 vaporising chamber to replace air and vapour drawn therefrom.

In one embodiment of the invention the heating means is an electrically powered heating means.

- 20 In another embodiment of the invention the heating means comprises a positive temperature control resistive heating element.

In another embodiment of the invention the heating means comprises an electrical resistive heating element, and in a further embodiment of the invention the heating

means comprises an electrical induction heating means.

Preferably, the heating means extends into the vaporising chamber, and advantageously, comprises an elongated member. Preferably, the elongated
5 member terminates in a pointed distal end, and ideally, a plurality of spaced apart elongated members forming the heating means are provided in the vaporising chamber.

Alternatively, the heating means comprises a heating means located externally of
10 the vaporising chamber, and a heat transfer means transfers heat from the heating means to the vaporising chamber, preferably, the heat transfer means extends into the vaporising chamber from the heating means. In one embodiment of the invention the heat transfer means comprises an elongated member extending into the vaporising chamber, and ideally, the elongated member forming the heat transfer
15 means terminates in a pointed distal end. Advantageously, a plurality of spaced apart elongated members each forming heat transfer means extend into the vaporising chamber.

Preferably, the vaporising chamber is formed by a main base wall and a main side
20 wall extending from and around the main base wall, and defining with the main base wall a main hollow interior region which forms the vaporising chamber.

In another embodiment of the invention the main side wall defines an open mouth to the main hollow interior region, and advantageously, a closure means is provided for

closing the open mouth.

In one embodiment of the invention the outlet is located in the closure means, and preferably, a mouthpiece through which the vapour from the vaporising chamber is drawn is coupled to the outlet, and ideally, is coupled to the outlet through a tubular member. Ideally, a cooling means is located in the tubular member for cooling the vapour, and preferably, the cooling means comprises a heat sink member, and advantageously, the heat sink member defines a tortuous passageway for accommodating the vapour from the outlet to the mouthpiece for collecting condensable undesirable compounds entrained in the vapour.

In one embodiment of the invention the closure member comprises a secondary base wall, and a secondary side wall extending from and around the secondary base wall and defining with the secondary base wall a secondary hollow interior region, the secondary side wall being engageable in the main hollow interior region in a plug/socket manner so that the main and secondary hollow interior regions together form the vaporising chamber.

Preferably, the main and secondary side walls are of cylindrical construction.

Ideally, the device is portable, and where the heating means is an electrically powered heating means, the device is battery powered.

Alternatively, the heating means may be gas powered, and in which case, the

heating means would be supplied with a fuel gas supply from a reservoir adapted for storing the fuel gas in liquid form.

The invention will be more clearly understood from the following description of some
5 embodiments thereof, which are given by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 is a side elevational view of a device according to the invention for vaporising vaporisable matter,

10

Fig. 2 is a transverse cross-sectional side elevational view of a portion of the device of Fig. 1 on the line II-II of Fig. 1,

Fig. 3 is an exploded perspective view of the device of Fig. 1,

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Fig. 4 is an enlarged perspective view of a detail of the device of Fig. 1,

Fig. 5 is an exploded perspective view of a portion of a device according to another embodiment of the invention for vaporising vaporisable matter, and

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Fig. 6 is an enlarged perspective view of a detail of the device of Fig. 5.

Referring to the drawings and initially to Figs. 1 to 4, there is illustrated a device according to the invention, indicated generally by the reference numeral 1, for

vaporising vaporisable matter, which may be any type of vaporisable matter, but typically, would be tobacco. The device 1 comprises a vaporising chamber 3 within which the vaporisable matter is vaporised. The vaporising chamber 3 is formed by a main base wall 4 and a main cylindrical side wall 5 which defines with the main base wall 4 a main hollow interior region 6. The main side wall 5 defines a main open mouth 7 to the main hollow interior region 6, which is closed by a closure means which comprises a closure member 8.

The closure member 8 comprises a secondary base wall 10 and a secondary cylindrical side wall 11 extending from the secondary base wall 10, which defines with the secondary base wall 10 a secondary hollow interior region 12. The secondary side wall 11 defines a secondary open mouth 14 to the secondary hollow interior region 12, and the secondary side wall 11 is sized relative to the main side wall 5 for engaging the main side wall 5 in the main hollow interior region 6 in a plug/socket manner so that the main and secondary hollow interior regions 6 and 12 form the vaporising chamber 3. In this embodiment of the invention the secondary side wall 11 and the main side wall 5 are sized so that the secondary side wall 11 engages the main side wall 5 with a relatively tight sliding fit for facilitating removal thereof to provide access to the vaporising chamber 3 for placing the vaporisable matter therein, while at the same time preventing inadvertent disengagement of the closure member 8 from the main hollow interior region 6.

An outlet 15 in the secondary base wall 10 accommodates vapour from the vaporisable matter being drawn from the vaporising chamber 3. A tubular member

16 extending from the outlet 15 terminates in a mouthpiece 17 through which the vapour from the vaporising chamber 3 is drawn. An air inlet 19 in the main side wall 5 accommodates air into the vaporising chamber 3 to replace air and vapour drawn therefrom through the mouthpiece 17. A gauze partition 20 extending transversely across the main hollow interior region 6 retains the vaporisable matter in the combustion chamber 3 from the air inlet 19, while at the same time accommodating air from the air inlet 19 through the combustion chamber 3.

A heating means, in this embodiment of the invention comprising an electrically powered positive temperature control resistive heating element 23 extends into the vaporising chamber 3 through a bore 24 in the main base wall 4. The heating element 23 is encased in an elongated tubular member 26 which extends into the vaporising chamber 3 through the bore 24 in the main base member 4 and engages the bore 24 with a relatively tight interference fit. The tubular member 26 terminates in a tapered distal portion 27 which terminates in a point 28 for puncturing a sachet in the event of the vaporisable matter being placed in the vaporising chamber 3 in a sachet, such as a tea-bag type sachet. A housing 29 extending from the main base wall 4 accommodates a battery (not shown) and suitable electrical and electronic control circuitry (also not shown) for powering the heating element 23.

20

A cooling means comprising a heat sink member 30 is located in the tubular member 16 between the outlet 15 and the mouthpiece 17 for cooling vapour as it is being drawn through the tubular member 16 in order to avoid the vapours burning the mouth. The heat sink member 30 is of brass and comprises a central core 31 and a

plurality of spaced apart circumferential flanges 32 extending from the central core 31. The flanges 32 define with the central core 31 respective spaced apart annular chambers 34 which communicate with each other through longitudinally extending grooves 35 formed in the flanges 32. The grooves 35 in the flanges 32 are
5 staggered from flange to flange in order to form with the annular chambers 34 a tortuous passageway for the vapour through the heat sink member 30 for facilitating cooling of the vapour. Additionally, it has been found that as the vapours are cooled, undesirable compounds entrained in the vapour, for example, tar and the like, condense on the heat sink member 30. The heat sink member 30 is located in the
10 tubular member 16 for facilitating removal for cleaning thereof for the removal of the condensed compounds therefrom at appropriate periodic intervals.

In use, with the closure member 8 disengaged from the main hollow interior region 6, and vaporisable matter to be vaporised is placed in the secondary hollow interior
15 region 12 defined by the closure member 8. The vaporisable matter may be placed in the secondary hollow interior region 12 in loose form or in sachet form. With the vaporisable matter in the secondary hollow interior region 12, the closure member 8 is engaged in the main hollow interior region 6, thereby forming the vaporising chamber 3. As the closure member 8 is being engaged in the main hollow interior
20 region 6, the tubular member 26 punctures the sachet in which the vaporisable matter is contained, if the vaporisable matter is placed in the secondary hollow interior region 12 in such a sachet. A power switch (not shown) on the housing 29 is operated for coupling the battery to the heating element 23 through the electrical and electronic control circuitry (not shown) for powering the heating element 23. Heat is

transferred through the tubular member 26 from the heating element 23 therein to the vaporisable matter, and on the vaporisable matter being brought to the appropriate temperature, vapour begins to be released therefrom. The vapour is then drawn from the vaporising chamber 3 through the outlet 15 and the mouthpiece 17, and as the vapour is being drawn through the tubular member 16, the heat sink member 30 acts to cool the vapour to a desirable temperature, and condensable compounds, such as tar entrained in the vapour are condensed on the heat sink member 30. Periodically the heat sink member 30 is removed for cleaning for removing the condensed compounds therefrom.

10

Referring now to Figs. 5 and 6, there is illustrated a device according to another embodiment of the invention, indicated generally by the reference numeral 40, also for vaporising vaporisable matter. The device 40 is substantially similar to the device 1 and similar components are identified by the same reference numerals. The main difference between the device 40 and the device 1 is that the device 40 is provided with four tubular members 26 extending into the vaporising chamber 3, each of which contains a heating element 23. Otherwise, the device 40 and its use is similar to that of the device 1.

15

While the heating means has been described as being provided by a positive temperature control resistive heating element, any other suitable heating means may be provided. For example, where the heating means is being provided by an electrically powered heating means, the heating means may comprise a conventional resistive heating element, an induction heating element or any other

20

suitable heating means. It is also envisaged that the heating means may be provided by a gas powered heating means, which would be located in the housing 29, and the elongated member 26 would be provided as a solid heat transfer member of, for example, brass or copper for transferring heat from the heat source into the vaporising chamber. It is also envisaged that where the heating means is provided by an electrically powered heating means, the heating means may be located externally of the vaporising chamber, for example in the housing 29, and in which case, the elongated member 26 would act as a heat transfer member and would be provided as a solid member for transferring heat from the external electrical heat source into the vaporising chamber.

While the cooling means has been described as a heat sink member, any other cooling means may be used, for example, in certain cases the cooling means may be provided as a fibrous filter of the type commonly used in cigarettes.

It is also envisaged that the temperature of the vaporising chamber may be controlled by an electronic thermostat using a self latching valve in the event of the vaporising device being gas powered, and in which case the self latching valve would control the supply of fuel gas to the device.

The invention is not limited to the embodiments hereinbefore described, which may be varied in construction and detail.

F.F. GORMAN & CO.

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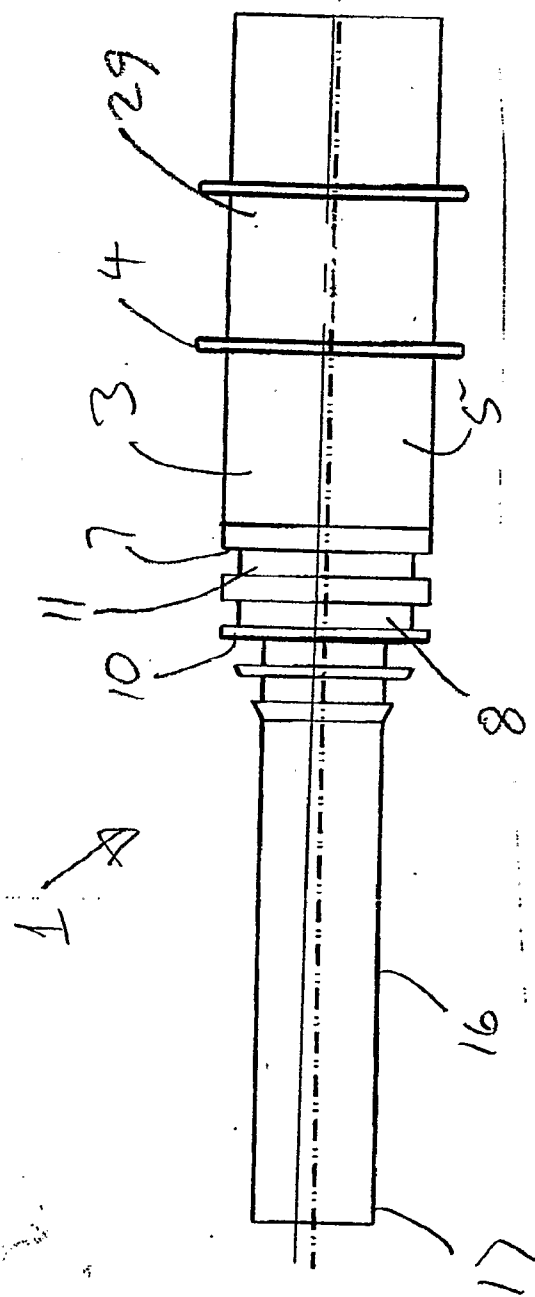


FIG 1

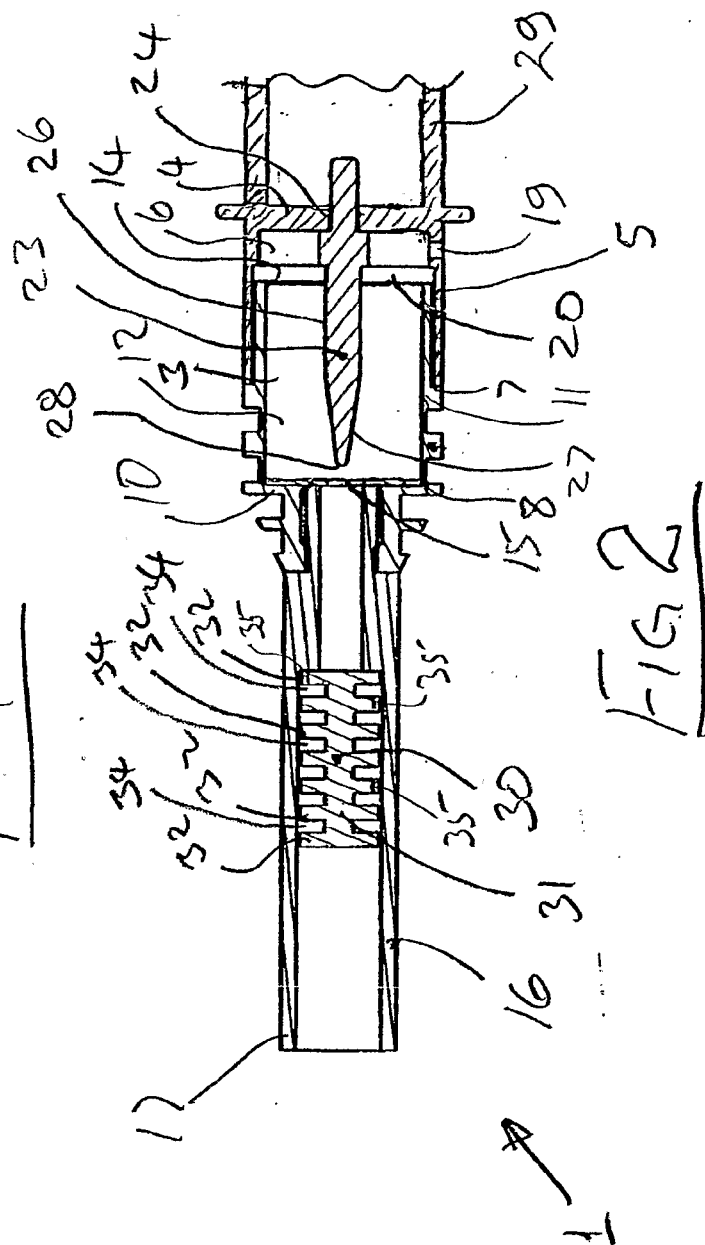
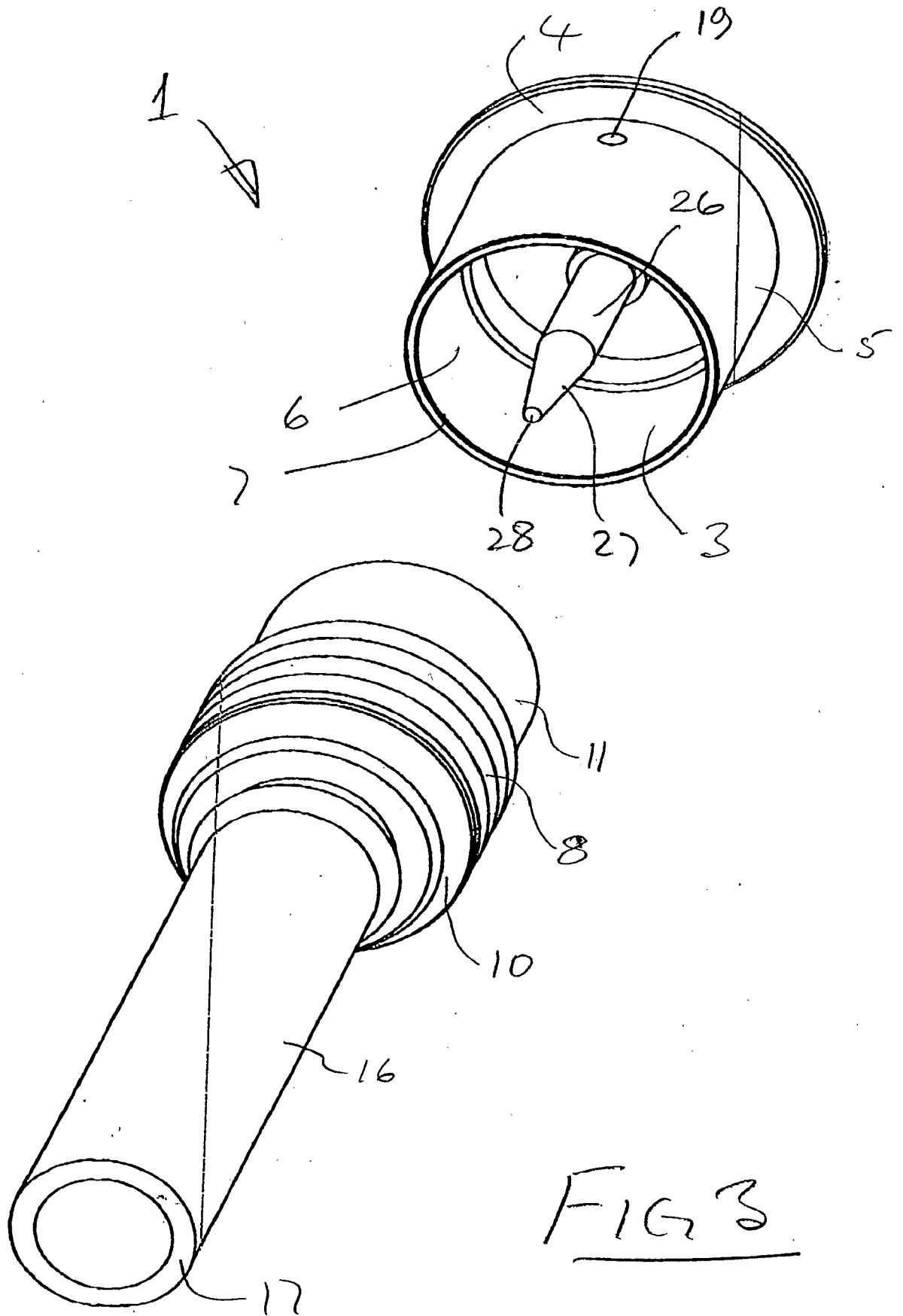
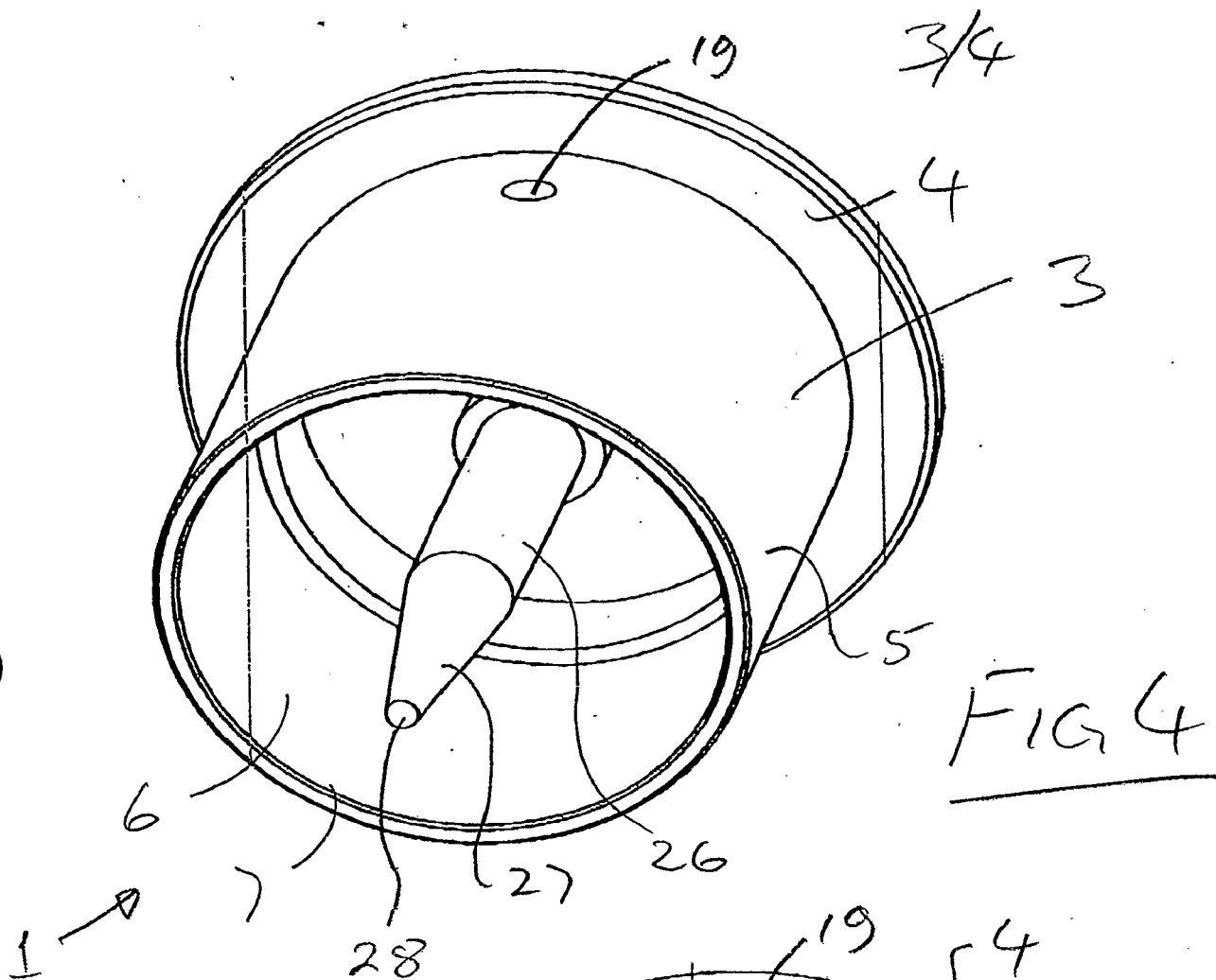
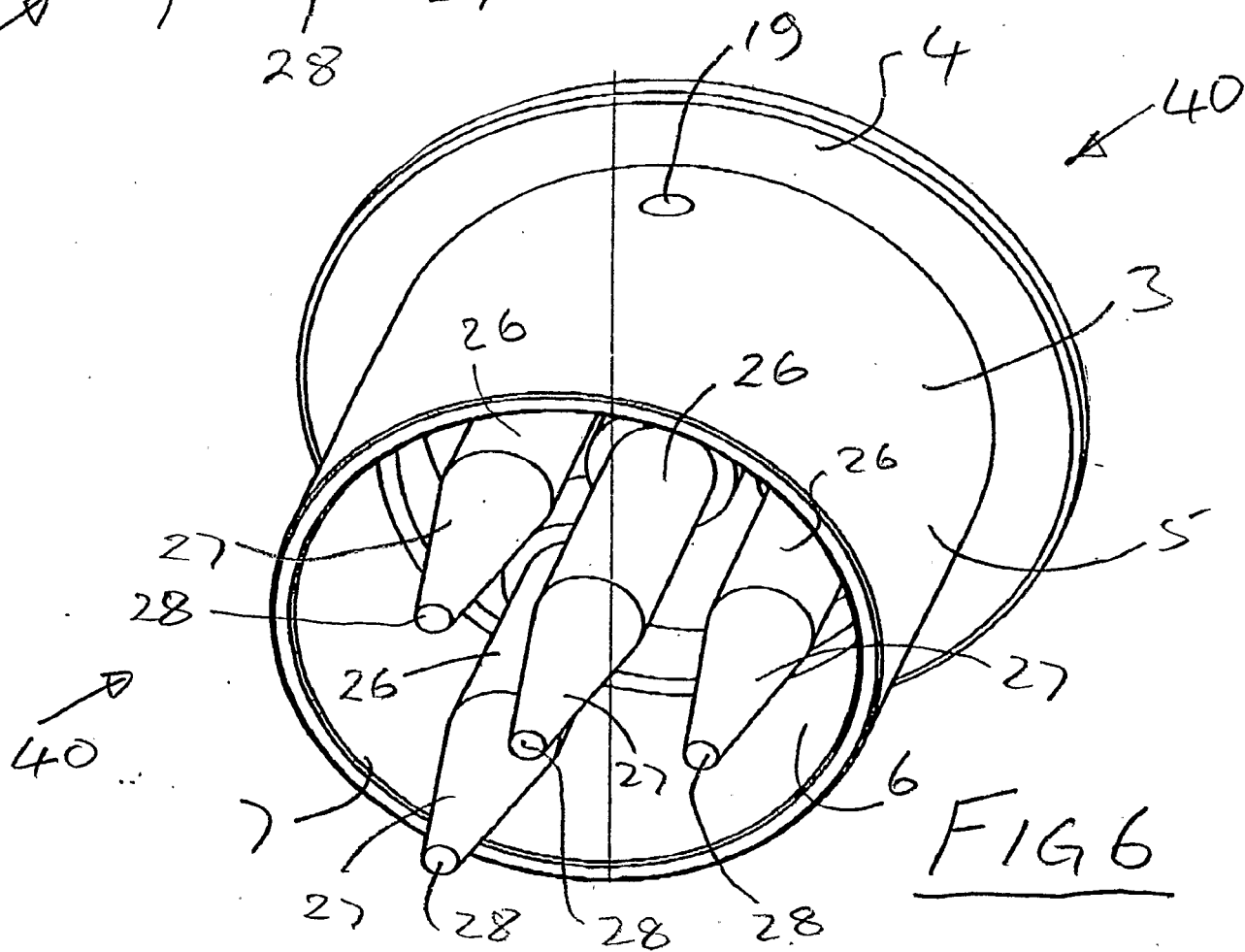


FIG 2

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4/4

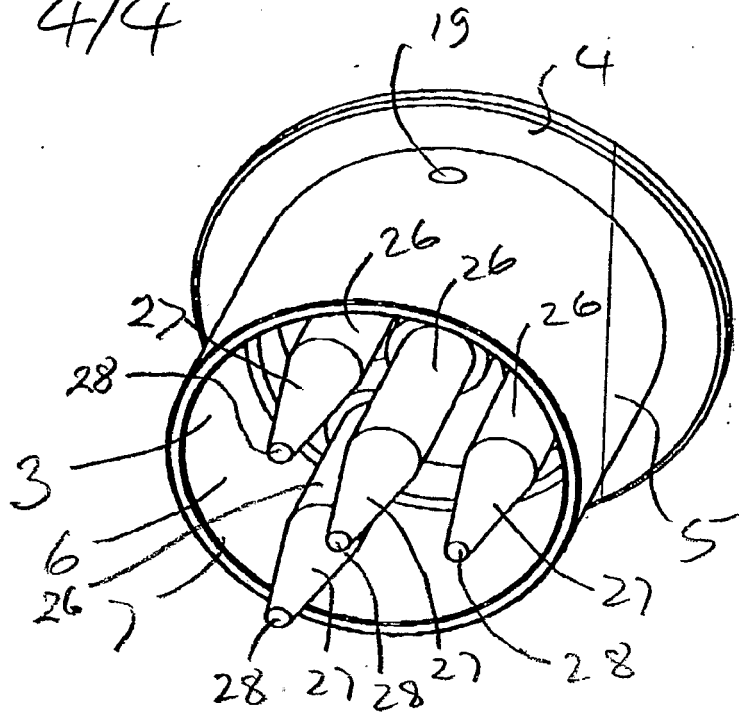
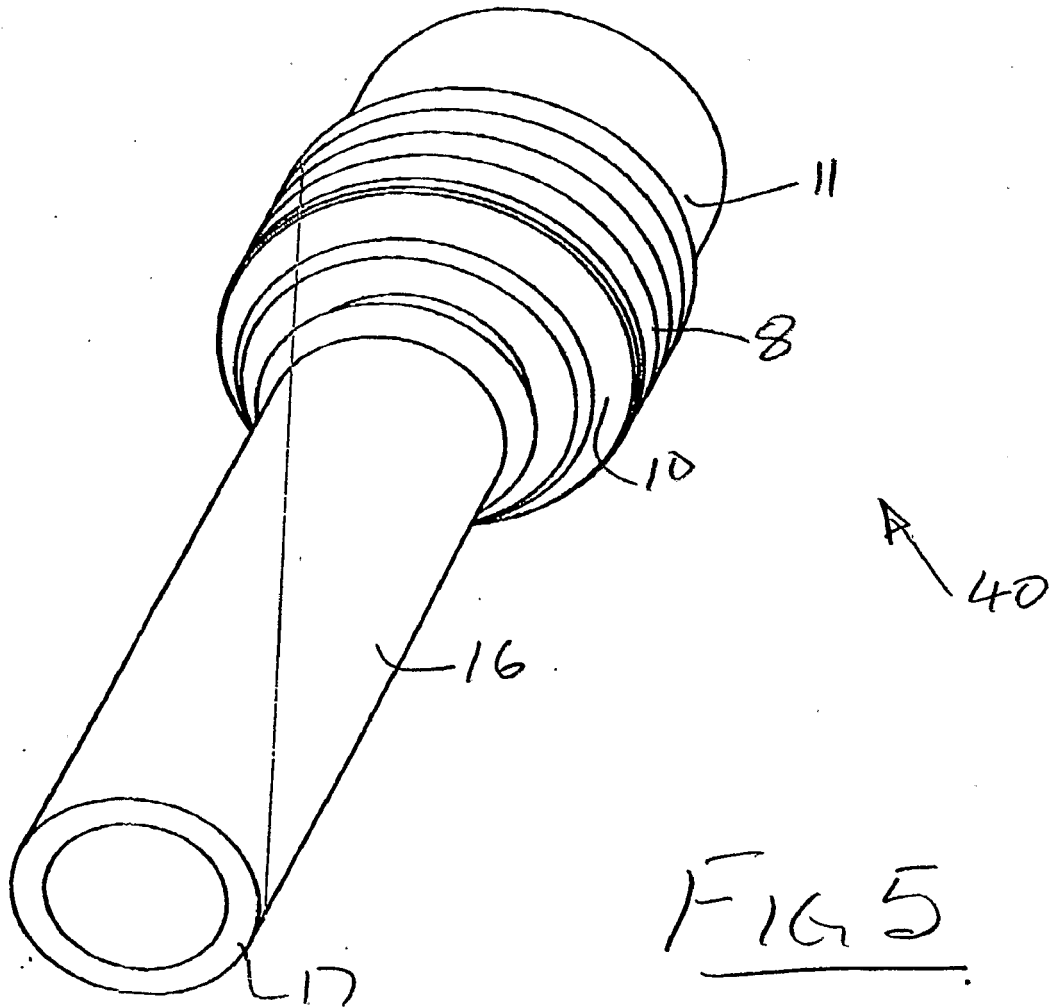


FIG 5

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⑪ 特許出願公開

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審査請求 未請求 請求項の数 22 (全12頁)

⑮ 発明の名称 シガレットフィルター要素のニコチンフィルター保留性と通過性の
制御方法

⑯ 特 願 平1-270161

⑰ 出 願 平1(1989)10月17日

優先権主張 ⑱ 1988年10月17日 ⑲ 米国(US) ⑳ 258366

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明細書の淨書(内容に変更なし)

明 細 書

1. 発 明 の 名 称

シガレットフィルター要素のニコチンフィルタ
ー保留性と通過性の制御方法

2. 特 許 請 求 の 範 囲

1. セルローズアセテート支持体または熱可塑性
合成繊維支持体のいずれかまたはこれらの組
合せを含むシガレットフィルター要素のニコチ
ンフィルター保留性と通過性の制御方法におい
て、

- (A) 前記フィルター要素またはそのプラグ成
分の1個以上の支持体を活性改質剤としての
弱酸の無毒性水溶性塩の有効量を含む水溶液
または水性懸濁液で処理する工程;または
- (B) 前記フィルターを形成する1個以上の繊
維状支持体またはフィルム支持体を処理する
工程;及び
- (C) 目的フィルター要素の製造を完成させる
工程
を含み、(1) 弱酸塩によるフィルター要素の

前記支持体またはプラグ成分の処理がニコチン
煙成分のフィルター通過を結粒状物通過濃度
に比べて増大させ; (2) 強酸塩によるフィルター
要素の前記支持体またはプラグ成分の処理がニ
コチン煙成分のフィルター通過を結粒状物通過
濃度に比べて減ずる方法。

2. 酸の無毒性水溶性金属塩を前記フィルター
要素またはそのプラグの1個以上の支持体に約
pH 8 ~ 約 pH 1.2 の範囲内の pH を有する緩
衝化水溶液または懸濁液として施布する請求項
1記載の方法。

3. 前記緩衝化溶液または懸濁液の pH 範囲が
約 pH 8 ~ 約 pH 1.0.5 である請求項2記載の
方法。

4. 前記支持体が熱可塑性合成繊維を含み、前
記水溶液または懸濁液が炭酸、リン酸、酢酸、
クエン酸及びフマル酸から成る群から選択した
酸の少なくとも1種類の無毒性金属塩を含む請
求項2記載の方法。

5. 無毒性金属塩が Mg(OAc)₂, Mn(OAc)₂,

KHCO_3 , K_2CO_3 , Na_2CO_3 , NaHCO_3 ,

K_3PO_4 , KH_2PO_4 及び KH_2PO_4 から成る群から選択した少なくとも1つの要素である請求項4記載の方法。

6. 前記水溶液または懸濁液が塩酸及び臭化水素酸から成る群から選択した酸の少なくとも1種類の無毒性金属塩を含む請求項1記載の方法。

7. 無毒性金属塩が ZnCl_2 , LiBr , KBr , CaBr_2 及び MgCl_2 から成る群から選択した少なくとも1つの要素である請求項6記載の方法。

8. シガレットフィルターを(a)開放繊維トウ(b)不織材料のリボン、(c)スライバー及び(d)ファイブリ化フィルムから成る群から選択した少なくとも1つとしての1個以上の支持体から製造する請求項1記載の方法。

9. シガレットフィルター要素が100重量%までのセルロースアセテートを含む請求項8記載の方法。

10. シガレットフィルター要素が100重量

%までの合成熱可塑性支持体を含む請求項1記載の方法。

11. シガレットフィルター要素が100重量%までのポリオレフィンを含む請求項10記載の方法。

12. 次の要素:

(a) セルロースアセテート繊維含有支持体または合成熱可塑性繊維含有支持体の1個以上を含む圧縮支持体であるフィルタープラグ;

(b) 強酸または弱酸と無毒性金属とから成る希望する水溶性塩の固相及び/または固相/液相から本質的に成り、前記圧縮支持体中に分布した複数の活性フィルター斑(loci)及び

(c) 前記圧縮支持体を固定するプラグラップの組合せから成り;

弱酸の無毒性水溶性塩を含むフィルター斑の存在がニコチンのフィルター通過を総粒状物フィルター通過濃度に比べて増大させ、強酸の無毒性水溶性塩を含むフィルター斑の存在がニコチ

ンのフィルター保留を、総粒状物フィルター通過濃度に比べて増大させるシガレットフィルターロッドまたは要素。

13. 前記活性フィルター斑が弱酸の無毒性水溶性塩の固相/液相から本質的に成り、前記液相が約pH8〜約pH12の範囲内のpHを有する請求項12記載のシガレットフィルターロッドまたは要素。

14. 水溶性塩が酢酸、炭酸、リン酸、クエン酸及びフマル酸から成る群から選択した酸の無毒性金属塩である請求項12記載のシガレットフィルターロッドまたは要素。

15. 水溶性塩が $\text{Mg}(\text{OAc})_2$, $\text{Mn}(\text{OAc})_2$, KHCO_3 , K_2CO_3 , Na_2CO_3 及び NaHCO_3 から成る群から選択した少なくとも1種類の塩である請求項14記載のシガレットフィルターロッドまたは要素。

16. 水溶性塩が MgCl_2 , LiBr , CaCl_2 及び CaBr_2 から成る群から選択した少なくとも1種類の塩である請求項12記載のシガレツ

トフィルター要素。

17. (a) 開放繊維トウ、(b) 不織材料リボン、(c) スライバー及び(d) ファイブリ化フィルムから成る群から選択した少なくとも1つとしての支持体からトウプラグを製造する請求項12記載のフィルター要素。

18. フィルター要素として請求項12記載のフィルター要素を用いるシガレット。

19. フィルター要素として請求項13記載のフィルター要素を用いるシガレット。

20. フィルター要素として請求項14記載のフィルター要素を用いるシガレット。

21. フィルター要素として請求項15記載のフィルター要素を用いるシガレット。

22. フィルター要素として請求項16記載のフィルター要素を用いるシガレット。

3. 発明の詳細な説明

本発明は、少なくとも1種類の活性水溶性調整剤成分を含むシガレットフィルター要素を用いることよつてシガレット煙からの放出粒状物質に比

べてニコチン放出を選択的に抑制するための改良シガレットフィルターと方法に関する。

繊維を主成分とするシガレットフィルター要素は周知であり、数年前から用いられているが、この種のフィルター用成分の選択は、コスト要因と先行技術のフィルターロッド製造装置を用いる高速フィルター製造に多くの天然繊維が適合していないこととのために、多年にわたって非常に限定されてきた。さらに、現在の商業的シガレットフィルター要素に対する要求は特に総合透過率とシガレット煙成分の選択的透過への要求の増大とに關して矛盾する傾向にある。

種々な繊維と繊維混合物が試みられ、評価されてきたが、多くの数のシガレットフィルター要素は、ある種のコストと取扱いの利点のために、古いテクノロジーを依然として好んで用いている。例えばセルロースアセテートは本質的に改良されていない先行技術のフィルターロッド製造装置を用いて、重大な妨害問題なしに、カット可能なフィルターロッドに容易に加工することができ

る。この利点は、例えばトリアセチン、ジアセチン、クエン酸のような有機可塑剤ならびに滑剤、フレーバー、薬剤、選択的透過剤等を含めた多量の添加剤の必要性が増大したにも拘らず、好まれている。一般に、このような添加剤は技術上認められた浸せき、吹付けまたはプリンティング (printing) 方法によつて開放繊維トウに水溶液として塗布する。

しかし、フィルター支持体としてセルロースアセテート繊維の利点はある種の欠点によつて妨げられる。例えば、このような繊維は例えばポリオレフィン繊維またはフィラメントのような熱可塑性合成繊維に比べて比較的弱い傾向にある。この性質は低い dpf のセルロースアセテート繊維トウが通常のフィルターロッド製造装置に導入される前に耐える伸縮度を重大に限定する。

しかし、ポリオレフィン繊維のような合成繊維は幾つかの欠点も有している。これらの欠点は、ポリオレフィン支持体が一般に疎水性であり、化学的に不活性になる傾向があるという事実起因

するが、公知のシガレットフィルター添加剤の大部分は親水性である。この理由から、このような添加剤を主要な支持体要素として疎水性合成繊維を用いるフィルター要素内に適量と機能的条件とで塗布し保持させることは非常に困難である。

シガレットフィルター分野に固有な他の問題は合成繊維フィルターの繊維デニールと総合透過率とを、フィルター要素の寸法安定性、硬度、圧力低下または耐延伸性を犠牲にすることなく最適化することの困難さに關する。

種々なフィルター支持体またはそれらの組合せの周知の利点を保ちながら、広範囲なタバコ混合物に合せて調整することのできる、すぐれた効率とドロー特性を有するシガレットフィルターを得ることが本発明の目的である。

総粒状物質の通過濃度に比べて、シガレット煙中のニコチン副生成物のフィルター放出とフィルター保留との両方を選択的に調節することが本発明の他の目的である。

上記目的は、セルロースアセテートまたは熱可

塑性合成繊維支持体のいずれかまたは組合せから成るシガレットフィルター要素のニコチンフィルター保留と通過特性を調節する、本発明の方法によつて達成される。

これらの支持体は (a) 開放繊維トウ (opened fiber tow)、(b) 不織材リボン、(c) スライバーまたは (d) フィブリル化フィルム of 形状で1種類以上の支持体を単独または組合せて含み、

(A) 前記フィルター要素またはそのプラグ成分の1種類以上の支持体を活性改質剤としての弱酸の無毒性水溶性塩の有効量を含む水溶液または水性懸濁液によつて処理することによつて；または

(B) 前記フィルター要素またはそのプラグ成分の1種類以上の支持体を活性改質剤としての強酸の無毒性水溶性無機塩の有効量を含む水溶液または懸濁液によつて処理することによつて活性化され；

(C) フィルター要素の乾燥を含めて目的シガレットの製造を完成させる；

これによつて(1)フィルター要素の支持体またはプラグ成分の弱酸の塩による処理が微粒状物通過濃度を基準にしてニコチン塩成分のフィルター通過を高め、(2)フィルター要素の支持体またはプラグ成分の強酸の塩による処理が微粒状物通過濃度を基準にしてニコチン塩成分のフィルター通過を減ずる。

総フィルター効率、特に固体粒状物除去効率は繊維デニール、フィルター長さ及び密度に実質的に依存するが、選択的通過特性、特に例えばニコチン保留及び通過特性のようなガス化フレーバー成分に対する制御は予測が困難であり、依然としてフィルター技術分野の継続的な問題である。

本発明は特定のタバコ混合物に含せてシガレットフィルターを容易に調節する方法と、急速に変化する市場の味覚と健康との要求を満たすことに関する。

特に、第1(a)族、第2(a)族及び遷移金属の無毒性水溶性金属塩として、好ましくは酢酸塩、炭酸塩またはリン酸塩、例えば $Mn(OAc)_2$ 、

後者のタイプの有効な塩には、例えばカルシウム、カリウム、亜鉛、リチウム、マグネシウムを含めた第1(a)族、第2(a)族及び遷移金属の特定の金属塩がある。このような塩には特に、例えば $ZnCl_2$ 、 $LiBr$ 、 KBr 、 $CaBr_2$ 、 $MnCl_2$ 及び $MgCl_2$ がある。

上記タイプの塩は1種類以上の適当な繊維状支持体またはファイブリル化フィルム支持体上に下記に示すような方法と有効量で個別に塗布する。

本発明の範囲内のシガレットフィルターロッドまたは要素は有効に、次の要素:

- (a) 例えば繊維形成またはフィルム形成ポリオレフィン、ポリエステルまたはポリアミドのような、1種類以上のセルロースアセテート繊維または合成熱可塑性繊維の連続支持体から成るフィルタープラグまたは圧縮支持体;
- (b) 強酸または弱酸と無毒性金属との好ましい水溶性塩の固体相及び固体/液体相から本質的に成り、圧縮支持体中に分散した複紋の活性フィルター斑(filter locus)。フィルター斑は

$Mg(OAc)_2$ 、 $KHCO_3$ 、 K_2CO_3 、 Na_2CO_3 、 $NaHCO_3$ 、 K_3PO_4 、 $KHPO_4$ 及び KH_2PO_4 として炭酸、リン酸、酢酸、クエン酸及びフマル酸から成る群から選択した弱酸の1種類以上の塩を塗布して用いることによつて、ニコチン放出量または保留量が増加することが判明する。このような目的のために、上記塩溶液または懸濁液を1種類以上のフィルター支持体上に約pH 8〜約pH 12好ましくは約pH 8.0〜pH 10.5のpH範囲を得るために十分な濃度で塗布することが特に有利だと判明している。

適当なフレーバーバランスを得るために、タバコ混合物がフィルター保留量を高めることを必要とする場合には、1種類以上のフィルター支持体に強無機酸の無毒性水溶性金属塩の有効量を単に塗布するだけで、繊維デニール、フィルター密度を実質的に変えることなく、このような保留量が微粒状物通過量に比べて選択的に高められることが判明している。塩酸または臭化水素酸の塩がこのような目的に特に有用だと分っている。

貯蔵によつて幾らか変動するが、好ましい最初の形態は飽和または濃縮水溶液としての少量の周囲液相を伴う結晶または固体である;及び(c) 圧縮支持体を固定してロッド及び究極的には上述のような好ましいニコチン保留性または通過性を有する好ましいフィルター要素を形成する紙またはフィルムのようなプラグラップを組合せて含む。

望ましい場合には、1種類以上の活性改質剤塩成分を別々のフィルター支持体表面に塗布してから(第2〜3図参照)、これらの支持体を単独でまたはレジスター(register)でガーニチャー(garniture)供給材料としてフィルターロッド製造装置に供給する。このような場合に、ガーニチャー供給材料成分を吹付けることによつて、活性改質剤成分の塗布を便利に行うことができる、または活性改質剤塩の溶液を形成されたフィルターロッドに通して真空抽出することができる。各場合に、フィルターロッドまたは要素は貯蔵する前にまたはタバコプラグと直接組合せる前に、制

御した熱及び湿度条件下でオープン乾燥させてフィルター要素の製造を完成させる。

本発明のために「活性改質剤成分の有効量」は、乾燥フィルタープラグ支持体の総重量を基準として、全体で約2重量%以上、好ましくは約3～10重量%の塩量である。上述したように、塩はフィルター支持体上に一様に分布された複数のフィルター斑として分散し、乾燥して、フィルター要素内の固体相または固体/液体相を形成することが最も望ましい。

本発明の範囲内には、(1) ソルビタン脂肪酸エステル、(2) 多価アルコールの脂肪酸モノエステルまたは(3) 多価アルコールの脂肪酸ジエステルとして表される1種類以上の界面活性剤を約0.1～10重量%、好ましくは0.5～10重量%の濃度で付加的に含むフィルター要素も含まれる。

適当な界面活性剤には、例えばエトキシレート、カルボン酸エステル、グリセロールエステル、ポリオキシエチレンエステル、アンヒドロソルビト

ールエステル、エトキシ化アンヒドロソルビトールエステル、エトキシ化天然脂肪、油及びワックス、脂肪酸のグリセロールエステル、ポリオキシエチレン脂肪酸アミド、ポリアルキレンオキシドブロッコポリマー、ポリ(オキシエチレン-コ-オキシプロピレン)等が含まれる。

上記で定義した「支持体」なる用語はフィルターロード製造装置への付加的供給材料として用いることのできる繊維状材料またはファイブリル化フィルムのトウ、スライバーまたはウェブを意味し、並立形及びシース/コア形(シースがコアより低融点である)を含めた、単成分、2成分または3成分繊維であるセルロースアセテート繊維または熱可塑合成繊維の1つ以上の開放繊維トウを含むものである。上記のような供給材料のウェブはフィルターロード製造装置のガーニチャー(garniture)へ単独でまたは完全にもしくは部分的に重ね合せて供給するのが便利である(第2図及び第3図参照)。

このようなガーニチャー供給材料は均一形または

混合形の支持体成分の約4個以上のウェブまでを便利に含むことができ、好ましい活性成分を選択した支持体の片面または両面に塗布することができるが、処理方法及び被処理面数は望ましいフィルター選択性とフィルター効率、さらに感度、硬度、及び延伸性に依存する。

本発明のために、ガーニチャー供給材料をその場で(すなわちガーニチャーの直前で)製造するか、それとも予め製造して使用するまで好蔵するかは重要ではない。

特にフィルター要素内の支持体の全てが活性改質剤の支持面として用いられるとは限らない場合には、ガーニチャー供給材料と、繊維組成とデニールが同じであるかまたは異なる1種類以上の不織布を用いることも適当であると判明している。

本発明によつてガーニチャー供給材料成分として不織布リボンまたは繊維トウを用いる場合には、このような成分は約100重量%までのセルロースアセテート繊維または合成熱可塑性繊維であり、好ましくは10～100重量%のポリオレフィン

(単成分、2成分または3成分)繊維(ここではステープルファイバーと見なす)の並立型またはシース/コア型から成るか、または例えば(a) ポリプロピレン/ポリエチレン、ポリプロピレン/ポリビニリデンクロリド、ポリプロピレン/セルロースアセテート、ポリプロピレン/レーヨン、ポリプロピレン/ナイロン、セルロースアセテート/ポリエチレン、可塑剤添加セルロースアセテート、ポリプロピレン/紙; または(b) ポリプロピレン/ポリスチレン/ポリエチレン等の繊維重量を基準にして約(a) 10%～90%/90%～10%または(b) 10～90%/45%～5%/45%～5%の好ましい比から、例えば米国特許第3,393,685号に述べられているように成る繊維の均質もしくは混合デニールのフィラメント、または組合せのフィラメントを含むウェブまたはトウから成る。

ファイブリル化フィルムを本発明の範囲内のガーニチャー供給材料として単独でまたは他の成分と重ね合せて使用する支持体成分として用いることが

できる。このような成分は例えば米国特許第4,151,886号と第4,310,594号〔ヤマザキ(Yamazaki)〕及び米国特許第3,576,931号〔コブラ(Chopra)〕に開示されている成分によつて得られる。

本発明のために、好ましいフィルター要素の製造工程の一部として、通常のフィルターロッド製造装置が用いられる。このような装置は例えば米国特許第3,144,023号と米国特許第2,794,480号に述べられている成分と方法とによると、トウトランペット(tow Trumpet)、ガーニチャー、成形手段及び切断手段を一般に含む。しかし、望ましい場合には、フィルターブラグの形成前または後に本発明の1種類以上の塩成分を導入するために、その場でまたは予め吹付け、浸せき、プリンティング、真空ドロー、またはその他の慣習的塗布方法を可能にするように改良を加えることができる。

他のバックグラウンドによると、ベールドスライバー(baled sliver)またはその他のガーニ

チャー供給材料は望ましい活性成分を含むタンク(reservoir)から供給される活性成分を、必要に応じて、連続的に浸せき塗布または1個以上のプリンティングロールを用いて送給可能に接触塗布された後、ニップロール、加熱乾燥ロールオーブン等を用いる通常の乾燥によつて上述のように仕上げ段階を施される。適当な乾燥は約70〜125℃の範囲内で行われる。

望ましい場合には、ガーニチャー供給材料として通した不織材料が技術上認められた方法を用いて均一デニールまたは混合デニールの繊維から得られる。このような不織材料は約10〜50 g/m²の重量範囲であり、約4"〜12"のリボン幅が生産速度で作動する慣習的なフィルターロッド製造装置のガーニチャーを確実に上首尾に通過する。

上述したように、適当なガーニチャー供給材料は重量、寸法、結合性、吸水性、繊維組成及びデニールが同じまたは異なる、1〜4個またはそれ以上の支持体ウェブを含むことができる。このようなウェブは完全にまたは部分的に重ね合せて装

置に任意にクロス方向または対角方向において導入される。しかし、最も良い結果を得るには、1枚の比較的軽い熱結合した布帛、トウ、スライバーまたはフィブリル化フィルムを1枚の不織布と重ね合わせるまたは2枚の不織布の間に重ね合わせる(第2図参照)が、良好な塩保持量、フィルタードロー及び硬度をもたらすことが判明している。

ガーニチャー供給材料として他のポリオレフィン繊維と組合せた、ポリエチレンのような付加的な低融点繊維を加えることも、広範囲な結合性と吸着性のトウブラグを得るために有用であることが判明している。

開放繊維トウと不織布リボンは混合デニールの比較的安価なポリオレフィンウェブの使用を可能にし、改質剤塩成分を正確に分布するという仕事を簡単化し、しかも支持体被覆のための技術上認められた方法及び例えばプリンティング・ロールやスプレーヘッドのような装置の使用を断念する必要がないので、コスト的に有利な組合せである

ことが判明している。

上記で定義した活性な改質剤塩成分の他に、例えばグリセロール、グリコール等の多価アルコールによつて例示されるような、1種類以上の保湿剤の水溶液、エマルジョン、懸濁液または分散液；例えば冬緑油、ミドリハツカ、ペツパーミント、チョコレート、カンゾウ、シナモン、フルーツフレーバー、カンキツ属等を含めた、ケトース及び多糖類のようなフレーバー及び香料；例えばメントール及びうつ血除去剤のような薬剤；及び米国特許第4,485,828号と第4,715,390号に述べられているような、その他の技術上認められた添加剤等の補助成分を用いることもできる。

添加剤の使用を正確に制御するためには、受容支持体をフィルター要素に変える前に水分含量に關して一致するように注意深く制御することが有利であると判明している。さらに、トウ、スライバーまたは不織布に活性成分を塗布し、次にこれを透過性の小さい、2枚以上の非処理不織布の間に差込む(第3図参照)ことによつて、フィルタ

一要素とそれに塗布した添加剤成分とがさらに分離されて、層と直接接触しないように遮べされることが有利である。望ましい場合には、得られたフィルター要素の外部をコルクまたは同様に不活性な断熱材(図示せず)によつて被覆することもできる。上記のようにフィルター要素に塗布される改質剤の量と効果は実質的に、支持体の幅とガーニチャーに同時に供給する支持体の数ならびにフィルター要素内でタバコ煙に暴露される処理面の量によつて定まる。

本発明のために、処理した布帛、リボン、トウ等と、これらと非処理布帛、リボン、トウ等との組合せとの両方は例えば約25~90 g/m²以上の範囲内の重量を有する紙のような通常のプラグラップ(plug wrap)を用いて任意に包むこともできる。

本発明を次に第1図~第4図においてさらに説明する。第1図は本発明による処理支持体をシガレットフィルター要素に加工することのできる通常のシガレットフィルターロッド製造装置の概略

ロッド製造装置(1)のガーニチャーTRANSPET(15)とガーニチャー(14)に導く。この装置(1)は支持体供給材料の成形・保持手段、ラッピング手段及びラップしたプラグまたはロッドをフィルター要素(16)に加工するための切断手段を含む(しかし図示せず)ガーニチャー部分(2)から成り；ラッピング手段は支持ロール(19)によつて支えられるラップ供給リール(5)から連続ガーニチャーベルト(3)上を移動してロッド製造装置に導入されるトウラップを便利に供給される。

上記装置はフィルタープラグの周囲をトウラップでシールする慣習的手段(図示せず)を含み、ラップされたプラグは次に切断手段によつて切断されて、望ましい長さ(通常は90mm以上)の一般に円筒形のフィルター要素(16)になり、容器に入れて包装されるためにフィルターシュート(18)(断片として示す)を通して取り出される。

第2図は、支持体(10A)と(10B)上に

図であり、第2図~第4図はラップしたフィルタープラグを吹付け、浸せき、または真空延伸することによつて、トウ、スライバー、不織布リボンまたはファイブリル化フィルム(1つ以上を1種類以上の活性な改質剤成分で処理する本発明の範囲内の変更と改良の概略図を表す。複数の支持体の使用はこのようにフィルター要素のかさの増大と耐破壊性または硬度の改良とを容易にする。

第1図をさらに詳細に説明すると、例えば開放横縦トウ、スライバー、ファイブリル化フィルムまたは不織布リボンのような単独の連続支持体(10)を供給リール(11)またはベール(bale)(図示せず)から、外部供給源(図示せず)からの供給ライン(21)に送給可能に連結した1個以上の向い合つたスプレーヘッド(21)を通して供給して、1種類以上の活性改質剤成分(22)を塗布する。生成した処理支持体を次に風乾手段(図示せず)と乾燥ロール(12)を通すことによつて乾燥させて、目的の乾燥度を得、次に案内ロール(17)によつてシガレットフィルターロ

1種類以上のフィルター改質剤成分またはその他の添加剤を別々に塗布するための他の装置の概略図を示す、これによつて供給ライン(21A)によつて供給される異なる配置のスプレーヘッド(20A)が別々に活性改質剤成分22A(同一成分またはその他の成分)を別々の支持体(10A、10B)に別々に塗布し、この支持体は次に少なくとも部分的に空気と加熱ロール(12A)によつて乾燥されてから、ロッド製造装置(1A)のガーニチャー(14A)に通して供給して、前記と同様にフィルター要素(16A)を形成する。支持体(10Aと10B)は供給ロール(11A)と(11B)またはベール(図示せず)から供給され、加熱ニツプロール(12A)において便利に重ね合されて、案内ロール(17A)によつてガーニチャー(14A)中に案内される；図示するガーニチャー供給材料または支持体要素は第1図~第3図の各々においてアラビア数字によつて図様に定義する。

第3図は第1図と第2図の装置と方法の他の実

変更様の概略図を示す。これによるとリールまたはボックス(図示せず)からの上記と同じまたは異なる種類(10C、10D及び10E)の幾つかの支持体が加熱ロール(12B)によつて形成されるニップを通つて供給されるが、中央の支持体(10D)は2枚の外部非処理支持体(10Cと10E)とは異なる幅を有し、活性成分(22B)を保留するためにより高い吸収または吸着性を有することが好ましい。図示するように、支持体(10B)は供給ライン(21B)から供給されるスプレーヘッド(20B)によつて両側において1種類以上の活性改質剤成分(22B)に選択的に暴露されて、活性改質剤成分(22B)を吹付塗布されるが、支持体の1つ(10E)はリボン(10)によつて保留されないまたは捕捉されない過剰ドリップまたは方向を誤つた活性成分を捕捉するように配置するのが好ましい、この後に3支持体の全ての少なくとも一部を、前述のように、重ね合せて加熱ニップロール(12B)に通して風乾し、第1図と第2図のように案内ロール

のように実施してから、上記のように処理することが便利である。

上述のように用いる支持体は上記のような多様なフィラメントから成る。従つて、ポリエステル、ポリアミド、アクリル樹脂ならびにポリプロピレン等を用いることが可能である。ポリプロピレンとエチレンまたは他の低級オレフィンポリマーとのフィラメント形成コポリマーの組合せは、他の合成繊維形成材料に比べて比較的的低密度であり、スピン特性(spin property)がすぐれているために、トウ、不織リボン、ファイブリン化フィルム材料として特に好ましい。

本発明を実施するためのトウのバルクデニール(bulk denier)は約2,000~10,000の範囲内であることが便利であり、このような支持体は単一リールもしくはベイルから、または結合した幾つかのリールもしくはベイルの複合体からけん組繊維として供給され、同時に流体ジェットに通される。しかし、繊維トウのシガレットフィルターとして最良の性能を得るには、少なく

(図示せず)によつてフィルターロッド装置のガーニチャー内に導く。

第4図は他の変更様の概略図であり、この装置では上記で定義した支持体1個以上(10Cとして示す)がベールまたはボックス(24C)から別々に供給され、案内ロール(17C)を通り、部液、懸濁液またはエマルジョンとして1種類以上の活性改質剤成分(22C)を含むタンク(25C)中に浸せきされ、ニップロール(26C)、加熱オープン(27C)、ドローロール(drawer roll)(28C)及び三段階乾燥オープン(29C)を通つて、上述の第1図~第3図のようにシガレットロッド製造装置のガーニチャーに達し、箱詰めされて将来の使用のために貯蔵される。

支持体成分として連続繊維トウを用いる場合には、1個以上のクリール(creel)からバルキング(bulking)またはテクスチャーリング(texturing)流体ジェット(図示せず)を通して繊維を取り出すことによつて、トウの調製を通常

とも一部のトウが実質的にねじられず、組織化されずに流体ジェットに入ることが好ましい。

本発明を次の実施例によつてさらに説明する。

実施例 1

(A) 溶融流量(MFR)16を有する溶融紡糸したアイソタクチックポリプロピレンから製造したベールド4.5 dpf「Y」断面ポリプロピレン繊維を破壊し、開放し、カードにかけ、けん組させ、引張つて、幅12~14 inchの薄いトウを形成する。このリボンをさらに処理することなく、モリス社(Molins Ltd.)(イギリス)から得られるモデルPM-2のような慣習的なフィルターロッド製造装置に通して延伸し、ガーニチャー供給材料を圧縮成形して、フィルターロッドを形成し、これをBXT-100ポリプロピレンフィルムで包んで108mmフィルターロッドを得る。このロッドを次に切断し、実質的に等重量かつ等しい耐延伸性*1の27mm長さに分割し、アール・ジェイ・レイノルド(R. J. Reynold)のキャメルライト(Camel Light)タバコプラグ上

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ヒューズで止め、調湿室 (humidity cabinet) (22℃、相対湿度55～65%) *2 内に48時間貯蔵してから、C-1及びC-2とグループ分けした対照サンプルとして用い、ホルダバート (Borwaldt) スモークシグナチュ*3 において2秒パフ/分で35mm長さになるまで同じように吸煙させた。生成した煙中の粒状物質を予め秤量したクソブリッジ・フイルターパッド (Combifilte filter pad) に捕捉し、このパッドを再秤量してシガレットフイルターを通過した粒状物質 (TPM) の総量と平均量とを求めた。次にクソブリッジパッドを一晩無水イソプロピルアルコール中に浸せきして、得られた抽出物をGC (ガスクロマトグラフィー) 自動サンプラー*4 を用いて、ニコチン含量と水分含量に關して通常のように検査した。

(B) 同じペーパルからの繊維トクを同様に処理して実施例1(A)の方法で10個の試験フイルター製葉を得たが、この場合には切断したフイルター製葉を次に KHCO_3 , K_2CO_3 / KHCO_3 混合塩、

$\text{Mg}(\text{OAc})_2$, $\text{Mn}(\text{OAc})_2$ 及び MgCl_2 の1%, 2%及び5%溶液でそれぞれ処理し、吸引バルブを用いて各フイルター製葉を延伸して、約2.0mmの改質利値で均一に処理するために充分な量の溶液を添加させた。このフイルター製葉を次に風乾させ、オーブン乾燥させて、調湿室に48時間貯蔵してから、アール・ジェイ・レイノルズのキヤメルライトのタバコグラフに前記と同様にチューブで止めた。ニコチン、総粒状物質量 (TPM) 及びフイルター効率に關する通常の検査を前記と同様に実施し、シガレット1本あたりを基準として秤量し、第1表にS-1からS-19までとして報告した。

*1 全ての試験フイルター製葉は111～136mmWg (水柱 (water gauge)) の範囲内の耐延伸性 (RTD) を有する。

*2 コレスダ (CORESTA) 標準法 #10による。

*3 モデルRM20/CSとRM1/G

*4 ヒューレットパッカード (Hewlett

Packard) モデルHP5890。

第 1 表

サンプル	溶 液	濃度 (%)	pH	Nic/TPM(%)
S-1	KHCO_3	2	8.20	6.86
S-2	KHCO_3	1	8.20	7.72
S-3	KHCO_3	2	8.31	6.65
S-4	KHCO_3	5	8.47	9.41
S-5	KHCO_3	1	8.53	9.33
S-6	KHCO_3	5	8.74	6.36
S-7	K_2CO_3 / KHCO_3 (1/4)	5	9.00	6.90
S-8	K_2CO_3 / KHCO_3 (1/1)	5	9.50	6.99
S-9	K_2CO_3 / KHCO_3 (1/1)	5	9.58	6.66
S-10	K_2CO_3 / KHCO_3 (4/1)	5	10.10	8.45
S-11	K_2CO_3 / KHCO_3 (4/1)	5	10.40	8.90

実施例 2

実施例 1 と同じベールからの繊維トリを同様処理してフイルター要素を得たが、この場合には切断した要素 (S-20 から S-24 までと名づける) に K_3PO_4 溶液及び K_2HPO_4 溶液を含浸させて、約 2.0 重/フイルター要素に等しい活性塩の有効濃度を得た。この結果の処理と乾燥したフイルター要素をアール・ジェイ・レイノルドのライトバコグラフに前記と同様にテープで止め、風乾させ、調湿室内に 48 時間保存してから、同じ方法で乾燥した。サンプルを回収して、前記と同様に試験し、平均の結果を下記の第 2 表に報告する。

サンプル	溶 液	濃度 (%)	pH	Nic/TPM (%)
S-12	K_2CO_3	2	11.50	8.20
S-13	K_2CO_3	5	11.80	8.10
S-14	$Mg(OAc)_2$	2	8.21	8.73
S-15	$Mg(OAc)_2$	5	8.13	7.02
S-16	$Mg(OAc)_2$	2	7.65	8.66
S-17	$Mg(OAc)_2$	5	7.68	6.84
S-18	$MgCl_2$	2	9.38	3.19
S-19	$MgCl_2$	5	9.09	4.87
C-1		1	7.00	5.14

* 5 処理量
* 6 乾燥量

第 2 表

サンプル	溶 液	濃度 (%)	pH	Nic/TPM	TDR
S-20	K_3PO_4	5	11.7	7.7	30.4
S-21	K_3PO_4/K_2HPO_4 (1/1)	5	11.0	7.2	36.3
S-22	K_3PO_4/K_2HPO_4 (1/8)	5	10.1	8.2	29.8
S-23	K_2HPO_4	5	9.0	7.0	35.5
S-24	KH_2PO_4	5	4.4	5.8	36.4
C-2		1	—	5.5	35.9

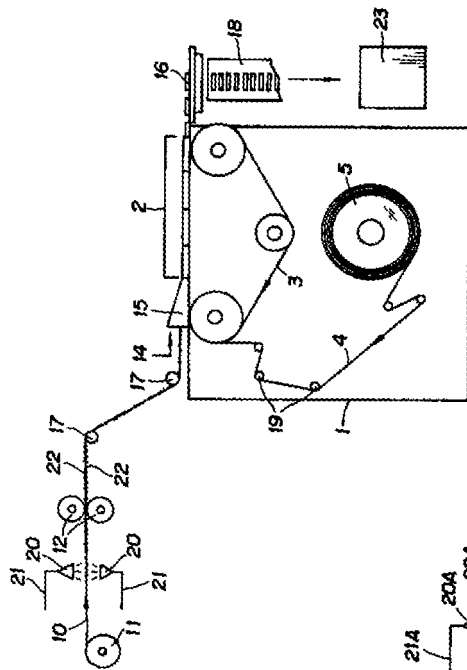
4. 図面の簡単な説明

第 1 図は本発明によつて処理した支持体をシガレットフイルター要素に加工するための通常のシガレットフイルター要素製造装置の概略図であり；

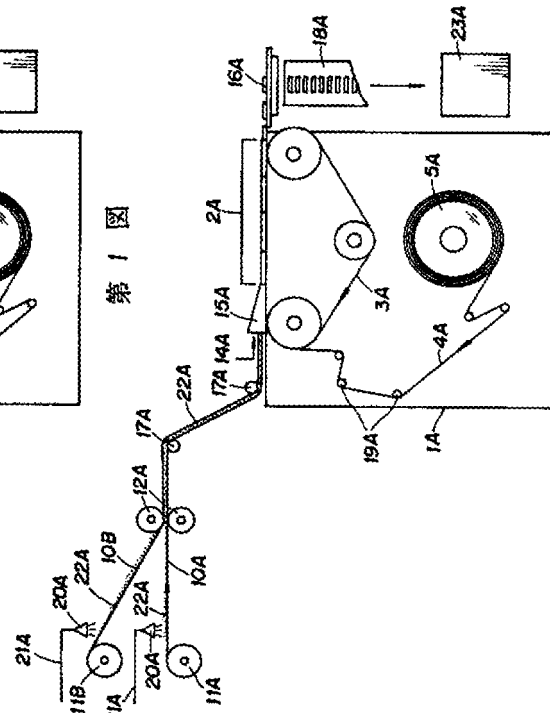
第 2 図～第 4 図はラップしたフイルターグラフを吹付け、浸せきまたは真空延伸することによつて、トリ、スライバー、不織布リボンまたはフイブリル化フイルムの 1 つ以上を 1 種類以上の活性な改質剤成分で処理する本発明の範囲内の要素と改良の概略図である。

1 … フイルター要素製造装置；
2 … ガーニチャーの一部； 3 … ガーニチャーベ
ルト； 5 … ラップ供給リール；
10 … 連続支持体； 12 … 加熱ロール；
14 … ガーニチャー； 16 … フイルター要素；
17 … 案内ロール； 18 … フイルターシュート
20 … スプレッヘンブ； 21 … 供給ライン；
22 … 活性改質剤成分。

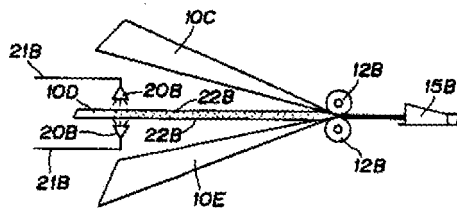
図面の浄書(内容に変更なし)



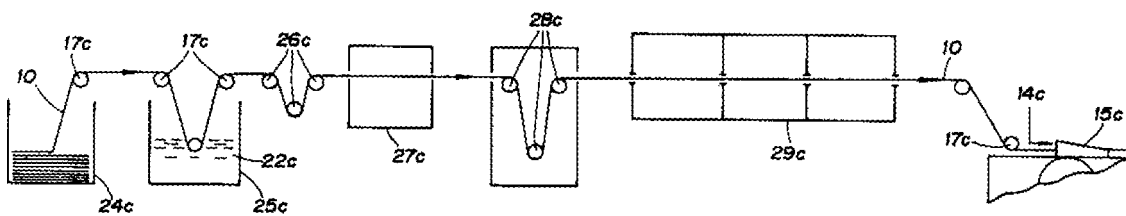
第 1 図



第 2 図



第 3 図



第 4 図

手続補正書

平成 元年12月 12日

特許庁長官 古田 文 毅 殿



1. 事件の表示

平成1年特許願第270161号

2. 発明の名称

シガレットフィルター要素のニコチンフィルター保留性と
通過性の制御方法

3. 補正をする者

事件との関係 特許出願人

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5. 補正の対象

タイプ印書により浄書した明細書

適正な図面

6. 補正の内容

別紙の通り (尚、明細書及び図面の内容には変更なし)



方式 (補正)
標 本

[54] **SELECTIVE DELIVERY AND RETENTION OF NICOTINE BY-PRODUCT FROM CIGARETTE SMOKE**

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[73] Assignee: **Hercules Incorporated**, Wilmington, Del.

[21] Appl. No.: 258,366

[22] Filed: Oct. 17, 1988

[51] Int. Cl.⁴ A24D 3/06; A24D 3/08;
A24D 3/16

[52] U.S. Cl. 131/342; 131/343;
131/345; 131/331

[58] Field of Search 131/334, 342, 343, 345,
131/331

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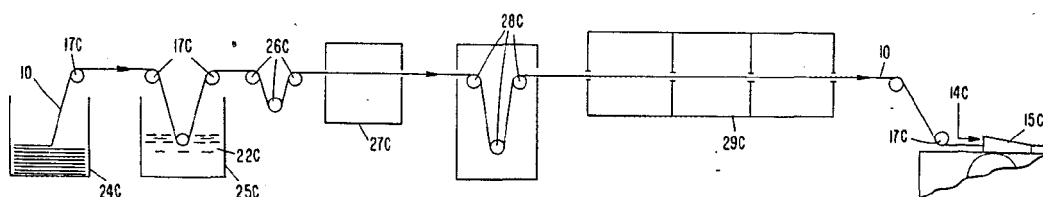
Primary Examiner—V. Millin

Attorney, Agent, or Firm—John E. Crowe

[57] **ABSTRACT**

A method for controlling nicotine delivery through a cigarette filter relative to total particulate pass-through concentration, and the corresponding filter utilizing, as a filter modifier component, at least one water-soluble metal salt of a weak acid, the choice and amount of salt within the filter favoring an alkaline pH exceeding about pH 8, the amount of alkalinity being correlated to the desired amount of nicotine pass-through while corresponding nicotine filter retention properties are keyed to the presence and concentration of a water soluble salt of a strong acid within the filter.

22 Claims, 2 Drawing Sheets



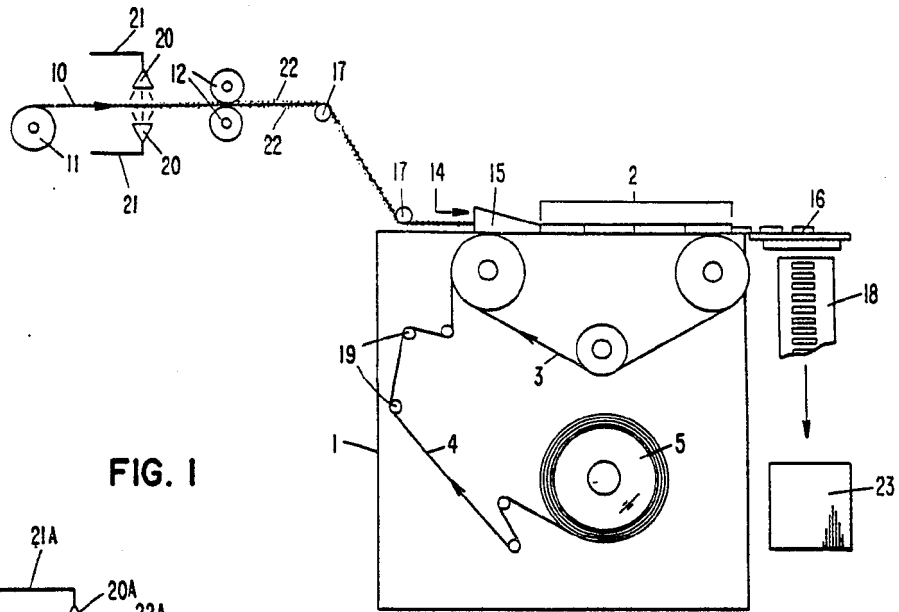


FIG. 1

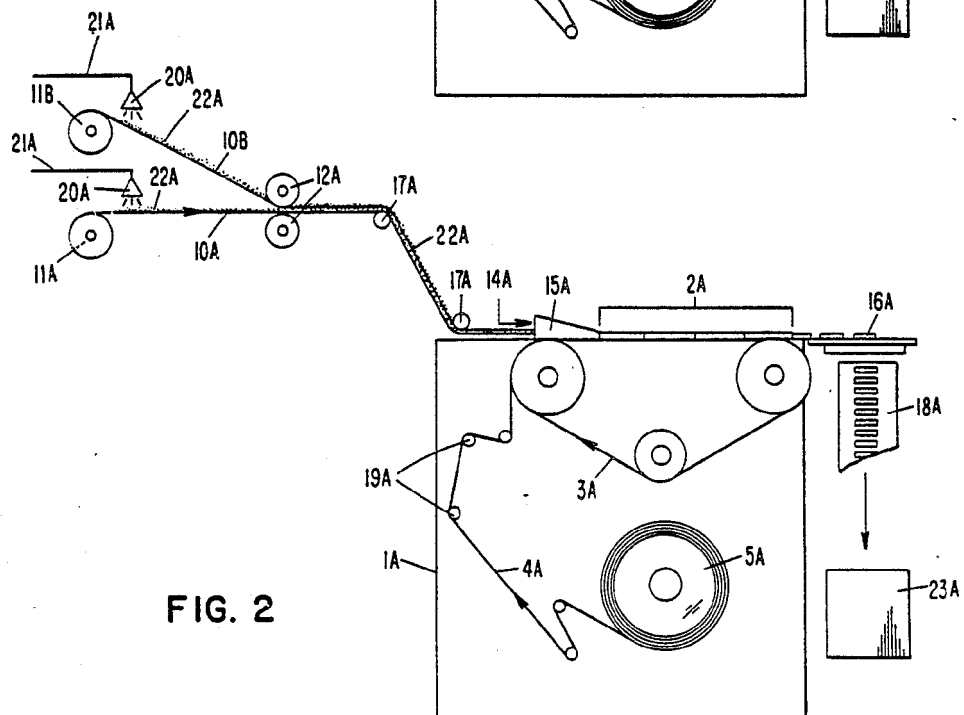


FIG. 2

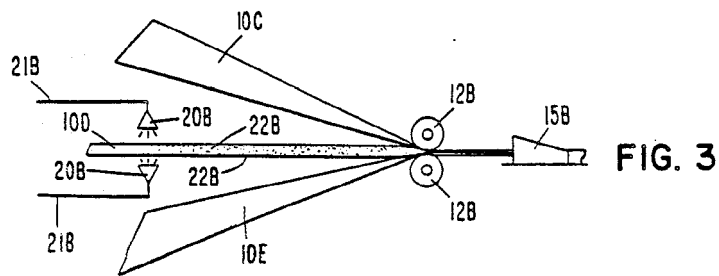


FIG. 3

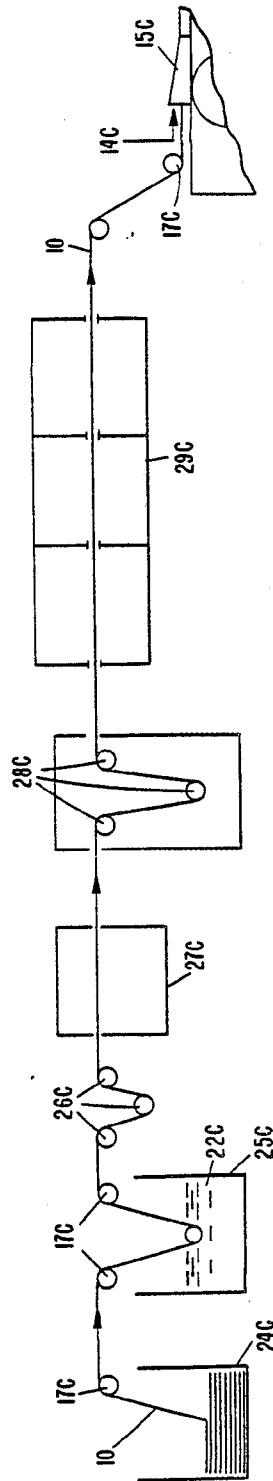


FIG. 4

SELECTIVE DELIVERY AND RETENTION OF NICOTINE BY-PRODUCT FROM CIGARETTE SMOKE

The present invention relates to an improved cigarette filter and method for selectively controlling nicotine delivery relative to delivered particulate matter from cigarette smoke by using a cigarette filter element containing at least one active water soluble modifier component.

BACKGROUND

Although fiber-based cigarette filter elements are well known and have been used for a number of years, the choice of components for this class of filters has remained quite limited over the years due to cost factors and lack of general suitability of many natural fibers for high speed filter production using state of the art filter rod-making apparatus. In addition, the demands on present day commercial cigarette filter elements tend to conflict, particularly with respect to general filtration efficiency and increased demand for selective filtration of cigarette smoke components.

While various fibers and fiber mixtures have been tried and evaluated, a substantial number of cigarette filter elements continue to favor old technology because of certain cost and handling advantages. For example, cellulose acetate tow can be readily processed into cuttable filter rods using an essentially unmodified state-of-the art filter rod-making apparatus without serious jamming problems. This advantage is enjoyed despite increased need for substantial amounts of additives, including organic plasticizers such as triacetin, diacetin, citric acid, as well as lubricants, flavors, medicines, selective filtering agents and the like. Generally, such additives are applied as aqueous solutions onto opened fiber tow by art-recognized dipping, spraying, or printing techniques.

The advantages of cellulose acetate fiber as filter substrate, however, are countered by certain disadvantages. For example, such fiber tends to be relatively weak compared with thermoplastic synthetics such as polyolefin fiber or filament. This characteristic seriously limits the amount of tension and crimp that a cellulose acetate fiber tow of low dpf will tolerate prior to introduction into a conventional filter rod-making apparatus.

Synthetics such as polyolefin fiber, however, also have some disadvantages. These arise from the fact that polyolefin substrates are generally hydrophobic and tend to be chemically inert, while a majority of known cigarette filter additives are hydrophilic. For this reason it is sometimes very difficult to apply and retain such additives in proper amount and functional condition within filter elements using hydrophobic synthetic fiber as a major substrate component.

Another problem, unique to the cigarette filter art, concerns the difficulty in optimizing fiber denier and general filter efficiency of synthetic fiber filters without corresponding sacrifice in dimensional stability, hardness, and pressure drop or draw across the filter element.

It is an object of the present invention to obtain cigarette filters of superior efficiency and draw which can be tailored to a wide variety of tobacco mixtures while retaining known advantages of various filter substrates or combinations thereof.

It is a further object of the present invention to control selectively both filter delivery and filter retention of nicotine by-product in cigarette smoke, compared with pass through concentrations of total particulate matter.

THE INVENTION

The above objects are obtained in accordance with the instant method for controlling nicotine filter retention and pass through characteristics of a cigarette filter element, comprising one or a combination of cellulose acetate- or thermoplastic synthetic- fiber substrate. These can include one or more substrates singly or in combination in the form of an (a) opened fiber tow, (b) ribbon of a nonwoven material, (c) sliver or (d) fibrillated film, which are activated by

(A) treating one or more substrate of said filter element or plug component thereof with an aqueous solution or suspension containing an effective amount of a non-toxic water soluble salt of a weak acid as an active modifier; or

(B) treating one or more substrate of said filter element or plug component thereof with an aqueous solution or suspension containing an effective amount of a non-toxic water soluble inorganic salt of a strong acid as an active modifier; and

(C) completing fabrication of the desired cigarette, inclusive of drying the filter element; whereby (1) treatment of the substrate or plug component of the filter element with the salt of a weak acid increases filter pass through of nicotine smoke component relative to total particulate pass through concentration, and (2) treatment of the substrate or plug component of the filter element with the salt of a strong acid decreases filter pass through of nicotine smoke component relative to total particulate pass through concentration.

General filter efficiency, particularly solid particulate removal, depends substantially upon fiber denier, filter length and density, but selective filtration properties, particularly control over gassified flavor components, such as nicotine retention and pass through characteristics, are less easily predicted, and remain a continuing problem in the filter art.

The present invention relates to a way of more easily tailoring cigarette filters for specific tobacco mixtures and to satisfy taste and health demands in a rapidly changing market.

In particular, it is found that increased nicotine delivery or pass through is obtained by applying and utilizing one or more salt of a weak acid selected from carbonic, phosphoric, acetic, citric and fumaric acids, in the form of non-toxic water soluble metal salts of group 1(a), 2(a) and Transition Elements, preferably acetate, carbonate, or phosphate salts exemplified by $Mn(OAc)_2$, $Mg(OAc)_2$, $KHCO_3$, K_2CO_3 , Na_2CO_3 , $NaHCO_3$, K_3PO_4 , $KHPO_4$ and KH_2PO_4 . For such purposes, it is found particularly advantageous to apply the above salt solutions or suspensions onto one or more filter substrate in sufficient concentration to obtain a pH range of about pH 8 to about pH 12, and preferably about pH 8.0 to about pH 10.5.

Where the tobacco mixture requires increased filter retention to obtain a proper flavor balance, it is found that such retention can be selectively promoted, relative to total particulate pass through, without substantially changing fiber denier or filter density, by merely adding to one or more filter substrate an active amount of a non-toxic water-soluble metal salt of a strong mineral

acid. Salts of hydrochloric, or hydrobromic acid are found useful for such purpose.

Active salts of the latter type include, for example, selected metal salts of group 1(a), 2(a) and Transition Elements, inclusive of calcium, potassium, zinc, lithium, and magnesium. Such salts specifically include, for instance, ZnCl_2 , LiBr , KBr , CaBr_2 , MnCl_2 , and MgCl_2 .

Salts of the above-defined types are individually applied, as needed, onto one or more appropriate fiber- or fibrillated film substrate(s) in a manner and in effective amounts as indicated hereafter.

Cigarette filter rods or elements within the scope of the present invention usefully comprise, in combination,

(a) a filter plug of compacted substrate comprising one or more of cellulose acetate- or synthetic thermoplastic-fiber continuing substrate such as a fiber- or film forming polyolefin, polyester or polyamide;

(b) a plurality of active filter loci distributed within the compacted substrate, wherein the loci consist essentially of solid and/or solid/liquid phases of the desired water soluble salt of a strong or a weak acid and a non-toxic metal. While the loci may vary somewhat with storage, the preferred initial configuration consists of crystals or noncrystalline solids in conjunction with a small surrounding liquid phase in the form of a saturated or concentrated aqueous salt solution; and

(c) a plug wrap such as paper or film securing the compacted substrate to form the rod and, ultimately, a filter element of desired nicotine retention or pass-through properties as above described.

If desired, one or more active modifier salt component(s) can be applied onto separate filter substrate surfaces (ref. FIGS. 2-3), which are then introduced singly or in register as garniture feed into a filter rod-making apparatus. In such instance, application of active modifier salt component can be conveniently effected by spraying the garniture feed component, or a solution of the active modifier salt can be vacuum drawn through the resulting formed filter rod. In each case filter rod or element is oven dried under controlled heat and humidity before storage or direct combination with a tobacco plug to complete fabrication of the filter element.

An "effective amount of active modifier component", for purposes of the present invention, is an amount of the salt totaling about 2% by weight or more; and preferably about 3-10%, based on total weight of dry filter plug substrate. As above noted, the salt is best distributed in the form of a plurality of filter loci evenly distributed onto a filter substrate and dried to form solid or solid/liquid phases within the filter element.

Also included within the scope of the present invention are filter elements additionally containing surfactant material in a concentration of about 0.1%-10% and preferably 0.5%-10% by weight of one or more of a class described as (1) a polyoxyalkylene derivative of a sorbitan fatty acid ester, (2) a fatty acid monoester of a polyhydroxy-alcohol, or (3) a fatty acid diester of a polyhydroxy alcohol.

Suitable surfactants can include, for instance, ethoxylates, carboxylic acid esters, glycerol esters, polyoxyethylene esters, anhydrosorbitol esters, ethoxylated anhydrosorbitol esters, ethoxylated natural fats, oils and waxes, glycol esters of fatty acids, polyoxyethylene fatty acid amides, polyalkylene oxide block copolymers, poly(oxyethylene-co-oxypropylene) and the like.

The term "substrate", as above defined, denotes a tow, sliver or web of fiber or fibrillated film usable as

garniture feed for a filter rod-making apparatus, including one or more of an opened fiber tow of cellulose acetate fiber or thermoplastic synthetic fiber of mono-, bi- or tri-component fibers inclusive of side-by-side and sheath/core varieties having a sheath of lower melting point than the core. Webs of such feed, as above noted, are conveniently introduced into a garniture of a filter rod-making apparatus alone or in complete or partial register (see FIGS. 2 and 3).

Such garniture feed can conveniently include up to about four or more webs of substrate component(s) of a homogeneous or mixed variety, the desired active components being applied onto one or both faces of selected substrates, the manner and number of faces treated depending upon desired filter selectivity and efficiency, plus feel, hardness, and draw characteristics.

For purposes of the present invention, it is immaterial whether the garniture feed is fabricated, in situ, (i.e. immediately upstream of the garniture) or earlier produced and stored before use.

It is also found suitable to use one or more nonwoven fabrics of the same or different fiber composition and denier as garniture feed, particularly when not all of the substrate in the filter element is to be used as a carrier surface for active modifier component(s).

When a ribbon of a nonwoven fabric or a fiber tow is used as garniture feed component in accordance with the present invention, such can again usefully comprise up to about 100% by weight of cellulose acetate- or synthetic thermoplastic substrate and preferably 10%-100% by weight of polyolefin (mono, bi-, or tri-component) fiber of the side-by-side and sheath/core types, identified here as staple fiber, or may consist of webs or tows having filaments of homogeneous or mixed denier, or combination of fibers such as (a) polypropylene/polyethylene, polypropylene/polyvinylidene chloride, polypropylene/cellulose acetate, polypropylene/rayon, polypropylene/nylon, cellulose acetate/polyethylene, plasticized cellulose acetate, polypropylene/paper; or (b) polypropylene/polystyrene/polyethylene, and the like, in preferred ratios of about (a) 10%-90% 90% -10% or (b) 10%-90%/4-5%-5%/45%-5% based on fiber weight, and as described, for instance, in U.S. Pat. No. 3,393,685.

Fibrillated film can be employed as a substrate component for use alone or in combination with other substrate components as garniture feed within the present invention. Such can be obtained, for instance, in accordance with components disclosed in U.S. Pat. No. 4,310,594 (Yamazaki) and U.S. Pat. No. 3,576,931 (Chopra).

For present purposes, and as part of the step of completing fabrication of the desired filter element is the use of a conventional filter rod-making apparatus. Such device generally contains a tow trumpet, garniture, shaping means, wrapping means, and cutting means in accordance with components and processes described, for instance, in U.S. Pat. Nos. 3,144,023 and 2,794,480. If desired, however, modifications can be made to permit in-situ or prior spraying, dipping, printing, vacuum draw, or other traditional application methods for introducing one or more salt components of the present invention prior to or after the formation of a filter plug.

By way of further background, baled sliver or other garniture feed can, if desired, be continuously dip coated or feedably contacted using one or more printing roll(s) fed from reservoir(s) containing desired active components(s), and the fabrication step completed, as

above noted, by conventional drying, using nip rolls, heated drying rolls, ovens, and the like. Suitable drying can occur at temperatures within the range of about 70° C.-125° C.

When desired, nonwoven material suitable for use as garniture feed is obtained from fiber of homogeneous or mixed denier, using art-recognized techniques. Preferably such nonwovens fall within a weight range of about 10-50 grams per m², and a ribbon width of about 4"-12" will generally assure successful passage through the garniture of a conventional filter rod-making apparatus operating at production speeds.

As above-noted, a suitable garniture feed may include about 1-4 or even more substrate webs of identical or different weight, dimensions, bonding properties, absorption properties, fiber composition, and denier. A plurality of such webs can be introduced wholly or partly in register and in machine, cross, or diagonal directions as desired. For best results, however, one relatively lightly thermally bonded fabric, tow, sliver or fibrillated film in register with one nonwoven fabric, or between two nonwoven fabrics (ref. FIG. 2) is found to offer good salt retention, filter draw, and hardness.

The inclusion of an additional low melting fiber such as polyethylene, combined with other polyolefin fiber as garniture feed is also found useful for obtaining tow plugs of widely varying bonding and adsorption properties.

Cost-wise, opened fiber tow and nonwoven ribbons are found to be an especially useful combination since they permit the use of relatively cheap polyolefin webs of mixed denier, and simplify the task of precise distribution of modifier salt components without the need for abandoning art-recognized techniques and equipment such as printing rolls and spray heads for substrate coating.

Supplemental components, in addition to the above-defined active modifier salt components, can also be employed such as, for instance, aqueous solutions, emulsions, suspensions, or dispersions of one or more humectants, exemplified by polyhydric alcohols such as glycerols, glycols, etc.; flavors and perfumes such as ketoses and polysaccharides, including wintergreen, spearmint, peppermint, chocolate, licorice, cinnamon, fruit flavors, citrus etc.; medicines, such as menthol and decongestants, and other art-recognized additives as found in U.S. Pat. Nos. 4,485,828 and 4,715,390.

In order to maintain precise control over application of additives, it is found useful if the receiving substrate is carefully controlled and consistent with respect to moisture content before conversion into a filter element. In addition, a filter element and its applied additive components is usefully further isolated or shielded from direct contact with the lips by applying the active component onto a tow, sliver or nonwoven fabric which is, in turn, sandwiched between two or more untreated nonwoven fabrics of lesser permeability (Ref. FIG. 3). If desired, the resulting filter element can also be externally coated with cork or similar inert heat-insulating material (not shown). The amount and effectiveness of modifier(s) applied to filter elements in the above way is determined substantially by the substrate width and number of substrates which are fed simultaneously into a garniture, as well as the amount of treated surface exposed to cigarette smoke in the filter element.

For purposes of the present invention both treated and combinations of treated and untreated fabric ribbon, tow, and the like can be usefully wrapped using

conventional plug wrap such as paper having a weight within a range of about 25-90 g/m² or higher, as desired.

The instant invention is further illustrated in FIGS. 1-4, in which FIG. 1 diagrammatically represents a conventional cigarette filter rod-making apparatus capable of converting treated substrate in accordance with the instant invention, into cigarette filter elements; FIGS. 2-4 diagrammatically represent further modifications and improvements within the instant invention, whereby one or more tows, slivers, ribbons of nonwovens, and fibrillated film are treated with one or more active modifier components by spraying, dipping, or by vacuum draw of wrapped filter plug, the use of multiple substrates in this manner favoring increased filter element bulk and improved crush resistance, or hardness.

Referring to FIG. 1 in further detail, a single continuous substrate such as opened fiber tow, sliver, fibrillated film or ribbon of nonwoven fabric (10) is fed from feed reel (11) or a bale (not shown) and across one or more opposed spray heads (20) feedably connected to feed lines (21) from outside sources (not shown) to apply one or more active modifier component (22). The resulting treated substrate is then dried by air drying means (not shown) and by passing through drying rolls (12), to obtain the desired degree of dryness, and then led by guide rolls (17) into a garniture trumpet (15) and garniture (14) of a cigarette filter rod manufacturing apparatus (1), comprised of a garniture section (2) including (but not showing) means for shaping and retaining the substrate feed, wrapping means, and cutting means for converting the wrapped plug or rod into filter element (16); the wrapping means is conveniently supplied with tow wrap from wrap feed reel (5) supported by support rolls (19) and moved onto a continuous garniture belt (3) for introduction into the rod-making apparatus.

The apparatus, as described, comprises conventional means for sealing a tow wrap around a filter plug (not shown), the wrapped plug then being cut by cutting means into generally cylindrical filter elements (16) of desired length (normally 90 mm or more), which are removed through filter chute (18) (shown in fragment) for packing in container (23).

FIG. 2 diagrammatically demonstrates a further arrangement for separately applying one or more filter modifier salt component(s) or other additives onto substrates (10A) and (10B), whereby differently arranged spray heads (20A) fed by feed lines (21A), separately apply active modifier components (identical or otherwise) (22A) onto separate substrates (10A, 10B), which are then at least partially dried using air and heated rolls (12A), before being fed through garniture (14A) of rod-making apparatus (1A), to form filter elements (16A) as before. Substrates (10A and 10B), are fed from feed rolls (11A) and (11B) or bales (not shown) and conveniently brought into register at heated nip rolls (12A), then guided by guide rolls (17A) into garniture (14A), the garniture feed or substrate components shown being similarly defined by arabic numbers in each of FIGS. 1-3.

FIG. 3 diagrammatically demonstrates a further modification of the equipment and process of FIGS. 1 and 2, whereby several substrates of the same or different types (10C, 10D, and 10E) as described above from reels or boxes (not shown) are fed through a nip created by heated rolls (12B), the middle substrate (10D) preferably being of different width and having higher absorption or adsorption properties for retaining active com-

ponents (22B) than the two external untreated substrates (10C and 10E). As shown, substrate (10D) is sprayed on both sides to selectively expose it to one or more active modifier components (22B) applied by spray heads (20B) fed from feedlines (21B), one substrate (10E) preferably being arranged so as to catch surplus drip or misdirected active components not retained or captured by ribbon (10D), all three substrates are then at least partially air dried by passing in register through heated nip rolls (12B), as before, and directed by guide rolls (not shown) into the garniture of a filter rod apparatus in the manner of FIGS. 1 and 2.

FIG. 4 is a diagrammatic representation of a further modification in which one or more substrates, as above defined, (shown as 10C) are separately fed from a bale or box (24C), passed over guide rolls (17C), and dipped into a reservoir (25C) containing one or more active modifier component(s) (22C) in solution, suspension, or emulsion, and then passed through nip rolls (26C), through a heating oven (27C), drawer rolls (28C), a three step drying oven (29C), then to garniture (14C) of a cigarette rod manufacturing apparatus in the manner of FIGS. 1-3, supra, or boxed and stored for future use.

Where a continuous fiber tow is used as a substrate component, preparation of the tow is conveniently carried out in the usual way by drawing the fiber from one or more creels through a fluid bulking or texturing jet (not shown in figures) and then handled as noted above.

Substrates which are employed in the above manner can usefully comprise a variety of synthetic filaments as noted above. Thus, it is possible to use polyesters, polyamides, acrylics, as well as polypropylene and the like. Due to its relatively low density, compared to other synthetic fiber-forming material and excellent spin properties, combinations of filament-forming copolymers of propylene with ethylene or other lower olefins monomers are particularly preferred as tow, nonwoven ribbon and fibrillated film material.

The bulk denier of a tow for carrying out the present invention can conveniently fall between about 2,000 and 10,000, and this substrate can be supplied as a crimped fiber from a single creel or bale, or a composite of several creels or bales combined and passed through a fluid jet simultaneously. For best performance of fiber tow as cigarette filters, however, it is preferred that at least some tow be substantially untwisted and untexturized prior to entering a fluid jet.

The invention is further illustrated by the following Examples.

EXAMPLE I

(A) Baled 4.5 dpf "y" cross section polypropylene fiber obtained from melt spun isotactic polypropylene having a melt flow rate (MFR) of 16, is broken, opened, carded, crimped and pulled to form a thin tow of about 12-inches in width. This ribbon is drawn, without further treatment, through the garniture of a conventional filter rod-forming apparatus identified as model PM-2 obtained from Molins Ltd. of Great Britain; and the garniture feed is compressed to form filter plugs which are wrapped with BXT-100 polypropylene film to obtain 108 mm filter rods. The rods are then cut and sorted into 27 mm lengths of substantially equal weight, and draw^{*1}, and taped onto R. J. Reynolds' Camel Light tobacco plugs, stored for 48 hours in a humidity cabinet at 55%-65% relative humidity at 22° C.*², and then used as control samples group-wise identified as C-1 and C-2 and identically smoked down to 35 mm

lengths in two second puffs per minute on a Borgwaldt smoking machine^{*3}. The particulate matter in the resulting smoke is trapped in a preweighed Cambridge filter pad, and the pad reweighed to determine total and average particulate matter (TPM) passed through the cigarette filter. The Cambridge pad is then soaked overnight in anhydrous isopropyl alcohol, and the resulting extract conventionally tested for nicotine and water content using a GC (gas chromatograph) autosampler^{*4}.

^{*1}All tested filter elements have a resistance to draw (RID) within the range of 111-136 mm Wg (water gauge).

^{*2}According to CORESTA Standard Method #10

^{*3}Models RM 20/CS 20 and RM 1/G

^{*4}Hewlett Packard Model HP5890

(B) Fiber tow from the same bale is identically processed to obtain ten test filter elements in the manner of Example 1A except that the cut filter elements are then treated with 1%, 2% and 5% solutions of KHCO₃, K₂CO₃/KHCO₃ mixed salts, Mg(OAc)₂, Mn(OAc)₂ and MgCl₂, respectively, using a suction bulb to draw up and impregnate each filter element with an amount of solution sufficient to treat in a uniform manner with about 20 mg. of modifier salt. The test filter elements are then air and oven dried, stored in a humidity cabinet for 48 hours, and then taped to an R. J. Reynolds' Camel Light tobacco plug as before. Conventional tests for nicotine, total particulate matter (TPM) and filter efficiency, are carried out as before, averaged on a per-cigarette basis, and reported in Table I as S-1 through S-19.

TABLE I

Sample	Solution	Conc (%)	pH	Nic/TPM (%)
S-1	KHCO ₃	2	8.20	6.86
S-2	KHCO ₃	1	8.20	7.72
S-3	KHCO ₃	2	8.31	6.65
S-4	KHCO ₃	5	8.47	9.41
S-5	KHCO ₃	1	8.53	9.33
S-6	KHCO ₃	5	8.74	6.36
S-7	K ₂ CO ₃ /KHCO ₃ (1/4)* ⁵	5	9.00	6.90
S-8	K ₂ CO ₃ /KHCO ₃ (1/1)	5	9.50	6.99
S-9	K ₂ CO ₃ /KHCO ₃ (1/1)	5	9.58	6.66
S-10	K ₂ CO ₃ /KHCO ₃ (4/1)	5	10.10	8.45
S-11	K ₂ CO ₃ /KHCO ₃ (4/1)	5	10.40	8.90
S-12	K ₂ CO ₃	2	11.50	8.20
S-13	K ₂ CO ₃	5	11.80	8.10
S-14	Mg(OAc) ₂	2	8.21	8.73
S-15	Mg(OAc) ₂	5	8.13	7.02
S-16	Mg(OAc) ₂	2	7.65	8.66
S-17	Mg(OAc) ₂	5	7.68	6.84
S-18	MgCl ₂ * ⁶	2	9.38	3.19
S-19	MgCl ₂	5	9.09	4.87
C-1		—	7.00	5.14

^{*5}In parts by weight.

^{*6}2 a strong acid salt.

EXAMPLE II

Fiber tow from the same bale as Example I is identically processed to obtain filter elements, except that the cut elements (identified as S-20 through S-24) are impregnated with K₃PO₄ and K₂HPO₄ solutions to obtain effective concentrations of active salt equal to about 20 mg/filter element. The resulting treated and dried filter elements are taped to R. J. Reynolds' Light tobacco plugs, as before, air dried, and stored in a humidity cabinet for 48 hours, before smoking in an identical manner. The samples are collected and tests run as before, average results being reported in Table II below.

TABLE II

Sample	Solution	Conc (%)	pH	Nic/TPM	TDR
S-20	K ₃ PO ₄	5	11.7	7.7	30.4
S-21	K ₃ PO ₄ /K ₂ HPO ₄ (1/1)	5	11.0	7.2	36.3
S-22	K ₃ PO ₄ /K ₂ HPO ₄ (1/8)	5	10.1	8.2	29.8
S-23	K ₂ HPO ₄	5	9.0	7.0	35.5
S-24	KH ₂ PO ₄	5	4.4	5.8	36.4
C-2	—	—	—	5.5	35.9

What is claimed:

1. A method for controlling nicotine filter retention and pass through characteristics of a cigarette filter element comprising one or a combination of cellulose acetate- or thermoplastic synthetic- substrate, comprising,

A. treating one or more fiber of film substrate forming said filter element or plug component, thereof with an aqueous solution or suspension having a pH within a range of about pH 8 to about pH 12 and containing an effective amount of a non-toxic water soluble salt of a weak acid as an active modifier; or

B. treating one or more fiber or film substrate forming said filter element or plug component thereof with an aqueous solution or suspension containing an effective amount of a non-toxic water soluble inorganic salt of a strong acid as an active modifier; and

C. completing fabrication of the desired filter element;

whereby (1) treatment of said substrate or plug component of the filter element with the salt of a weak acid increases filter pass through of nicotine smoke component relative to total particulate pass through concentration, and (2) treatment of said substrate or plug component of the filter element with the salt of a strong acid decreases filter pass through of nicotine smoke component relative to total particulate pass through concentration.

2. The method of claim 1 wherein the non-toxic water soluble metal salt of acid is applied to one or more substrate of said filter element or plug thereof as a buffered solution or suspension having a pH within a range of about pH 8 to about pH 12.

3. The method of claim 2 wherein the pH range of said buffered solution or suspension is from about pH 8.0 to about pH 10.5.

4. The method of claim 2, wherein said substrate comprises thermoplastic synthetic fiber, and said aqueous solution or suspension comprises at least one non-toxic metal salt of an acid selected from the group consisting of carbonic, phosphoric, acetic, citric, and fumaric acid.

5. The method of claim 4, wherein the non-toxic metal salt is a member selected from the group consisting of at least one of Mg(OAc)₂, Mn(OAc)₂, KHCO₃, K₂CO₃/KHCO₃, NaHCO₃, KHPO₄, and KH₂PO₄.

6. The method of claim 1, wherein said aqueous solution or suspension contains at least one non-toxic metal salt of an acid selected for the group consisting of hydrochloric and hydrobromic acid.

7. The method of claim 6 wherein the non-toxic metal salt is at least one member selected from the group consisting of ZnCl₂, LiBr, KBr, CaBr₂ and MgCl₂.

8. The method of claim 1, wherein the cigarette filter element comprises up to 100% by weight of cellulose acetate.

9. The method of claim 1, wherein the substrate of the cigarette filter comprises up to 100% by weight of synthetic thermoplastic substrate.

10. The method of claim 9 wherein the cigarette filter comprises up to 100% by weight of a polyolefin.

11. A cigarette filter rod or element comprising, in combination,

(a) a filter plug of compacted substrate comprising one or more of cellulose acetate- or synthetic thermoplastic-fiber containing substrate;

(b) a plurality of active filter loci distributed within said compacted substrate; said loci consisting essentially of solid and/or solid/liquid phases of the desired water soluble salt of a strong or a weak acid and a nontoxic metal; and

(c) a plug wrap securing said compacted substrate; whereby the presence of filter loci comprising the nontoxic water soluble salt of a weak acid favor filter pass through of nicotine relative to total particulate filter pass through concentration, and the presence of filter loci comprising the nontoxic water soluble salt of a strong acid favor filter retention of nicotine, relative to total particulate filter pass through concentration.

12. A cigarette filter rod or element of claim 11 wherein said active filter loci consist essentially of solid/liquid phases of a nontoxic water soluble salt of a weak acid, said liquid phase having a pH within a range of about pH 8 to about pH 12.

13. A cigarette filter of claim 11 wherein the water soluble salt is a non-toxic metal salt of an acid selected from the group consisting of acetic, carbonic, phosphoric, citric and fumaric acid.

14. A cigarette filter element of claim 13 wherein the water soluble salt is at least one of Mg(OAc)₂, Mn(OAc)₂, KHCO₃, K₂CO₃ and NaHCO₃.

15. A cigarette filter element of claim 11 wherein the water soluble salt is at least one of MgCl₂, LiBr, CaCl₂ and CaBr₂.

16. A cigarette utilizing as filter element the element defined in claim 11.

17. A cigarette utilizing as filter element the element defined in claim 12.

18. A cigarette utilizing as filter element the element defined in claim 13.

19. A cigarette utilizing as filter element the element defined in claim 14.

20. A cigarette utilizing as filter element the element defined in claim 15.

21. A method for controlling nicotine filter retention and pass through characteristics of a cigarette filter element comprising one or a combination of cellulose acetate- and thermoplastic synthetic-substrate, comprising,

treating one or more substrate consisting of an open fiber tow, a ribbon of a nonwoven material, a sliver, and a fibrillated film with a buffered aqueous solution or suspension having a pH within a range of about pH 8 to about pH 12, said solution or suspension containing an effective amount of a non-toxic water soluble salt of a weak acid as active modifier; and

completing fabrication of the desired filter element; whereby treatment of said substrate or plug component of the filter element with the salt of a weak acid increase filter pass through of nicotine smoke component relative to total particulate pass through concentration.

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22. A cigarette filter rod or element comprising, in combination,

- (a) a filter plug of compacted substrate comprising one or more of cellulose acetate- or synthetic thermoplastic-substrate in the form of at least one of an opened fiber tow, a ribbon of nonwoven material, a sliver, and a fibrillated film;
- (b) a plurality of active filter loci distributed within said compacted substrate, said loci consisting essentially of solid and/or solid/liquid phases of desired

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nontoxic water water soluble salt of a strong or a weak acid; and

- (c) a plug wrap securing said compacted substrate; whereby the presence of filter loci, comprising said nontoxic water soluble salt of a weak acid, favors filter pass through of nicotine relative to total particulate filter pass through concentration, and the presence of filter loci comprising the nontoxic water soluble salt of a strong acid favors filter retention of nicotine relative to total particulate filter pass through concentration.

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 4,896,683

Page 1 of 2

DATED : JANUARY 30, 1990

INVENTOR(S) : COHEN & GIBBONI

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 1, Line 31

"state-of-the art" should read --state-of-the-art--

Column 4, Line 31

"(mono , bi-, or..." should read --(mono-, bi-, or...--

Column 4, Line 42

"(b) 10%-90%/4-" should read --(b) 10%-90%/--

Column 4, Line 43

"5%-5%/45%-5%" should read --45%-5%/45%-5%--

Signed and Sealed this

Sixteenth Day of April, 1991

Attest:

HARRY F. MANBECK, JR.

Attesting Officer

Commissioner of Patents and Trademarks

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 4,896,683

Page 2 of 2

DATED : JANUARY 30, 1990

INVENTOR(S) : COHEN & GIBBONI

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 5, Lines 37-38

"abo-vedefined" should read --above-defined--

Column 7, Line 56

"12--inches" should read --12-14 inches--

Column 8, Line 54

"*⁶2 a strong acid salt." should read
--*⁶ a strong acid salt.--

Column 9, Line 18

"fiber of film" should read --fiber or film--.

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明 細 書

1. 発明の名称

シガレット

2. 特許請求の範囲

1. 下記の各項を備えたことを特徴とする紙巻タバコ:
タバコ・ロッド;
前記タバコ・ロッドを取り巻く金属ラッパ;
前記金属ラッパで包まれたタバコ・ロッドを取り囲む炭素燃焼物の円筒体;
前記炭素燃焼物円筒体を取り巻く通気性のあるラッパ;
前記タバコ・ロッドの一端に同軸状に位置し、前記炭素燃焼物円筒体に当接するフィルタプラグで、タバコ・ロッドと縦方向に一致した貫通孔を有するフィルタプラグ。
2. 前記金属ラッパがアルミニウムフォイルで作製されたことを特徴とする特許請求の範囲第1項記載の紙巻タバコ。
3. 前記アルミニウムフォイルラッパが紙の

層とアルミニウムの層とからなる積層体であり、該アルミニウム層が前記タバコ・ロッドに隣接する状態でアルミニウムフォイルラッパが配置されたことを特徴とする特許請求の範囲第2項記載の紙巻タバコ。

4. 前記タバコ・ロッドが10mmから19mmの範囲の円周を有することを特徴とする特許請求の範囲第1項記載の紙巻タバコ。

5. 前記炭素燃焼物円筒体を取り巻く通気性のラッパが不燃性であることを特徴とする特許請求の範囲第1項記載の紙巻タバコ。

6. 前記通気性の不燃性ラッパが処理紙で作製されたことを特徴とする特許請求の範囲第5項記載の紙巻タバコ。

7. 前記炭素燃焼物円筒体を取り巻く通気性のラッパが可燃性であることを特徴とする特許請求の範囲第1項記載の紙巻タバコ。

8. 前記炭素燃焼物円筒体を取り巻く通気性のラッパが紙で作製されたことを特徴とする特許請求の範囲第8項記載の紙巻タバコ。

9. 前記フィルタプラグが、タバコロッドと同軸状に貫いて延び且つタバコロッドの内周より大きくない内周を有する円筒状の通路を備えたことを特徴とする特許請求の範囲第8項記載の紙巻きタバコ。

10. 前記フィルタプラグを取り巻き、前記ラップされた燃焼物円筒体とフィルタプラグに隣接した端部で円周方向に沿って一部重なり合う非通気性の吸い口材をさらに備えたことを特徴とする特許請求の範囲第1項記載の紙巻きタバコ。

11. 前記フィルタプラグを取り巻き、前記ラップされた燃焼物円筒体とフィルタプラグに隣接した端部で円周方向に沿って一部重なり合う通気性の吸い口材をさらに備えたことを特徴とする特許請求の範囲第1項記載の紙巻きタバコ。

3. 発明の詳細な説明

産業上の利用分野

本発明は紙巻きタバコ（シガレット）に関し、特に非タバコ燃焼物の円筒体によって取り囲まれ、中央に配置されたタバコカラムを有する紙巻きタ

バコに關するものである。
に配置され、多孔性炭素、グラファイト、セラミックス、ガラス、アルミナ及び粘土等、熱的に安定な多孔性材が充填される。筒状容器内の多孔性材は、煙霧形成物質を含む。中心開口を有するシールが燃焼要素の端部に位置し、燃焼要素のその端部をシールすると共に、中心開口は筒状容器と一致している。

筒状部材が中心を貫いて延びた燃焼物カラムを有する各種の喫煙品は、以下の各特許に示されている：1987年12月5日付けで C. O. Ellis 他に発行された米国特許第 3,358,084号；1982年7月20日付けで Bell 他に発行された米国特許第 4,340,072号；1987年12月22日付けで Chandra K. Banerjee 他に発行された米国特許第 4,714,082号；1987年12月29日付けで Bwo Lynn 他に発行された米国特許第 4,715,389号；及び1988年3月22日付けで James L. Resce 他に発行された米国特許第 4,732,168号。

課題を解決するための手段

本発明は、金属フォイルで取り巻かれた円筒状

タバコに關するものである。

従来の技術と課題

燃焼物によって取り囲まれた、燃焼せずにニコチン味を放出する素材からなる内側ロッドを有する喫煙品は、それ自体周知である。

例えば、1986年8月28日付けで C. O. Ellis 他に発行された米国特許第 3,258,015号は、タバコが充填された中心のフォイルチューブを備え、中心チューブがタバコからなる円筒体で取り囲まれた喫煙品を開示している。この円筒体が、多孔性の紙ラッパによって包まれている。喫煙品の一端に凝集（核形成）室が位置し、煙を受け入れる。

別の実施例として、1987年2月5日付けで R. J. Reynolds Tobacco Companyによって出願されたヨーロッパ特許出願第 0 245 732号は、燃焼速度が二重の燃焼要素を有する喫煙品を開示している。この燃焼要素は、熱分解された綿繊維を型成形または押出成形して得た炭素で形成されている。ステンレス鋼製の筒状容器が燃焼要素の中心

のタバコロッドと、該ラップされたタバコロッドを取り囲む炭素燃焼物の円筒体と、該炭素燃焼物円筒体を取り巻く通気性のあるラッパと、タバコロッドの一端に同軸状に位置し、炭素燃焼物円筒体に当接するフィルタプラグとを有する喫煙品を提供するものである。

実施例

本発明は、添付の図面を参照した実施例に関する。以下の説明からより明解に理解されよう。

第1図を参照すると、全体を参照番号10で示した本発明の喫煙品の斜視図が示しており、この喫煙品は従来の紙巻きタバコと外観が類似している。

第1図を引続き参照しつつ、第2図及び第3図も参照すれば、喫煙品10はタバコロッド12を備え、金属フォイル（箔）14がタバコロッド12の周囲を取り巻いている。非タバコ燃焼物の円筒体16が、金属フォイルでラップされたタバコロッド12を取り囲み、タバコロッド12の全長に沿って延びている。燃焼物円筒体16は、それ

を取り巻く通気性のあるラッパ 18 を有する。フィルタプラグ 22 が燃焼物円筒体 16 の一端（吸い口端）に位置し、吸い口材 24 を巻き付けることによって燃焼物円筒体 16 に取り付けられており、吸い口材 24 はフィルタプラグ 18 を取り巻くと共に、ラップされた燃焼物円筒体 16 のフィルタプラグ 22 に隣接する端部と円周方向に沿って一部重なり合っている。

タバコロッド 12 は、円周が 10 mm から 19 mm の範囲で、 1 cm^3 当たり 100 mg から 1 cm^3 当たり 300 mg の充填密度であるのが好ましい。

金属フォイル 14 は、紙の層 14 A とアルミニウムの層 14 B とを含む積層体であるのが好ましい。この積層フォイル 14 が、アルミニウム層 14 B をタバコロッド 12 に隣接させた状態で配置される。

非タバコ燃焼物円筒体 16 は、例えば炭素布、炭素フェルト、あるいは型成形または押出成形した炭素からなる炭であるのが好ましい。

燃焼物円筒体 16 の周囲を取り巻くラッパ 1

8 は通気性があり、不燃性または可燃性いずれの素材でもよい。取巻ラッパ 18 は例えば、不燃性のセラミックまたは処理の施された紙（処理紙）から作製できる。あるいは、通気性のある、可燃性紙材によっても取巻ラッパ 18 を作製可能である。通気性のあるラッパ 18 が、そこを通過して非タバコ燃焼物円筒体 16 へと至る周囲空気の流れを与え、非タバコ燃焼物の燃焼を支える。

第 2 図に示したフィルタプラグ 22 は、非タバコ燃焼物円筒体 16 の外周とほぼ同じ外周を有し、燃焼物円筒体 16 と同軸状に配置されている。フィルタプラグ 22 は、非タバコ燃焼物円筒体 16 及びタバコロッド 12 の両方と流体連通している。

第 3 図に示したフィルタプラグ 122 も、非タバコ燃焼物円筒体 16 の外周とほぼ同じ外周を有し、燃焼物円筒体 16 と同軸状に配置されているが、フィルタプラグ 122 にはさらに、その中心を同軸状に貫く円筒状の通路 26 が形成されている。この通路 26 はタバコロッド 12 の円周より大きくない円周を有し、通路 26 がタバコロ

ッド 12 とだけ連通するようになっている。通路 26 を備えたフィルタプラグ 122 が、非タバコ燃焼物円筒体 16 と流体連通している。

吸い口材 24 は通気性がなくてもあってもよく、後者の場合には、フィルタプラグ 22 へと至る周囲空気の流れを与え、フィルタプラグ 22 を通って流れる煙を希釈する。

喫煙品 10 の喫煙時、非タバコ燃焼物円筒体 16 が燃焼して燃え、燃焼する非タバコ燃焼物円筒体 16 からの熱が金属フォイル 14 を介してタバコロッド 12 に伝達され、タバコロッド 12 を加熱する。火のついた状態で一層すると、タバコロッド 12 内のタバコは黒焦げ（炭）になるだけで、燃焼はしない。

以上の詳細な説明は理解を明確にすることを主目的としており、上記の開示から当業者にとっては変更が自明であり、発明の精神または特許請求の範囲を逸脱せずに変更が可能であるため、不要な制限として理解されるべきでない。

4. 図面の簡単な説明

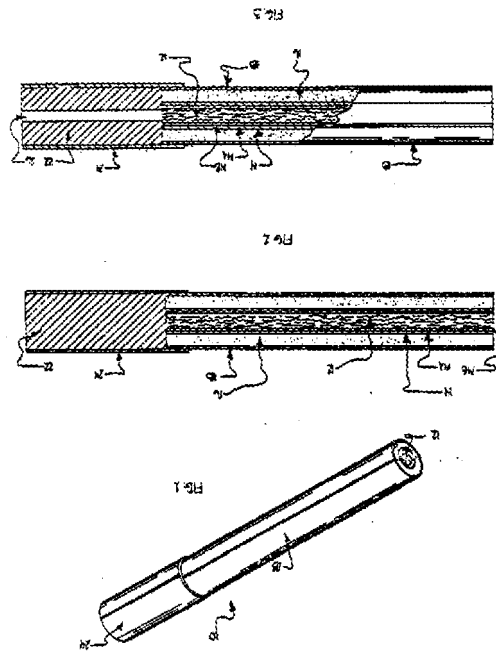
第 1 図は本発明の喫煙品の斜視図、第 2 図は第 1 図の喫煙品の縦方向断面図、及び第 3 図は第 1 図の喫煙品の縦方向破断断面図である。

（符号の説明）

10…紙巻きタバコ、12…タバコロッド、14…金属ラッパ（フォイル）、14A…紙層、14B…アルミニウム層、16…燃焼物円筒体、18…通気性ラッパ、22、122…フィルタプラグ、24…吸い口材、26…通路。

出 願 人 ブラウン アンド ウィリアムソン
タバコ コーポレーション

代 理 人 丸 山 幸 雄



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(54) **Smoking articles**

(57) A smoking article including a tobacco rod 12 circumscribed by a metal foil wrapper 14 and having a cylinder of carbon fuel 16 surrounding the metal foil wrapped tobacco rod. An air permeable outer wrapper 18 circumscribes the cylinder of carbon fuel. A filter plug 122 is located at one end of the smoking article and can have a central passageway which communicates only with the rod 12.

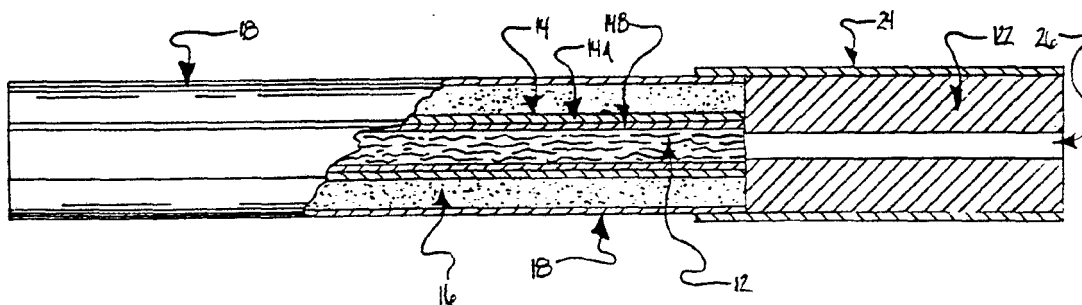
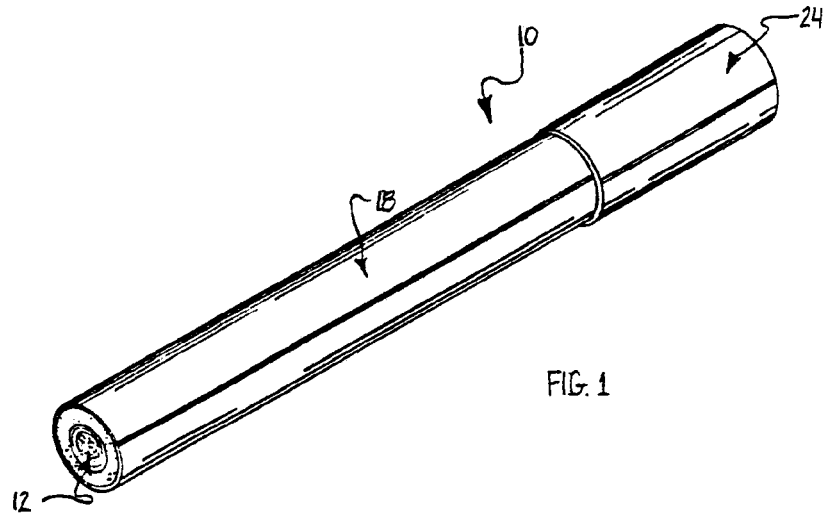
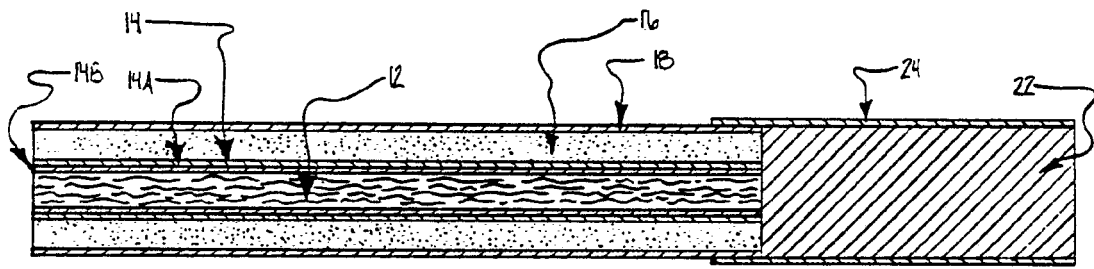
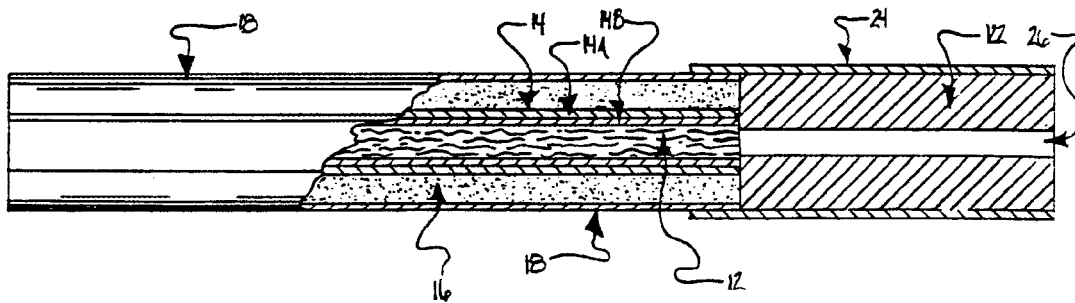


FIG. 3

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IMPROVEMENTS RELATING TO SMOKING ARTICLES

The present invention relates to smoking articles, and more particularly to a cigarette like smoking article having a centrally disposed tobacco column surrounded by a cylinder of non-tobacco fuel.

Smoking articles having an inner rod of a non-burning nicotine flavour releasing material surrounded by a fuel are, per se, known.

For example, U.S. Patent No. 3,258,015 issued on June 28, 1966 to C.D. Ellis, et al discloses a smoking article which includes a central foil tube filled with tobacco with the central tube surrounded by a cylinder of tobacco. The cylinder is wrapped by a porous paper wrapper. A nucleating chamber is located at one end of the smoking article to receive the smoke.

In another example, European Patent Application No. 0 245 732 filed February 5, 1987 by R.J. Reynolds Tobacco Company discloses a smoking article having a dual burn rate fuel element. The fuel element is made of a moulded or extended carbon prepared from pyrolyzed cotton fibre. A tubular container of stainless steel is centrally located in the fuel element filled with a thermally stable, porous material such as porous carbons, graphite, ceramics, glass, alumina and clays. The porous material in the tubular

container includes an aerosol forming substance. A seal having a central orifice therethrough is located at the end of the fuel element which seals the end of the fuel element and the orifice is aligned with the tubular capsule.

Various smoking articles having a fuel column with a tubular member therethrough are shown in the following patents: U.S. Patent No. 3,356,094 issued on December 5, 1967 to C.D. Ellis, et al; U.S. Patent No. 4,340,072 issued on July 20, 1982 to Bolt, et al; U.S. Patent No. 4,714,082 issued on December 22, 1987 to Chandra K. Banerjee, et al; U.S. Patent No. 4,715,389 issued on December 29, 1987 to Dwo Lynn, et al; and, U.S. Patent No. 4,732,168 issued on March 22, 1988 to James L. Resce, et al.

The present invention provides a smoking article comprising a tobacco rod; a metallic wrapper circumscribing the tobacco rod; a cylinder of carbon fuel surrounding the wrapped tobacco rod; an air permeable wrapper circumscribing the cylinder of carbon fuel; and a filter plug coaxially located at one end of the tobacco rod and surrounding cylinder of carbon fuel.

A better understanding of the present invention will be had upon reference, by way of example, to the following description in conjunction with the accompanying drawing, wherein:

Figure 1 is a perspective view of a smoking article of the present invention;

Figure 2 is a longitudinal cross-sectional view of the

smoking article of Figure 1; and,

Figure 3 is a longitudinal cross-section view of a further smoking article.

With reference to Figure 1, there is shown a perspective view of a smoking article, generally denoted by the numeral 10, of the present invention which resembles a conventional cigarette in outward appearance.

With reference to Figures 2 and 3, and continued reference to Figure 1, the smoking article 10 comprises a tobacco rod 12 with a metallic foil 14 circumscribing the tobacco rod 12. A cylinder of a non-tobacco fuel 16 surrounds the metal foil wrapped tobacco rod 12 and extends along the entire length of the tobacco rod 12. The fuel cylinder 16 has an air permeable circumscribing wrapper 18. A filter plug 22 is located at one end (the mouth end) of the fuel cylinder 16 and is attached to the fuel cylinder 16 by a wrapper of tipping material 24 circumscribing the filter plug 18 and circumferentially overlapping the wrapped fuel cylinder at the end thereof adjacent the filter plug 22.

The tobacco rod 12 has preferably a circumference within the range of 10 mm to 19 mm with a packing density within the range of 100 mg per cm^3 to 300 mg per cm^3 .

The metallic foil 14 is preferably a laminate including a layer of paper 14A and a layer of aluminium 14B. The laminated foil 14 is disposed with the aluminium layer in juxtaposition with the tobacco rod 12.

The non-tobacco fuel cylinder 16 is preferably a charcoal in the form of, for example, a carbon cloth, carbon felt, or moulded or extruded carbon.

The circumscribing wrapper 18 around the fuel cylinder 16 is air permeable and can be either a non-combustible or a combustible material. For example, the circumscribing wrapper 18 can be fabricated of a non-combustible ceramic or treated paper. Alternatively, the circumscribing wrapper can be air permeable combustible paper material. The air permeable wrapper 18 provides for the flow of ambient air therethrough into the non-tobacco fuel cylinder 16 to support combustion of the non-tobacco fuel.

The filter plug 22 shown in Figure 2 has an outside circumference substantially the same as the outside circumference of the non-tobacco fuel cylinder 16 and is coaxially located with the fuel cylinder 16. The filter plug 22 is in flow communication with both the non-tobacco fuel cylinder 16 as well as the tobacco rod 12.

The filter plug 122 shown in Figure 3 has an outside circumference substantially the same as the outside circumference of the non-tobacco fuel cylinder 16 and is coaxially located with the fuel cylinder 16. Further, the filter plug 122 is formed with a cylindrical passageway 26 coaxial therethrough and has a circumference no larger than the circumference of the tobacco rod 12 so that the passageway 26 communicates only with the tobacco rod 12. The filter plug 122 with the passageway 26 therethrough is

in flow communication with the non-tobacco fuel cylinder 16.

The tipping material 24 can be either air impermeable, or air permeable to provide for the flow of ambient air into the filter plug 22 to dilute the smoke flowing through the filter plug 22.

In use of the smoking articles of Figures 2 and 3 the non-tobacco fuel cylinder 16 combusts or burns and the heat from the burning non-tobacco fuel cylinder 16 is transferred through the foil 14 to the tobacco rod 12 to heat the tobacco rod 12. The tobacco of the rod 12 chars, but does not combust after the lighting puff.

The foregoing detailed description is given primarily for clearness of understanding and no unnecessary limitations are to be understood for modification will become obvious to those skilled in the art upon reading this disclosure and may be made without departing from the scope of the invention or scope of the appended claims.

CLAIMS

1. A smoking article comprising a tobacco rod; a metallic wrapper circumscribing the tobacco rod; a cylinder of carbon fuel surrounding the wrapped tobacco rod; an air permeable wrapper circumscribing the cylinder of carbon fuel; and, a filter plug coaxially located at one end of the tobacco rod and surrounding cylinder of carbon fuel.
2. A smoking article according to Claim 1, wherein the metallic wrapper is fabricated of aluminium foil.
3. A smoking article according to Claim 2, wherein the aluminium foil wrapper is a laminate comprising a paper layer and an aluminium layer, the wrapper being disposed with the aluminium layer in juxtaposition with the tobacco rod.
4. A smoking article according to Claim 1, 2 or 3, wherein the tobacco rod has a circumference in a range of 10 mm to 19 mm.
5. A smoking article according to any one of the preceding claims, wherein the air permeable wrapper circumscribing the cylinder of carbon fuel is non-combustible.
6. A smoking article according to Claim 5, wherein the air permeable, non-combustible wrapper is fabricated of a treated paper.

7. A smoking article according to any one of Claims 1 to 4, wherein the air permeable wrapper circumscribing the cylinder of carbon fuel is combustible.
8. A smoking article according to Claim 7, wherein the air permeable wrapper circumscribing the cylinder of carbon fuel is fabricated of paper.
9. A smoking article according to any one of the preceding claims, wherein the filter plug comprises a passageway therethrough in alignment with the tobacco rod.
10. A smoking article according to Claim 9, wherein the passageway is of a circumference no larger than the circumference of the tobacco rod.
11. A smoking article according to any one of the preceding claims and further comprising an air impermeable tipping material circumscribing the filter plug and circumferentially overlapping the wrapped fuel cylinder at the end thereof adjacent the filter plug.
12. A smoking article according to any one of the preceding claims and further comprising an air permeable tipping material circumscribing the filter plug and circumferentially overlapping the wrapped fuel cylinder at the end thereof adjacent the filter plug.
13. A smoking article substantially as hereinbefore described with reference to Figure 1 and to Figure 2 or 3 of the drawing hereof.

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Amendments to the claims
have been filed as follows

1. A smoking article comprising a tobacco rod; a metallic wrapper circumscribing the tobacco rod; a cylinder of carbon fuel surrounding the metallic wrapped tobacco rod; an air permeable wrapper circumscribing the cylinder of carbon fuel; and, a filter plug coaxially located at one end of the tobacco rod and surrounding cylinder of carbon fuel; the filter plug having a cylindrical passageway therethrough in longitudinal alignment with the tobacco rod; the carbon fuel being in flow communication with the filter plug.
2. A smoking article according to Claim 1, wherein the metallic wrapper is fabricated of aluminium foil.
3. A smoking article according to Claim 2, wherein the aluminium foil wrapper is a laminate comprising a paper layer and an aluminium layer, the wrapper being disposed with the aluminium layer in juxtaposition with the tobacco rod.
4. A smoking article according to Claim 1, 2 or 3, wherein the tobacco rod has a circumference in a range of 10 mm to 19 mm.
5. A smoking article according to any one of the preceding claims, wherein the air permeable wrapper circumscribing the cylinder of carbon fuel is non-combustible.

6. A smoking article according to Claim 5, wherein the air permeable, non-combustible wrapper is fabricated of a treated paper.
7. A smoking article according to any one of Claims 1 to 4, wherein the air permeable wrapper circumscribing the cylinder of carbon fuel is combustible.
8. A smoking article according to Claim 7, wherein the air permeable wrapper circumscribing the cylinder of carbon fuel is fabricated of paper.
9. A smoking article according to any one of the preceding claims, wherein the passageway is coaxial with the tobacco rod and has a circumference no larger than the circumference of the tobacco rod.
10. A smoking article according to any one of the preceding claims and further comprising an air impermeable tipping material circumscribing the filter plug and circumferentially overlapping the wrapped fuel cylinder at the end thereof adjacent the filter plug.
11. A smoking article substantially as hereinbefore described with reference to Figure 1 and to Figure 2 or 3 of the drawing hereof.

⑩ 日本国特許庁(JP)

⑪ 特許出願公開

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識別記号

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A 24 D 1/02
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審査請求 未請求 請求項の数 24 (全21頁)

⑮ 発明の名称 シガレット及びシガレット用可喫煙補充料材

⑯ 特 願 平2-255490

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明 細 書

1. 発明の名称

シガレット及びシガレット用可喫煙
補充料材

2. 特許請求の範囲

1. (a) (i) 無機成分と有機成分を有する凝
集マトリックス補充料と、(ii) タ
バコ材との緊密な混合物を含む可喫
煙補充料材と、

(b) 該可喫煙補充料材を包蔵したラッ
プ材と、

から成るシガレット。

2. 前記可喫煙補充料材は、結合剤を含有し
ていることを特徴とする特許請求の範囲第1項に
記載のシガレット。

3. 前記結合剤は、アルギン酸アンモニウム
を含むことを特徴とする特許請求の範囲第2項に
記載のシガレット。

4. 前記タバコ材は、タバコ材の抽出物であ
ることを特徴とする特許請求の範囲第1〜3項の
いずれかに記載のシガレット。

5. エアゾール製生物質を含有することを特
徴とする特許請求の範囲第4項に記載のシガレ
ット。

6. 前記ラップ材は、コレステラ単位約5未満
の多孔率を有する紙であることを特徴とする特許
請求の範囲第1項に記載のシガレット。

7. 前記凝集マトリックス補充料は、炭酸カ
ルシウム成分とアルギン酸塩から成るものである
ことを特徴とする特許請求の範囲第1項又は6項
に記載のシガレット。

8. 前記凝集マトリックス補充料は、有機成
分1重量部当り約10〜約89重量部の炭酸カル
シウム成分を含むことを特徴とする特許請求の範
囲第1項に記載のシガレット。

9. (a) 無機補充料成分と有機成分を有する
凝集マトリックス補充料を含む可喫
煙補充料材と、

(b) 該可喫煙補充材料を包被したラップ材と、
から成るシガレット。

10. 前記可喫煙補充材料は、結合剤を含有していることを特徴とする特許請求の範囲第9項に記載のシガレット。

11. 前記結合剤は、アルギン酸アンモニウムを含むことを特徴とする特許請求の範囲第10項に記載のシガレット。

12. 前記ラップ材は、コレクタ単位約5未満の多孔率を有する紙であることを特徴とする特許請求の範囲第9項に記載のシガレット。

13. 前記凝集マトリックス補充料は、炭酸カルシウム成分とアルギン酸塩から成るものであることを特徴とする特許請求の範囲第8項又は12項に記載のシガレット。

14. 前記凝集マトリックス補充料は、有機成分1重量部当たり約10～約99重量部の炭酸カルシウム成分を含むことを特徴とする特許請求の範囲第9項に記載のシガレット。

22. 前記結合剤は、アルギン酸塩を含むことを特徴とする特許請求の範囲第16項に記載の可喫煙補充材料。

23. オルト磷酸一水素アンモニウムを含むことを特徴とする特許請求の範囲第20項に記載の可喫煙補充材料。

24. 残留発泡剤を含むことを特徴とする特許請求の範囲第20項に記載の可喫煙補充材料。

3. 発明の詳細な説明

産業上の利用分野

本発明は、シガレット及びその他の喫煙物品に関し、特に、喫煙したとき発生する不完全燃焼生成物、及び側流「タール」及び臭気量が比較的に少なく、FTC喫煙条件下での喫煙中くすぶりを維持するシガレットに関する。

ここで、「FTC喫煙条件」とは、58秒間のくすぶり（休止）期間をはさんで2秒間の吸込動作即ちパフ（採容積35ml）を行うことである。「パフ」とは、タバコの煙を吸込む1回のこ

15. 無機成分と有機成分を有する凝集マトリックス補充料から成る可喫煙補充材料。

16. 結合剤を含有していることを特徴とする特許請求の範囲第15項に記載の可喫煙補充材料。

17. エアゾール系生物質を含有することを特徴とする特許請求の範囲第15項に記載の可喫煙補充材料。

18. タバコ材を含有することを特徴とする特許請求の範囲第15項又は16項に記載の可喫煙補充材料。

19. 前記無機成分は、炭酸カルシウムの粒子を含むことを特徴とする特許請求の範囲第15項に記載の可喫煙補充材料。

20. 前記有機成分は、アルギン酸塩を含むことを特徴とする特許請求の範囲第15項又は19項に記載の可喫煙補充材料。

21. 前記タバコ材は、タバコ材の抽出物であることを特徴とする特許請求の範囲第18項に記載の可喫煙補充材料。

とである。

従来の技術

シガレット（紙巻タバコ）等の一般的な喫煙物品は、円筒状ロッド（棒状体）の形の構造を有し、紙ラップ（巻紙）で包被されて、いわゆる「可喫煙ロッド」の形とされた鋭利タバコ材（例えばタバコ材刻み補充料）のような可喫煙材のロール又は装入物を含む。「補充料」とは、紙巻タバコや、葉巻の中身のことであり、通常、シガレットは、可喫煙ロッドに突合せ関係に結合された円筒形のフィルタ素子を有している。「タバコ材刻み補充料」とは、刻みタバコ材から成る補充料のことである。一般に、フィルタ素子は、プラグラップによって包被された酢酸セルロースのトウから成り、外包チップ材（吸口紙）によって可喫煙ロッドに付設される。

喫煙者は、シガレットの先端に火をつけて可喫煙ロッドを燃焼させ、それによって生じる煙を吸い込む。可喫煙ロッドは、普通、タバコ材補充料（刻みタバコ材から成る補充料）（単に「刻み補

充料」とも称する)である。喫煙者は、シガレットの吸口端(例えば、フィルタ端)から吸引することによって主流煙を口中に吸込み、喫煙の喜び(例えば、嗅味、感熱、満足感等)を得る。

シガレットの燃焼中、側流煙即ち副流煙が発生する。側流煙とは、シガレットの点火端から直接大気に放出される煙のことである。側流煙は、大気中に拡散し、その特有の可視特性及び臭気が周囲の人に知覚され得る場合がある。燃焼するシガレットから生じる可視側流煙の相対量は、その燃焼するシガレットから放出される側流「タール」の量に関連する。タバコ刻み補充料を燃焼させる全長約84mm(例えば、可喫煙ロッドの長さ約57mm、フィルタ素子の長さ約27mm)の一般の市販シガレットは、普通、約25mg〜約35mgの側流「タール」を発生する。シガレットの側流「タール」の測定方法及び装置については、プロクター他編「アナリスト」1988年刊、第113巻、第1509頁を参照されたい。

可視側流煙の発生レベルが比較的低いと称され

るいろいろな種類のシガレットが従来から提案されている。そのようなシガレットは、例えば、米国特許第4,637,410号、4,624,268号、4,407,308号、4,231,377号、4,420,002号、4,450,847号、4,108,151号、4,225,636号、4,433,697号、4,461,311号、及び4,561,454号に記載されている。

又、主流タバコ煙の組成を改変するためのいろいろな方法が従来から提案されている。例えば、おくのタバコ代替材が提案されており、そのような多種類の材料のリストが米国特許第4,079,742号に記載されている。更に、「シトレル」及び「NSM」という商標名を有するのタバコ代替喫煙材が1970年代にヨーロッパに導入されている。

又、香味付蒸気及び、又は可視エアゾールを発生する喫煙物品を提案した多数の先行技術文献がある。そのような喫煙物品の大概のものは、エアゾールを創生するために、及び、又はエアゾール

発生物質を加熱するために可燃燃料源を使用している(例えば、米国特許第4,714,082号に記載された技術背景参照)。

タバコ材を必ずしも燃焼させることなく加熱することによって、多量の不完全燃焼生成物を発生することなくシガレット喫煙に伴う喜びを与えることができる喫煙物品は、米国特許第4,714,082号、4,756,318号及び4,792,365号に開示されている。そのような喫煙物品は、燃発生のための可燃燃料素子と、燃料素子とは物理的に別体に配置され、燃料素子と熱交換関係に置かれたエアゾール創生物質を使用する。喫煙中、燃料素子によって創生された熱がエアゾール創生物質を揮発させ、それによってタバコ煙に類似したエアゾールを発生する。この種の喫煙物品は、FTC「タール」排出量(FTC喫煙条件で喫煙した場合の「タール」排出量)が低レベルであるとともに、可視側流煙の発生レベルも極めて低い。

発明が解決しようとする課題

本発明は、良好な喫煙満足感を与え、主流煙に含まれる炭化水素が比較的少なく、発生する不完全燃焼生成物の量が比較的少なく、FTC喫煙条件下でくすぶりを維持することができ、生成される灰が腐ましい物理的特性を有しており、側流「タール」の排出量が少なく、従って可視側流煙の発生量が少ない、良好な香味を発生するシガレットを提供することを課題とする。

従って、本発明は、刻み補充料の形の、及び、又は加工された形のタバコ材(以下、単に「タバコ」とも称する)を包含した喫煙物品に関する。

課題を解決するための手段

本発明による好ましい喫煙物品は、2つの主要構成部材、即ち、(i)可喫煙材のロール又は捲入物と、(ii)可喫煙材のロール又は捲入物を包被する外側ラップ材(紙ラップ)を有するシガレットの形にされる。本発明のシガレットは、その可喫煙材の少なくとも一部分として後に詳述する可喫煙補充料を含む。

可喫煙材のロールを包被して可喫煙ロッドを構

成するのに好ましいラップ材は、空気透過率の低い紙ラップである。空気透過率の低い、即ち多孔率の低い特に好ましいラップ材は、コレスタ(CORESTA)単位約5以下の多孔率を有するものである。コレスタ単位は、1センチパールの低圧下で1ccm³の面積のラップを透過する直線空気速度の尺度である。コレスタ単位については、「コレスタ広報」ISO/TC 128/SC 1 N159E(1986)を参照されたい。

本発明は、上記課題を解決するために可喫煙材の一形態として、タバコ含有可喫煙補充料から成るものを提供する。この可喫煙材は、(i)タバコ材(例えば、裁切タバコ葉片、粉砕タバコ葉片、タバコ葉柄の小片、タバコ微粉、タバコ粉末、又はタバコ抽出物又はその他の加工タバコ)と、

(ii)緊密に接触した有機成分と無機成分を有する凝集マトリックス補充料との緊密な混合物から成る。この凝集マトリックス補充料(凝集したマトリックス状の補充料)は、粒状の形とすることが好ましい。有機成分は、アルギン酸塩、又は、

的に混合(ブレンド)して、あるいは他の何らかの態様でタバコ材刻み補充料と組合せて使用してもよい。

本発明は、又、別の形態の可喫煙補充料として、緊密に接触した有機成分と無機成分を有する凝集マトリックス補充料の緊密な混合物から成るものを提供する。凝集マトリックス補充料は、粒状の形とすることが好ましい。有機成分は、アルギン酸塩、又は、周囲条件下で実質的に水に不溶性の凝集マトリックス補充料を構成することができるその他の有機材料である。通常、無機材料は、炭酸カルシウムである。可喫煙補充料材は、凝集マトリックス補充料及びタバコ材に緊密に接触した結合剤(バインダー)を含む。結合剤は、可喫煙補充料材を構成するために凝集マトリックス補充料の粒子を結合状態に維持する役割を果たす。このような可喫煙材には、又、香料及び、又はエアゾール創生物質を緊密に接触させた状態で含めることもできる。このタバコ材含有可喫煙材は、水性スラリーからシートとして乾燥させる

周囲条件下で実質的に水に不溶性の凝集マトリックス補充料を構成することができるその他の有機材料である。通常、無機材料は、炭酸カルシウムである。可喫煙補充料材は、凝集マトリックス補充料及びタバコ材に緊密に接触した結合剤(バインダー)を含む。結合剤は、可喫煙補充料材を構成するためにタバコ材の粒子及び凝集マトリックス補充料の粒子を結合状態に維持する役割を果たす。このようなタバコ材含有可喫煙補充料材には、又、ある種の香料(例えば、ココア、甘草、メントール等)及び、又はエアゾール創生物質(例えば、グリセリン、プロピレングリコール等)を緊密に接触させた状態で含めることもできる。このタバコ材含有可喫煙補充料材は、水性スラリーからシートとして乾燥させることができ、例えば、製紙法を用いて、あるいは押出成形によりシートの形に形成することができる。このようなタバコ材含有可喫煙補充料材を、本発明のシガレットの唯一の可喫煙材としてそのままで使用してもよく、あるいは、タバコ材刻み補充料と物理

ことができ、例えば、製紙法を用いて、あるいは押出成形によりシートの形に形成することができる。このような可喫煙材を、タバコ材含有可喫煙材及び、又はタバコ材刻み補充料と物理的に混合(ブレンド)して使用してもよく、あるいは、あるいは他の何らかの態様でタバコ材含有可喫煙材及び、又はタバコ材刻み補充料と組合せて使用してもよい。

実施例

第1図には、本発明のシガレット及び可喫煙補充料材の好ましい一実施例が示されている。このシガレット(紙巻タバコ)10は、円筒状の可喫煙(喫煙可能)ロッド(「可喫煙ロッド」又は単に「ロッド」とも称する)15を有する。ロッド15は、少なくとも1層の外包ラップ材(例えば、紙)25内に包まれた可喫煙材のロール又は装入物20から成る。可喫煙ロッド15の両端は開放し、燃焼させるべき可喫煙材を露出させている。可喫煙ロッド15の一端に点火すると、可喫煙材が燃焼しエアゾール(例えば、煙)が発生す

る。かくして、可喫煙ロッド15は、その点火された一端から他端に向けて燃焼する。

シガレット10は、又、可喫煙ロッド15の一端に軸線方向に整列して配置され、好ましくは突を合わせ関係に当接させたフィルタ素子30を備えている。フィルタ素子30は、円筒形であり、その直径は、可喫煙ロッドの直径と実質的に等しい。フィルタ素子30の両端は、空気及び煙を通すように開放している。フィルタ素子30は、少なくとも2つのフィルタセグメント（部片）から成るものとするのが好ましい。第1図に示されるように、フィルタ素子30の第1フィルタセグメントは、可喫煙ロッドに近接して配置され、炭素質フィルタ材35と、その外周面を包被するラップ材37とから成るものとするのが好ましく、第2フィルタセグメントは、シガレットの吸口端に配置され、ひた寄せした不織ポリプロピレンのウェブ又は酢酸セルロースのトウのようなフィルタ材40と、その外周面を包被するラップ材45とから成るものとするのが好ましい。第2

セグメントのフィルタ材40は、美しい、白色の外観を呈する材料であることが好ましい。いずれのフィルタセグメントも、周知のフィルタロッド製造機械を用いて製造することができる。これらの2つのセグメントは、周知のプラグ両端結合技術を用いて組合せ、包被ラップ（フィルタプラグを包被するラップであることから「プラグラップ」とも称する）50を用いて結合させ、フィルタ素子30を形成する。

フィルタ素子30は、通常、その全長と、それに近接する可喫煙ロッド15の煙部を包被するチャッピング材（吸口或付け用ラップ材）55によって可喫煙ロッド15に取付ける。チャッピング材55の内面は、適当な接着剤を用いてプラグラップ50の外周及び可喫煙ロッド15のラップ材25の外周に固着する。このシガレット10は、周知のシガレット製造法及び装置を用いて製造することができる。又、シガレット10は、所望ならば、チャッピング材55、プラグラップ50及びラップ材37を貫通して穿設した、例えば一連のバ

ーフォレーション（小孔）66から成る空気稀釈手段（空気によってタバコ煙を稀釈するために空気を導入する手段）を備えた通気性、即ち空気稀釈型シガレットとすることができる。そのような通気バーフォレーションは、レーザー穿孔法等の周知の技法を用いて形成することができる。

第2図は、本発明のシガレット及び可喫煙補充材材の別の好ましい実施例を示す。この実施例のシガレット10は、その可喫煙材をセグメントの意様のブレンドの形とした点を除いては第1図のものと同様である。即ち、この実施例では、可喫煙ロッド15の一端（即ち、シガレットの点火端側）に、可喫煙材の第1セグメント70を配設し、可喫煙ロッド15の他端（即ち、シガレットのフィルタ素子側）に、可喫煙材の第2セグメント75を配設する。可喫煙材の第1セグメント70と、可喫煙材の第2セグメント75とは、その組成が異なる。これらの2つのセグメントを突合せ当接関係に整列させるが、両セグメントが接触する領域に両者の可喫煙材の若干量の混交が存在

してもよい。第1セグメントと第2セグメントの長手方向の長さは異なるものとするができるが、第1セグメント対第2セグメントの長さの比は、通常、約2:1～約1:2の範囲とし、約1:1とすることが好ましい。このような可喫煙ロッドは、米国特許第4,008,722号及び4,516,586号に記載された装置を用いて製造することができる。

第2図の実施例の場合、第1セグメント70は、通常、可喫煙の形のタバコ材を含むものとする。そのような可喫煙の形のタバコ材としては、タバコ材刻み補充料（例えば、タバコ葉片、加工タバコ材、膨脹処理されたタバコ材補充料、再構成タバコ材補充料等、及びそれらのブレンド）、又はそのようなタバコ材刻み補充料と他の可喫煙材とのブレンドを用いることができる。加工タバコ材の一例として、米国特許第4,887,618号及び4,941,484号に記載された脱蛋白再構成タバコ材がある。加工タバコ材の他の例として、1990年2月23日に出版された米国特許第

484, 587号に記載された方法によって加工されたタバコ材がある。第2セグメント75は、第1セグメント70の可燃煙材の全体的組成とは異なる全体的組成を有する可燃煙材又は可燃煙材のブレンドから成る。第1セグメント70及び第2セグメント75の両方又はいずれか一方は、本発明の少なくとも1種類の可燃煙補充材料を含むものとする。

第3図は、本発明のシガレット及び可燃煙補充材料の更に別の好ましい実施例を示す。この実施例のシガレット10は、本発明による可燃煙材（セグメント70、75）を加工タバコ材シート80で包被した点を除いては第1図及び第2図のものと同様である。加工タバコ材シート80は、通常、製紙法を用いて製造された再構成タバコ材シートであり、1層のシート80で可燃煙材を包被する。可燃煙材を包被した加工タバコ材シート80を更に1層の外側ラップ材25（例えば、シガレット用巻紙）で包被する。

第4図は、本発明のシガレット及び可燃煙補充

材料の更に別の好ましい実施例を示す。この実施例のシガレット10は、そのフィルタ素子30を3つのセグメントで構成した点を除いては第1、2及び3図のものと同様である。即ち、この実施例では、フィルタ材35から成る第1フィルタセグメントとフィルタ材40から成る第2フィルタセグメントの間に第3フィルタセグメントを介設する。第3フィルタセグメントは、活性炭粒子、硫酸マグネシウム粒子、シリカ粒子等の粒状体より成るフィルタ材85と、それを包被するラップから成る。

本発明の可燃煙ロッドの製造に使用する可燃煙材は、いろいろな材料とすることができるが、最も好ましいのは、刻み補充料の形としたものである。ここで、可燃煙材に関連して用いられる「刻み補充料」という用語は、シガレットのための可燃煙ロッドの製造に使用するのに適した形態を有するいろいろな可燃煙材を意味する。刻み補充料の例としては、ブレンドされ、シガレットの製造に適する形態とされたいろいろな可燃煙材があ

る。そのような可燃煙材は、通常、シガレットの製造に慣用されているストランド又は裁断片の形で使用する。例えば、刻み補充料は、シート状又はストリップ状の材料から裁断したストランド又は裁断片の形で用いることができる。そのようなストリップ材は、約5.08〜約0.423mm（約1/5〜約1/60in）、好ましくは約1.016〜約0.726mm（約1/25〜約1/35in）の幅にカットする。一般に、そのようなストランド又は裁断片は、約6.35〜約7.62mm（約0.25〜約3in）の長さを有する。刻み補充料は、押出成形された形態のもの（例えば、押出成形されたストランド）、又はその他の物理的に加工された形態のものであってもよい。

本発明のシガレットの可燃煙ロッドは、本発明の可燃煙補充材料を含む。可燃煙補充材料は、刻み補充料の形で用いることができる。

本発明の可燃煙補充材料の1つの好ましい形態は、緊密に接触させた有機成分と無機成分の凝集マトリックスを含む凝集マトリックス補充料から

成るものである。この凝集マトリックス補充料を結合剤と緊密に混合して可燃煙補充材料を調製する。このような可燃煙補充材料には、その最終混合物の一部として、少なくとも1種類のエアゾール創生物質及び、又は少なくとも1種類の香味剤を含有させることが極めて好ましい。所望ならば、この可燃煙補充材料によって創生されるエアゾールの組成を改変することができる他の薬剤をも可燃煙補充材料に含有させることができる。凝集マトリックス補充料は、有機成分1重量部当り通常約2〜約99重量部、好ましくは約5〜約20重量部の無機成分を含むものとする。又、このような可燃煙補充材料は、通常約50〜約90重量%、好ましくは約65〜約85重量%の凝集マトリックス補充料を含み、最高約20重量%、好ましくは約2〜約10重量%の結合剤を含み、最高約20重量%、好ましくは約3〜約15重量%のエアゾール創生物質を含み、所望の香味特性を付与するのに十分な量の香味剤を含むものとする。所望ならば、この可燃煙補充材料に、その機

乾量を基準として、通常は最高約10重量%、場合によっては最高約30重量%の追加の炭素質材料（例えば、熱分解セルロース）を混入してもよい。ただし、そのような追加の炭素質材料は、本発明の可燃煙補充材料の必須成分ではなく、省いてもよい。この可燃煙補充材料は、可燃性であり、本発明のシガレットを製造するために、通常は、他の可燃煙材と一緒に（ブレンドして）用いる。

本発明のタバコ材含有可燃煙補充材料の1つの好ましい形態は、緊密に接触させた有機成分と無機成分の凝集マトリックスを含む凝集マトリックス補充料から成るものである。この凝集マトリックス補充料を何らかの形態のタバコ材及び結合剤と緊密に混合してタバコ材含有可燃煙補充材料を調製する。このようなタバコ材含有可燃煙補充材料には、その最終混合物の一部として、少なくとも1種類のエアゾール創生物質及び、又は少なくとも1種類の香味剤を含有させることが好ましい。所望ならば、この可燃煙補充材料によって創

生されるエアゾールの組成を改変することができる他の薬剤をも可燃煙補充材料に含有させることができる。この凝集マトリックス補充料は、その有機成分1重量部当り通常約2〜9.9重量部、好ましくは約5〜約20重量部の無機成分を含む。又、このようなタバコ材含有可燃煙補充材料は、通常は最高約7.5重量%、典型的には最高約5.0重量%の何らかの形態のタバコ材を含み、最高約8.0重量%、好ましくは約2.0〜約6.5重量%の凝集マトリックス補充料を含み、最高約2.0重量%、好ましくは約2〜約1.0重量%の結合剤を含み、最高約2.0重量%、好ましくは約3〜約1.5重量%のエアゾール創生物質を含み、所望の香味特性を付与するのに十分な量の香味剤を含むものとする。所望ならば、このタバコ材含有可燃煙補充材料に、その総乾量を基準として、通常は最高約10重量%、場合によっては最高約30重量%の追加の炭素質材料（例えば、熱分解セルロース）を混入してもよい。ただし、そのような追加の炭素質材料は、本発明の可燃煙補充材料の必

須成分ではなく、省いてもよい。このタバコ材含有可燃煙補充材料は、可燃性であり、本発明のシガレットの唯一の可燃煙材としてそのまま用いることができる。

本発明の可燃煙補充材料の他の好ましい形態は、有機成分と無機成分の凝集マトリックスを含む凝集マトリックス補充料から成るものである。この凝集マトリックス補充料を結合剤と少なくとも1種類のエアゾール創生物質と混合して可燃煙補充材料を調製する。このような含有可燃煙補充材料には、その最終混合物の一部として、少なくとも1種類の香味剤と、何らかの形態のタバコ材を含有させることが好ましい。この凝集マトリックス補充料は、その有機成分1重量部当り通常約2〜9.9重量部の無機成分を含む。又、このような可燃煙補充材料は、通常は最高約2.0重量%、好ましくは約3〜約1.5重量%の結合剤を含み、約2.0重量%以上、好ましくは約2.5〜約5.0重量%のエアゾール創生物質を含み、上述した凝集マトリックス補充料を含む約8.0重量%未満、好

ましくは約3.0〜約7.0重量%の補充料成分を含有するものとする。詳述すれば、この補充料成分は、(i) 上述した凝集マトリックス補充料の全部、又は (ii) 上述した凝集マトリックス補充料と、無機補充材料（例えば、沈降炭酸カルシウム）及び、又は有機補充材料（例えば、タバコ材）とのブレンドを含むものとして行うことができる。又、この可燃煙補充材料に、所望の香味特性を付与するのに十分な量の香味剤を含めることができる。所望ならば、この可燃煙補充材料に、その総乾量を基準として、通常は最高約10重量%、場合によっては最高約30重量%の追加の炭素質材料（例えば、熱分解セルロース）を混入してもよい。ただし、そのような追加の炭素質材料は、本発明の可燃煙補充料の必須成分ではなく、省いてもよい。この可燃煙補充料は、可燃性であり、他の可燃煙材とブレンドして用いることができる。

本発明の上記タバコ材含有可燃煙補充材料には、その製造行程中に何らかのタバコ材を含有さ

せる。そのようなタバコ材含有可喫煙補充料材を調製するのに使用するタバコ材は、タバコ材抽出物、タバコ微粉又は粉末、煙刻又は粉砕されたタバコ葉片、タバコ葉類、蒸餾処理されたタバコ材補充料、又はその他の加工タバコ等、又はそれらの組合せを含むいろいろな形態のものであってよい。タバコ材抽出物は、加工タバコであり、水、二酸化炭素、炭化水素又はハロカーボンのような溶媒、又はその他のいろいろな有機又は無機溶媒を用いてタバコ材を抽出することによって得られる。タバコ材抽出物としては、1990年4月19日付米国特許第511,158号及び1989年12月18日付米国特許第452,175号に記載されているような喫煙乾燥抽出物、凍結乾燥抽出物、熱処理抽出物、及び、ヨーロッパ特許第326,370号に記載されているようなタバコエッセンス、及び、米国特許第4508,682号及び1989年2月13日付米国特許第310,413号に記載されているような芳香油及び抽出物などがある。

塩である。アルギン酸塩、特に高粘度のアルギン酸塩は、調整された量の遊離カルシウムイオンと組合せて使用することができる。その他の結合剤として、スターチ（例えば、コーンスターチ）、グアガム、イナゴ豆ガム、ペクチン、キサンタンガム等がある。これらの結合剤の組合せ又はブレンド（例えば、グアガムとイナゴ豆ガムとの混合物）を用いることもできる。

本発明の可喫煙補充料材には、少なくとも1種類のエアゾール創生物質及び、又は少なくとも1種類の香味剤を含有させることができる。好ましいエアゾール創生物質としては、ポリオール（例えば、グリセリン、プロピレングリコール、トリエチレングリコール）、及び可喫エアゾールを発生するその他の物質、又はそれらの混合物が挙げられる。エアゾール創生物質は、（例えば、結合剤がアルギン酸プロピレングリコールである場合）結合剤の一部として供給することができる。又、いろいろなエアゾール創生物質を組合せて用いることもできる。香味剤としては、メントール、

本発明の可喫煙補充料材は、結合剤を含有する。好ましい結合剤の例としては、アクアロン・カンパニーから販売されている「クルセルH」（商品名）のようなヒドロキシプロピルセルロース、ダウ・ケミカル・カンパニーから販売されている「メトセル K4MS」（商品名）のようなヒドロキシプロピルメチルセルロース、アクアロン・カンパニーから販売されている「ナトロセル 250MRCS」（商品名）のようなヒドロキシエチルセルロース、FMCから販売されている「アビセル」（商品名）のような微晶質ヒドロキシエチルセルロース、ダウ・ケミカル・カンパニーから販売されている「メトセル A4M」（商品名）のようなメチルセルロース、ハーキュルズ・インコーポレイテッドから販売されている「CMC 7HF」及び「CMC 7H4F」（商品名）のようなカルボキシメチルセルロースナトリウム等が挙げられる。特に好ましい結合剤は、アルギン酸アンモニウム、アルギン酸ナトリウム、アルギン酸プロピレングリコール等のアルギン酸

ル、バニリン、クエン酸、りんご酸、ココア、甘草等、及びそれらの組合せを用いることができる。香味剤については、レフィングル他編「喫煙製品のためのタバコ材香味付け」（1972年）を参照されたい。

本発明の可喫煙補充料材にカラメル化材を混入することが望ましい場合がある。カラメル化材は、(i) シガレットの灰及び燃焼する円錐状火塊の健全性（崩落せず一体性を保つ性質）、(ii) 可喫煙補充料の外観、及び (iii) シガレットの主流煙の香味特性を改善する働きをする。カラメル化材は、可喫煙補充料材の調製中に該補充料材に組入れてもよく、あるいは、可喫煙補充料材の製造後にその表面に被覆してもよい。通常、特定の可喫煙補充料材を処理するのに使用するカラメル化材の量は、そのカラメル化材を含めた最終の可喫煙補充料材中のカラメル化材の含有量が最高約20重量部、処理される可喫煙材の含有量が約80重量部以上となるように定める。適当なカラメル化材の例としては、グルコース、フラクトー

ス、サッカロース等の砂糖、及びM、D、ニール・インコーポレイテッドから販売されている「キャロブ パウダー コード1739」(商品名)のような化合物が挙げられる。

本発明の可喫煙補充料材は、ある種の物質で表面処理することができる。例えば、可喫煙補充料材の表面に粉末物質を被覆することができる。そのような粉末物質の例としては、ココア粉末、甘草粉末、粉末無機材(例えば、炭酸カリウム又は炭酸鉄)、タバコ粉末、炭化タバコ葉片等、又はそれらのブレンドがある。そのような表面処理により可喫煙補充料材に改良された色、外観、反特性、及び香味特性を付与することができる。

先に述べた凝集マトリックス補充料は、無機成分と有機成分を有する。例えば、アルギン酸塩を用いて凝集させた炭酸カルシウムは、無機成分と有機成分を有する。その他の無機成分としては、硫酸カルシウム、酸化マグネシウム、炭酸マグネシウム等がある。アルギン酸アンモニウムは、特に好ましいアルギン酸塩である。そのような凝集

の粒子とすることもできる。アルギン酸塩に対する炭酸カルシウムの量の比は、乾量を基準として約99:1から約2:1、好ましくは約20:1から約5:1の範囲とする。通常、アルギン酸塩を用いて凝集させた炭酸カルシウムの粒子は、周囲条件下では実質的に水に不溶性である。この凝集マトリックス補充料中のアルギン酸塩の水不溶性は、凝集マトリックス補充料が周囲条件下で水に接触したときその凝集性を喪失する傾向を大いに制限する。この凝集マトリックス補充料は、アルギン酸塩と炭酸カルシウムのカルシウムイオンとの相互作用により水不溶性とされる。所望ならば、凝集マトリックス補充料を酸の稀釈溶液で処理し、それによって炭酸カルシウムの一部を分解してカルシウムイオンを放出させ、そのカルシウムイオンが凝集マトリックス補充料のアルギン酸塩成分を水不溶性にするようにすることができる。

無機成分と有機成分を有する上記凝集マトリックス補充料には、上述したもの以外の他のい

マトリックス補充料は、炭酸カルシウム粒子と水和アルギン酸塩との水性スラリーを生成し、そのスラリーを乾燥させて炭酸カルシウムの凝集マトリックス(即ち、連続した、又は半ば連続したアルギン酸塩相中に分散した多数の炭酸カルシウム粒子から成るマトリックス)を形成することによって調製することができる。所望ならば、このスラリーをそれに発泡剤を導入することによって膨脹させることもできる。そのための適当な発泡剤の例としては、直鎖ナトリウムベンゼンスルホネート、直鎖アルキルスルホネート、直鎖アルキルエトキシスルホネート酸等がある。凝集マトリックスは、炭酸カルシウムとアルギン酸塩との固形分の高い水性スラリーを噴霧乾燥させて炭酸カルシウムとアルギン酸塩の凝集粒子(例えば、常態においては球状の粒子)とすることによって調製するのが好ましい。あるいは別法として、そのようなスラリーを加熱によって乾燥させ、凝集した炭酸カルシウムとアルギン酸塩の中実塊体とし、その中実塊体を粉砕することによって所望の粒度

の粒子とすることもできる。アルギン酸塩に対する炭酸カルシウムの量の比は、乾量を基準として約99:1から約2:1、好ましくは約20:1から約5:1の範囲とする。通常、アルギン酸塩を用いて凝集させた炭酸カルシウムの粒子は、周囲条件下では実質的に水に不溶性である。この凝集マトリックス補充料中のアルギン酸塩の水不溶性は、凝集マトリックス補充料が周囲条件下で水に接触したときその凝集性を喪失する傾向を大いに制限する。この凝集マトリックス補充料は、アルギン酸塩と炭酸カルシウムのカルシウムイオンとの相互作用により水不溶性とされる。所望ならば、凝集マトリックス補充料を酸の稀釈溶液で処理し、それによって炭酸カルシウムの一部を分解してカルシウムイオンを放出させ、そのカルシウムイオンが凝集マトリックス補充料のアルギン酸塩成分を水不溶性にするようにすることができる。

本発明の可喫煙補充料材に混入することができる別の種類の補充料として、更に別の無機材料がある。そのような無機材料は、多くの場合、繊維状、フレーク、結晶、非晶質、中空、又は粒状である。そのような無機材料の例としては、炭酸カ

ルシウム、炭酸カルシウム粒子、酸化マグネシウム、水酸化マグネシウム、パーライト、人工重母、パーミキュライト、クレー、熱安定性炭素繊維、酸化亜鉛、ドーソナイト、炭酸カルシウムの低密度中空球体、ガラス球、ガラス泡、珪酸ナトリウム、熱安定性炭素微小球、炭酸カルシウム繊維、セラミックの中空微小球、アルミナ、有機材を用いて凝集させた炭酸カルシウム、低密度加工炭酸カルシウム、等がある。

凝集マトリックス補充料は、無機成分と炭素質成分との凝集マトリックスの形とすることができる。そのような無機成分としては、炭酸カルシウム、炭酸カルシウム、酸化マグネシウム、炭酸マグネシウム等がある。特に好ましい凝集マトリックス補充料は、凝集炭酸カルシウムであり、極めて好ましいのは、凝集沈降炭酸カルシウムである。そのような凝集マトリックス補充料は、炭酸カルシウム粒子と結合剤との水性スラリーを生成し、そのスラリーを乾燥させて炭酸カルシウムの凝集マトリックス（即ち、結合剤の連続した、又

は半ば連続した相中に分散した複数の炭酸カルシウム粒子のマトリックス）を形成することによって調製することができる。この凝集マトリックスを生成するのに使用される炭酸カルシウムの粒子は、「ジャーナル・オブ・アメリカン・ケミカル・ソサィアティ」第80巻、第309頁（1938年）に記載されたブルナウアー・エメット・テラー（BET）法で測定して、通常、約 $20\text{ m}^2/\text{g}$ 未満、大抵の場合約 $10\text{ m}^2/\text{g}$ 未満、場合によっては約 $1\text{ m}^2/\text{g}$ 未満の表面積を有する。代表的な結合剤は、セルロースの誘導体（例えば、カルボキシメチルセルロースナトリウム）等の有機物質であり、好ましくは糖蜜、フラクトース含量の高いコーンシロップ、又はM、F、ニール・インコーポレイテッドから販売されている「キャロブ パウダー コード1739」等の砂糖含有物質である。ペクチンやアルギン酸塩等の有機物質を用いることもできる。ペクチン、アルギン酸塩等の有機物質、及び上述した他の有機材を用いることができる。

炭酸カルシウムと結合剤の凝集粒子（例えば常態では球状粒子）は、炭酸カルシウムと結合剤との固形分含量の高い水性スラリー（例えば、約40～約55重量%の固形分含量を有するスラリー）を噴霧乾燥することによって生成するのが好ましい。あるいは別法として、そのようなスラリーを加熱によって乾燥させ、それによって、凝集した炭酸カルシウムと結合剤の中実塊体とし、その中実塊体を粉碎することによって所望の粒度の粒子とすることもできる。結合剤に対する炭酸カルシウムの量の比は、乾量を基準として約20:1から約2:1、好ましくは約15:1から約4:1の範囲とする。通常、糖類又は多糖類を用いて凝集させた炭酸カルシウム粒子は、それに含まれる糖類又は多糖類が水溶性の性質を有しているため、周囲条件下で水に接触すると凝集性を喪失する傾向がある。

このことを考慮して、無機成分と有機結合剤との凝集マトリックスに熱処理を施す。それによって、有機結合剤から揮発成分が放逐され、有機結

合剤が凝成された實質的に水不溶性の清浄な可溶炭素質成分を生成する。通常、そのような凝集マトリックス補充料の熱処理は、結合剤の酸化を最少限又は防止するために、制御された雰囲気で行う（例えば、1989年9月29日出願の米国特許第414,833号参照）。この熱処理は、炭素質材の形の結合剤を調製し、その結合剤が無機成分の粒子をマトリックスの形に凝集させるための手段となるようにすることが好ましい。詳述すれば、凝集した炭酸カルシウムと結合剤の粒子をオープン、バッチ炉、流動層、回転焼成器、又はベルト型焼成器等を用いて、例えば最高約625℃、通常は最高約600℃の温度にまで加熱処理することができる。例えば、糖蜜を用いて凝集させた噴霧乾燥炭酸カルシウムの粒子の場合は、流動化用ガスとして窒素ガスを使用する流動層内で該粒子を約300℃～約625℃にまで加熱するのに十分な温度で加熱し、取集することができる。無機成分と有機結合剤の凝集マトリックスの場合は、（例えば、無機成分が炭酸カルシウムで

ある場合)その無機成分の熱分解を回避するのに十分な条件下で凝集マトリックスを極めて高い温度(例えば、最高約900℃)に短時間露呈させることによって有機結合剤を焼成するのに十分な熱処理を施すことができる。ただし、無機成分が炭酸カルシウムであって、焼成工程にある程度の熱分解を起こすような場合は、その焼成した凝集マトリックスを、(i)二酸化炭素雰囲気中に露呈することによって、あるいは(ii)水中に分散させ、その分散水中に二酸化炭素をバブルとして吹込むことによって、再炭酸化することができる。

この焼成工程を経た後の凝集炭酸カルシウム粒子は、通常、約80重量%を超える、多くの場合約90重量%を超える炭酸カルシウム分を有し、約3重量%を超える、炭素質成分による炭素含量を有する。通常、このようにして得られた凝集炭酸カルシウム粒子を篩にかけて、米国基準メッシュ約-50/+325、多くの場合-80/+200の粒度までの粒子を得る。焼成処理された好ましい凝集炭酸カルシウム粒子は、実質的に水不

溶性であり、形状は球状であり、自由流動性を有する。その濃密度は、水銀浸透法で測定して約0.1g/cm³~約1.1g/cm³、多くの場合約0.3g/cm³~約1g/cm³である。かくして、焼成済み凝集炭酸カルシウム粒子は、約2.5g/cm³を超える濃密度を有する無機成分を含む、約2g/cm³未満の濃密度、好ましくは約1g/cm³未満の濃密度を有する無機材料を提供する。通常、このような焼成済み凝集炭酸カルシウム粒子の表面積は、BET法で測定して約30m²/g未満、多くの場合約10m²/g~約25m²/gである。

所望ならば、焼成済み凝集炭酸補充料の濃密度は、その無機成分の一部を酸で溶解させることによって低下させることができる。例えば、焼成済み凝集炭酸補充料を水中に分散させ、得られたスラリーに塩酸の水溶液を追加し攪拌する。酸は、炭酸カルシウムと反応するが、炭素質成分とはほとんど反応しない。炭酸カルシウムの一部は反応して二酸化炭素ガスと水溶性の塩化カルシウムを

生成し、炭素質成分は、残った炭酸カルシウムを結合状態に保持する働きをする。

本発明の可炭焼補充材料に転入れることができる別の種類の無機材料として、低密度無機補充料がある。そのような無機補充料は、カルシウム塩の粒子を準備し、そのアニオンを分解し、該粒子を二酸化炭素に接触させることによって調製する。そのような適当な塩の例として、プロピオン酸カルシウム、琥珀酸カルシウム、酒石酸カルシウム、ステアリン酸カルシウム、サルチル酸カルシウム、パルミチン酸カルシウム、オレイン酸カルシウム、乳酸カルシウム、グルコン酸カルシウム、くえん酸カルシウム、アスクルビン酸カルシウム、アセチルサルチル酸カルシウム、安息香酸カルシウム等がある。その他の適当な塩としては、陰類及び多糖類のカルシウム塩がある。そのような塩をそのアニオンを分解するのに十分な条件に露呈する。その工程は、通常、塩を二酸化炭素雰囲気中で熱処理する工程を伴う。

低密度無機補充料を調製するための1つの方法

は、米国基準メッシュ約-80/+170の粒度にまで篩別された乳酸カルシウムの粒子を228ml/分の一定流量の二酸化炭素ガスの流れ雰囲気下で約600℃の温度で約8時間加熱し、約65%の重量を喪失した材料を調製し、その材料の約30重量部を約80重量部の水中に投入し、得られたスラリーを、そのpHを約8.8に低下させるのに十分な塩酸溶液に接触させ、次いでその材料を水中から取出して、水で洗浄し、乾燥させた後、篩にかけて-80/+170の粒度までの材料を得る方法である。そのようにして得られた材料の炭酸カルシウム含量は、約95重量%を超える。該材料の濃密度は、水銀浸透法で測定して約0.4g/cm³である。

通常、本発明の可炭焼補充材料は、結合剤と、該可炭焼補充材料の、結合剤以外の他の成分との水性スラリーを生成し、そのスラリーをシートとして流延し、その流延した材料を乾燥させて比較的乾燥した加工可能なシートを形成することによって調製することができる。スラリーをシートと

して流延するための技術及び装置は、当業者には周知である。上記スラリーには、酢酸カルシウム、炭酸カリウム、pH制御剤、界面剤、アミノ酸、塩化カリウム及び、又は水酸化カルシウム等の他の物質を混入することもできる。又、スラリー内には、スラリー中のカルシウムイオン濃度を制御するのに十分な量の金属イオン封鎖剤（例えば、オルト燐酸一水素二アンモニウム、くえん酸ナトリウム、ヘキサメタ燐酸カリウム又はピロ燐酸四ナトリウム）を混入することもできる。シートとして流延させたスラリーを周囲温度又は高い温度で乾燥させることができる。更に、この流延させたスラリーにカルシウム塩の水溶液を被覆することができる。得られた乾燥シートをストリップの形に切断又は分断し、後にそのストリップを刻み補充料の形に細断又は鋸刻することができる。本発明の可喫煙補充料は、製紙法を用いて製造することができる。詳述すれば、セルロース質材（例えば、硬質木材パルプ、軟質木材パルプ、混雑繊維及び、又は鋸刻タバコ葉柄）と、上述し

理し（例えば、ローウ等を用いて圧延処理し）所望の形状に形成することができる。

本発明のシガレットの可喫煙ロッドは、多くの場合、複数種の可喫煙材料の物理的混合物又はブレンドを含むものとする。このブレンドは、本発明による少なくとも2種類以上の可喫煙補充料材を含むものとしてことができ、あるいは、本発明による少なくとも1種類の可喫煙補充料材と少なくとも1種類の他の可喫煙補充料材との物理的混合物を含むものとしてすることができる。ある種のシガレットにおいては、1本のシガレット中の可喫煙材に上記ブレンドの総重量を基準として少なくとも約1%の炭素質材料が含まれるようにするのに十分な量の本発明による少なくとも1種類の可喫煙補充料材を該ブレンドに含める。詳述すれば、そのようなタイプの可喫煙補充料材を有し、低多孔度（例えば、コレスタ単位約5未満）の外製紙ラップで包絡されたシガレットは、FTC喫煙条件下で喫煙した場合、パフ（吸込み）とパフの間にくすぶりを維持する（即ち、自然消火しな

た各種補充料との水性スラリーを繊維材製ベルト又はワイヤスクリーン上にマットとして流延させ、所望の含水率になるまで乾燥させる。通常、このマットに、香味剤、タバコ材抽出物、タバコ材の細片、エアゾール剤生物質等を（例えば、スプレーとして）添加することができ、得られたマットを更に乾燥させてシートとする。この乾燥シートをストリップの形に切断又は分断し、後にそのストリップを刻み補充料の形に細断又は鋸刻することができる。紙状のシートを製造するための技術及び装置は、当業者には明らかであろう。

本発明の可喫煙補充料は、適当な押出成形法を用いて所望の形に押出成形することもできる。そのような押出成形法の詳細については米国特許第4,880,018号を参照されたい。別法として、可喫煙材の構成成分と、結合剤としてのアルギン酸塩との水性スラリーをカルシウムイオンの水溶液（例えば、塩化カルシウムの水溶液）として押出し、収束して乾燥させることもできる。所望ならば、押出成形した可喫煙補充料材を物理的に処

理し性質を有する。FTC喫煙条件とは、60秒毎に2秒間の35mlの容積の吸込み動作（パフ）を行うことである。

本発明の可喫煙補充料材は、タバコ材刻み補充料とブレンドすることができる。タバコ材刻み補充料としていろいろな種類のタバコ材、例えば熟成乾燥バーレー種タバコ、メリーランド種タバコ、オリエンタル種タバコ、種種又は特殊タバコ、又はそれらのブレンドを用いることができる。そのようなタバコ材刻み補充料は、タバコ葉片、鋸断させたタバコ葉片、刻み圧延タバコ葉柄又は刻み鋸断タバコ葉柄のような加工タバコ葉柄、(i) 米国特許第4,887,618号及び米国特許第4,941,484号に記載された再構成タバコ材、(ii) 米国特許第3,353,541号、3,420,241号及び3,385,449号、及び1989年9月13日出願の米国特許第4,086,377号及び1990年1月5日出願の米国特許第4,612,116号に記載された燐酸含有再構成タバコ材、(iii) 1988年11月18日出願の米国特

特許第272,156号及びボーズ編「タバコ百科事典」第389頁(1984年)に記載された再構成タバコ材、(iv) 1989年9月29日出願の米国特許第4,183,322号及び1989年9月29日出願の米国特許第4,148,333号に記載された再構成タバコ材等の再構成タバコ材、又はそれらのブレンドを含むものとすることができる。

可燃煙材には、シガレット製造のいろいろな段階で慣用の態様でケーシング処理又はトップドレッシング処理を施すことができる。例えば、シガレットの刻み煙葉料を加工する場合に一般に行われるように、可燃煙材に香味剤を付与することができる。適当な香味剤としては、バニリン、ココア、甘草、メントール等がある。又、可燃煙材に香味改変剤を付与することもできる。例えば、可燃煙材の乾量を基準として約0.01〜約2%、通常約0.1〜1%、好ましくは約0.2〜約0.6%の量のレブリン酸のような香味改変剤として可燃煙材に付与することができる。あるいは、可燃煙材

の乾量を基準として約5%未満、通常約2〜約3%の量の炭酸カルシウムを香味改変剤として可燃煙材に付与することができる。又、この可燃煙材には、グリセリンやプロピレングリコールのようなエアゾール創生物質及び保潤剤を付加することもできる。香味改変剤は、ケーシング剤及びトップドレッシング剤として可燃煙材に付与することができる。

可燃煙ロッドを形成するためのラップ材として好ましいのは、空気透過率の低いシガレット用ラップ材(紙巻タバコ用の巻紙)である。そのようなラップ材は、コレスタ単位約5未満、多くの場合コレスタ単位約3未満、大抵の場合コレスタ単位約1未満の空気透過率を有する。代表的なラップ材は、シガレット用紙ラップである。好適なラップ材の例としては、キンバリ・クラーク社からD D-71-1、D D-71-8、MTR-1021、P-2831-60-2、P-2831-60-3、P-2831-60-4、P-2831-60-5、P-2674-110、P-283

1-60-1、及びD D-100-2という商品名で販売されているシガレット用紙ラップが挙げられる。又、何種類かの好適な低多孔率シガレット用紙ラップが、市販されており、それらに適当量の熱焼印剤、融剤等を添加することができる。特に好ましいのは、望ましい低空気透過率を有する紙とするのに十分な量のフィルム形成ポリマー材を含有したシガレット用紙ラップである。例えば、紙ラップに十分な量のフィルム形成ポリマー材(例えば、カルボキシメチルセルロースナトリウム又はエチルセルロース)の水溶液を塗布することができる。フィルム形成ポリマー材の種類は、当業者には明らかであろう。

このような隨意選択としてのフィルム形成ポリマー材は、紙ラップにその製造中に付与してもよく、あるいは、紙ラップの製造後に印刷又は塗布により付与してもよい。通常、フィルム形成ポリマー材は、その付与操作を容易にするために、種液溶液(例えば、溶媒に対して約0.2〜約5重量%の濃度の溶液)として紙ラップに付与する。紙

ラップに付与するフィルム形成ポリマー材の量は、その紙ラップの空気透過性、そのフィルム形成ポリマー材のフィルム形成能力等の要素によって異なる。通常、使用されるフィルム形成ポリマー材の量は、その紙ラップの乾量を基準として、約1〜約10%の範囲である。例えば、エタノールを溶媒とする5重量%のエチルセルロース又は水を溶媒とする約5重量%のカルボキシメチルセルロースナトリウムを、サイジングアプリーケータを用いてシガレット用紙ラップに塗布し、その紙ラップを乾燥させて、コレスタ単位約1未満、好ましくはコレスタ単位約0.5未満の多孔率を有する非湿潤性、防湿性の紙ラップを調製することができる。

本発明の可燃煙ロッド及びそれを用いてのシガレットは、周知のシガレット製造法及び装置により周知の態様で製造することができる。可燃煙ロッドは、多くの場合、可燃煙材を単一層のラップ材で包被することによって形成するが、種類の異なる2層のラップ材で包被することもできる(例

えば、1990年5月24日出願の米国特許第528,302号参照)。

種類の異なる2層のラップ材で包被した可燃煙ロッドを有するシガレットの場合、上述した低多孔率紙ラップの1つを2層のラップ材のうちの外側ラップ材として使用することが好ましい。内側ラップ材は、いろいろな材料のものとしてすることができるが、通常はタバコ含有ラップ材である。そのような内側ラップ材の例としては、ジャワ種タバコ葉約3部と、木材パルプ約1部を含む紙ラップを挙げることができる。そのような紙ラップは、キンバリ・クラーク社からP-2249-115及びP-2831-23-3という商品番号で販売されている。その他の好適な内側ラップ材としては、やはりキンバリ・クラーク社からP-2540-94-A、P-2540-94-C、及びP-2540-94-Dという商品番号で販売されている。タバコ材と炭素質材を含む紙ラップがある。内側ラップ材には、燃焼抑制剤(例えば、くえん酸カリウム、酢酸カリウム又は磷酸カリウ

ム)を含有させることができ、あるいは又、内側ラップ材は、香味剤(例えば、メントール又はバニリン)又は香味先駆体(例えば、バニリングルコシド又はエチルバニリングルコシド)を保持するための基材とすることもできる。

通常、可燃煙ロッドは、約30mm〜約70mm、好ましくは約35mm〜約60mmの長さを有し、約17mm〜約27mm、好ましくは約22mm〜約25mmの周囲長を有する。特に比較的高い充填密度を有する可燃煙材を使用した場合は、短い(例えば、約30mm〜約50mmの長さの)可燃煙ロッドを使用することができる。

「充填密度」とは、可燃煙ロッド内の単位体積当たりの填充料の重量を意味する。外側ラップ材に包被する可燃煙材の充填密度は、いろいろな値とすることができる。本発明のシガレットの可燃煙ロッドの代表的な充填密度は、約150mg/cm³〜約400mg/cm³の範囲である。通常、可燃煙ロッドの充填密度は、約200mg/cm³〜約380mg/cm³、多くの場合、特

に比較的短い(例えば、長さ50mm未満)可燃煙ロッドを用いる場合は約250mg/cm³〜約380mg/cm³の範囲とする。

本発明のシガレットには、フィルタ素子、特に2つ以上のフィルタセグメントから成るフィルタ素子を付設することが好ましい。通常、2つ以上のフィルタセグメントを有する好ましいフィルタ素子の各セグメントは、約10mm〜約30mmの長さを有し、約17mm〜約27mm、好ましくは約22mm〜約25mmの周囲長を有する。各フィルタセグメントを包被するブラグラップ(ブラグ即ちフィルタ用ラップ)は、通常、慣用の紙ブラグラップであり、空気透過性であってもよく、あるいは実質的に空気不透過性であってもよい。

それらのフィルタセグメントのうちの1つのセグメントのフィルタ材は、炭素質材(例えば、活性炭粒子、チャーコール粒子又は炭素紙)を含むものとする。特に好ましいフィルタ材の一例は、キンバリ・クラーク社からP-144-BACと

いう商品番号で販売されているタバコ/炭素紙をひだ寄せすることによって調整されたものである。そのようなフィルタ材は、喫煙者の口中へ吸引される主流煙からある種の気相成分を減少させる。このように、このセグメントの好ましいフィルタ材は、主流煙に悪臭又はその他の望ましくない特性を与える可能性のある煙を減少させる働きをする。

上記フィルタセグメントのうちの他の1つのセグメントのフィルタ材は、通常、繊維質材を含むものとして好ましい。そのような好適なフィルタ材の一例は、ひだ寄せしたポリプロピレンの不織ウェブである。特に好ましいポリプロピレンの不織シート状ウェブは、キンバリ・クラーク社からPP-100-Fという商品番号で販売されているものである。もう1つの好適なフィルタ材の例は、酢酸セルロースのトウである。特に好ましい、酢酸セルロースのトウは、(i)1フィラメント当たり約8デニール、合計約40,000デニールの酢酸セルロースのトウ、(ii)1フィラメ

ント当たり約8デニール、合計約15,000デニールの許酸セルロースのトウ、(iii)1フィラメント当たり約8デニール、合計約25,000デニールの許酸セルロースのトウ、(iv)1フィラメント当たり約8デニール、合計約30,000デニールの許酸セルロースのトウである。上記のフィルタ材にトリアセチン、プロピレングリコール又はくえん酸トリエチル等の可塑性材を組合せることができる。

更に別のフィルタセグメントとして、タバコ材抽出物含有フィルタ材を構成するように、水溶性タバコ材抽出物に緊密に接触させた不燃熱可塑性（即ち、疎水性）繊維のひだ寄せウエブから成るフィルタ材を用いることができる。特に好ましい不燃ウエブは、キンバリ・クラーク社からPP 200 SDという商品番号で販売されているポリプロピレン繊維の不燃ウエブである。このようなフィルタセグメント及びフィルタ素子の例は、1989年9月29日出願の米国特許第4,483,555号及び1990年5月3日出願の米国特許

第5,185,977号に記載されている。そのようなフィルタセグメントは、それを通る主流煙の香味特性を高めることができる。

更に別のフィルタセグメントとして、タバコ紙（タバコ材で作られた紙）から成るフィルタ材を用いることができる。例えば、そのようなフィルタ材は、キンバリ・クラーク社からP-144-Bという商品番号で販売されているタバコ紙のひだ寄せウエブから成るものとするることができる。

本発明に使用するのに適するフィルタ素子のフィルタセグメントは、周知のシガレットフィルタ製造法及び装置を用いて製造することができる。例えば、フィルタ素子は、周知の技法で許酸セルロースのトウから製造することができる。又、フィルタ素子は、炭素紙、タバコ紙又はシート状の不燃ポリプロピレンのウエブから米国特許第4,807,809号に記載されたフィルタ製造法を用いて製造することができる。別法として、適当なフィルタ材から成る2つのセグメントの間にチャーコール粒子又は活性炭粒子から成る第3のセグメ

ントを介設することによっていわゆる「トリプル」（三重）フィルタ素子の構成とすることもできる。

フィルタ素子は、所望に応じて低い、中間の、又は、高い通過効率（主流煙除去効率）を有するものとして構成することができるが、主流エアゾール（即ち、煙）除去効率ができるだけ低く、かつ、シガレットの望ましい吸引特性を有するフィルタ素が好ましい。主流煙除去効率の低いものは、いわゆる「低効率」フィルタと称されるものである。低効率フィルタは、主流煙の粒状物を除去する能力が小さい。フィルタ素子の主流煙除去効率については、キース著「タバコの化学とタバコの煙」第157頁（1972年）を参照されたい。一般に、低効率フィルタ素子の粒子除去効率は約40重量%未満である。

チップング材は、フィルタ素子とそれに隣接する可喫煙ロッドの一部分を圍繞し、可喫煙ロッドの長手に沿って約3mm〜約8mm延在させる。チップング材は、通常、慣用の紙製チップング材

である。チップング材としては、いろいろな多孔率を有するものを使用することができる。例えば、チップング材は、実質的に空気不透過性であってもよく、あるいは空気透過性であってもよく、あるいは、チップング材に、空気稀釈手段を構成するためにパーフォレーション（多数の小孔）、開口又は空気孔を形成するように例えば機械的技法又はレーザー式技法を用いて穿孔処理を施すことができる。本発明のシガレットの性能特性を制御するために、パーフォレーションの総面積及びシガレットの外周面に沿ってのパーフォレーションの配置をいろいろに変えることができる。

本発明の空気稀釈されるシガレットの場合、空気稀釈の量をいろいろに定めることができる。通常、空気稀釈されるシガレットの空気稀釈の量は、約25%以上、大抵の場合約40%以上である。シガレットの空気稀釈の上限は、通常、約75%未満、多くの場合約65%未満である。ここでいう「空気稀釈」とは、シガレットを通して吸

引され、シガレットの吸口端から流出する空気とエアゾール（煙）の総量に対して、空気希釈手段を通して吸引される空気の量の割合（通常％で表わされる）をいう。空気希釈については、セルク他著「Beitrag zur Tabak-Inn」第4巻、第193頁（1978年）を参照されたい。

本発明のシガレットは、喫煙したとき、香味豊かな主流エアゾールを送出する。このシガレットの主流エアゾールは、不完全燃焼生成物の量も、気相成分の量も低レベルである。又、このシガレットは、少なくともFTC喫煙条件下で喫煙したとき、許容範囲の速度で燃焼し、パフとパフの間のくすぶりを維持する。燃焼によって生じる灰及び円錐状火塊は、過度の凝集性を有さず、従って長さが長くなり過ぎない。ただし、その灰及び円錐状火塊は、良好な保全性を有する（崩壊しにくい）。

本発明のシガレットは、喫煙したとき、プロクタ他著「アナリスト」第113巻、第1509頁

（1988年）に記載されている装置及び技法を照会して測定して、1本当たり約20mg未満、好ましい例では約10mg未満の側流タールを送出する。このシガレットのFTC喫煙条件下で喫煙したときの1本当たりの総パフ数は、通常、約5パフより多く、好ましい例では6パフより多い。又、本発明のシガレットのFTC喫煙条件下で喫煙したときの1本当たりの総パフ数は、通常、約20パフ未満とし、多くの場合約15パフ未満とする。

以下に本発明を具体化した実施例の例を説明するが、これらの例は、本発明の範囲を限定するものではない、特に断わらない限り、以下の説明において用いられる「部」及び「％」は、いずれも重量基準である。

例 1

A. タバコ材含有可喫煙補充材料の調製

補充料を下記のようにして調製する。

高剪断ブレンダー内に約500部の水道水と、マーク・エンド・カンパニー・インコーポレイテッドのケルコ・ディビジョンからアモロイドHVという商品名で販売されている約5部の高粘性アルギンアンモニウムを投入し、得られた混合物を周囲温度で攪拌し、アルギン酸塩を水中に分散させ水和させる。次いで、この水／アルギン酸塩混合物にフアイバー・インコーポレイテッドからUSPライトという商品名で販売されている約95部の沈降炭酸カルシウムを添加する。得られたスラリーを中速の速度で約10分間攪拌し、均質なスラリーを生成する。

このスラリーを、霧化ノズルを有するアンヒドロ型ラプS1噴霧乾燥機を用いて入口温度約290℃、出口温度約104℃として噴霧乾燥させ

る。この噴霧乾燥機は、コールーバー・マー・インスツルメント・カンパニー製の7016-20型ヘッドを有するマスターフレックス・ポンプシステムを装備している。ノズルの霧化用空気の圧力は、281g/cm² (4psi)であり、液体供給速度は、そのポンプ速度制御を2にセットすることによって得られる速度である。このようにして噴霧乾燥された粒子は、ほぼ球状である。これらの粒子を篩にかけて米国基準で-80/+325メッシュの粒度までの粒子を得る。

上記噴霧乾燥された粒子は、自由流動性を有し、周囲温度条件下で実質的に水に不溶性であり、周囲条件下で水に接触されても凝集状態を維持する。各粒子は、アルギン酸塩中に分散した多数の沈降炭酸カルシウムから成る凝集マトリックスである。

可喫煙材を下記のようにして調製する。

225部の水道水を収容し、低速度にセットされた高剪断ブレンダー内に、マーク・エンド・カンパニー・インコーポレイテッドのケルコ・ディ

ビジョンからアモロイドRⅤという商品名で販売されている約5部の高粘性アルギンアンモニウムを投入し、得られた混合物を周囲温度で攪拌し、アルギン酸塩を水中に分散させ水和させる。次いで、この水／アルギン酸塩混合物に20部のグリセリンと35部の水道水を投入する。次いで、この混合物に約17.2部の上記凝集炭酸カルシウムを投入する。得られたスラリーを攪拌し、均質なスラリーを生成する。

このスラリーを高粘度ポリエチレンの上に約0.635mmの厚さのシートとして流延させ、空気乾燥させる。得られたシートは、淡褐色を有し、可塑性を有する。このシートを紙細断機を用いて11n (2.54cm) 当り32カットに細断する。

それらの細断片に、約5部の微細ベンシルバニラ揮発性タバコ葉片を振りかける。

B. シガレットの調製

ップで包被することによって形成する。1本のシガレット中の可燃煙材の重量は約1gである。

第1フィルタセグメントは、キンバリ・クラーク社からP-144-BACという商品番号で販売されているタバコ／炭素紙の29.8cm幅のウェブを米国特許第4,807,809号の例1に記載されたフィルタロッド形成装置によりひだ寄せすることによって製造する。この第1フィルタセグメントのためのブラグラップは、エクスタ・コーポレーション社から基準No. 5831として市販されているものである。この第1フィルタセグメントを可燃煙ロッドに隣接させて配置する。

第2フィルタセグメントは、キンバリ・クラーク社からP-100-Fという商品番号で販売されている不織ポリプロピレンの29.8cm幅のウェブを米国特許第4,807,809号の例1に記載されたフィルタロッド形成装置によりひだ寄せすることによって製造する。この第2フィルタセグメントのためのブラグラップは、エクスタ・コーポレーション社から基準No. 5831として

第3図に示されたようなシガレットを下記のようにして調製する。

長さ約57mmの可燃煙ロッドと、長さ約15mmの第1フィルタセグメントと、長さ約12mmの第2フィルタセグメントを有する、全長約84mm、周囲長約24.8mmのシガレットを製造する。第1フィルタセグメントと、第2フィルタセグメントとでフィルタ素子を構成する。フィルタ素子は、非孔質のチップング紙を用いて可燃煙ロッドに結合する。その場合、フィルタ素子の全長と、フィルタ素子に隣接する可燃煙ロッドの約4mmの長さ部分を包被することによって両者を結合する。フィルタ素子には、シガレットの吸口端から約12mmのところではチップング紙とフィルタ素子のブラグラップを貫通する複数のリング状に配列したパーフォレーションを穿設することによって約60%の空気制限を与えるように通気孔を設ける。

可燃煙ロッドは、周知の技術により刻み補充材の形の上述したタバコ材含有可燃煙材を2層のラ

市販されているものである。第2フィルタセグメントは、シガレットの吸口端側に第1フィルタセグメントに隣接させて配置する。

可燃煙ロッドの外側ラップ材は、コレスタ単位約0の空気透過率を有するシガレット用紙ラップ（巻紙）である。そのような紙ラップは、キンバリ・クラーク社からP-2831-60-1という商品番号で販売されている。

可燃煙ロッドの内側ラップ材は、キンバリ・クラーク社からP-2831-23-3という商品番号で販売されているタバコ材含有紙ラップである。

このシガレットは、紙ラップに包被された可燃煙材を燃焼させることによって使用され、可燃煙材が燃焼して煙を生じる。このシガレットの可燃煙材の発生量は、非常に少なく、副産煙の臭いはほとんどない。このシガレットは、P.T.C燃焼条件下でのバフとバフの間のくすぶり期間中に自然消火することはない。

例 2

アルギン酸塩で凝集させた炭酸カルシウムの粒子を下記のようにして生成する。

約750mlの水道をブレンダー内に投入し、次いで、約20gのグリセリンを投入する。この混合物を緩やかに攪拌しながら、約10gの例1で述べたアルギン酸アンモニウムをゆっくり添加してアルギン酸塩を水中に分散させる。得られた混合物を1.5ジャーに移して密栓し、一昼夜緩やかに回転させてアルギン酸塩を水和させる。

一方、ファイツア・インコーポレイテッドからコードNo. 2Aという商品番号で販売されている約250gの沈降炭酸カルシウムを約250gの水道水に投入してスラリーを生成し、そのスラリーを200gの上記水／グリセリン／アルギン酸塩混合物に添加する。得られたスラリーを緩やかに攪拌して滑らかなスラリーとする。

このスラリーを高密度ポリエチレンシートの上に約1.018mmの厚さのシートとして流延させ

する。

このスラリーを約33.39～35.15kg/cm²の供給圧力で約2.718kg/分の流量で噴霧乾燥機へ連続的にポンプ送りすることによって噴霧乾燥する。この噴霧乾燥機は、SD-046ノズルを装備したボウエン型商業用ユニットであり、商業用モードで動作させる。入口温度は約243℃（約470°F）とし、出口温度は約127℃（約260°F）とする。得られた噴霧乾燥粒子は、ほぼ球状であり、約2%以下の水分含量を有する。これらの粒子を篩にかけて米国基準で-70/+200メッシュの粒度までの粒子を得る。

そのような粒度の噴霧乾燥粒子を縦横30.48×91.44cm（12×36in）のスチール製トレー上に約1.27cmの厚さに積み上げて載せる。次いで、そのトレーを約20.32～約30.48cm（約8～12in）/分の速度で連続ベルト式炉内へ搬入し、窒素雰囲気下で約600℃以上の温度で約10分間加熱し、次いで約400℃

で空気乾燥させ、それによって得られた約15.24×15.24cmの乾燥シートを微小粒子に手で粉砕し、それらを米国基準で-50メッシュの粒度にまで篩別する。

焼成凝集炭酸カルシウムの粒子を下記のようにして調製する。

低剪断ミキサー内に、約832部の周囲温度の水道水と、ファイツア・インコーポレイテッドからアルガカー5970という商品名で販売されている約757部の沈降炭酸カルシウムをと、約267部の糖蜜を投入する。炭酸カルシウムは、ロゼット構造を有し、約2μmの平均粒度（顕微鏡）を有する。糖蜜は、サバンナ・シュガー・カンパニーからリファイナード・シロップという商品名で販売されており、約3.7:1の固形分/水比を有する。得られた混合物を約5～約10分間攪拌し、約5.2%の固形分を有し、円筒形のLVスピンドルNo. 4を備えたブルックフォードLVT粘度計で測定して約1,200CPS（センチポアズ）の粘度を有するスラリーを調製

以上の温度で約20分間加熱焼成する。炉を約720℃の温度にセットし、その時間中トレーを最高約870℃の温度の空気に露呈させる。かくして加熱焼成された粒子を炉から取出し、窒素雰囲気下の冷却帯域へ導入し約1時間かけて周囲温度にまで冷却する。

このようにして焼成した粒子は、黒色の球状であり、自由流動性を有し、防湿性である。又、これらの粒子は、約93%炭酸カルシウムであり、約0.5g/cm³の高密度を有する。各粒子は、炭素質材料内に分散した複数の沈降炭酸カルシウム粒子から成る凝集したマトリックスである。

タバコ材含有可燃煙補充料を下記のようにして調製する。

高剪断ブレンダー内に約225mlの水道水を投入し、その水内に約5gの例1で述べたアルギン酸アンモニウムを投入する。得られた混合物を周囲温度で緩やかに約15分間攪拌し、アルギン酸塩を水和させる。次いで、その混合物に約25mlのグリセリンを添加し、更に約25mlの水

道水を加える。この混合物に、粉末状態に粉碎されたタバコ材料補充料の「アメリカンブレンド」約18.7gを添加する。次いで、この混合物に約25mlの水道水を添加し、得られたスラリーを緩やかに攪拌して滑らかなスラリーとする。得られたスラリーに、焼成済み沈降炭酸カルシウム約13.8gと、アルギン酸アンモニウムで凝集させた炭酸カルシウムの粒子約13.8gの混合物を添加する。得られた混合物を攪拌して滑らかなスラリーとし、そのスラリーを高密度ポリエチレンシートの上に約0.835mmの厚さのシートとして流延させ、空気乾燥させる。

例 3

A. 凝集マトリックス補充料（炭酸カルシウムの多数の粒子を凝集させたマトリックスから成る補充料）の調製

ブレンダー内に高剪断状態に維持された周囲温

が水不溶性にされているからである。この材料は、巨量付きシリンドラで測定して約0.26g/cm³のタップ密度を有する。元の炭酸カルシウムのタップ密度は、結核時方法で測定して約0.48g/cm³である。

B. 可喫煙補充料材の調製

ブレンダー内に高剪断状態に維持された約20部の周囲温度の水道水の中に、マーク・エンド・カンパニー・インコーポレイテッドのケルコ・ディビジョンからアモロイドHVという商品名で販売されている約53.33部のアルギンアンモニウムと、約4.5部のグリセリンを投入する。得られた混合物を約15分間攪拌して真正水に完全に水和させる。次いで、その混合物を卵撹混ぜ型ミキサーへ移して攪拌する。一方、約80部の上述した凝集炭酸カルシウムを約400部の水道水と混合して得られたスラリーを上記混合物に添加する。この混合物を円滑な稠度を得られるまで緩や

度の約500部の水道水中へ、マーク・エンド・カンパニー・インコーポレイテッドのケルコ・ディビジョンからアモロイドHVという商品名で販売されている約5部のアルギンアンモニウムを投入し、得られた混合物を攪拌し、アルギン酸塩を完全に水和させる。次いで、この混合物を卵撹混ぜ型ミキサーへ移し、その混合物に約94.5部の例1で述べた沈降炭酸カルシウムを投入する。この混合物をなめらかな稠度となるまで攪拌し続ける。次いで、この混合物にアルドリッチ・ケミカル・カンパニーから販売されている約0.5部のデシル炭酸ナトリウムを投入し、これを引続き攪拌して、その間に混合物を発泡させる。

このスラリーを高密度ポリエチレンシートの上に約1.27mmの厚さのシートとして流延させ、空気乾燥させる。得られたシートは、白色で、脆い性質のものである。このシートを粉碎して、篩にかけ、米国基準で-30/+100メッシュの程度の粒子を得る。この材料は、水に浸漬しても、その構造を失わない。なぜなら、その結合剤

かに攪拌する。次いで、その混合物を高密度ポリエチレンシートの上に約1.27mmの厚さのシートとして流延させる。得られたシートは、白色で、可撓性である。このシートの密度は、約0.39g/cm³である。（元の不凝集沈降炭酸カルシウムで同様のシートを製造した場合、そのシートの密度は、約0.96g/cm³である。）このシートを0.79mm幅のストリップに切断し、可燃タバコ材料補充料を得る。

例 4

凝集マトリックス補充料を下記のようにして調製する。

ブレンダー内に高剪断状態に維持された周囲温度の約20部の水道水中へ、ハーケルズ・ケミカル社から販売されている約5部のシュガーレスペクチン LM-20 A-S-Zを投入し、得られた混合物を攪拌し、ペクチンを完全に水和させる。次いで、この混合物を卵撹混ぜ型ミキサーへ

移す。一方、約80部の例1で述べた沈降炭酸カルシウムを約200部の水道水に投入し、それに、シグマ・ケミカル・カンパニーからツイン80という商品名で販売されている約0.3部のモノオレイン酸ポリオキシエチレンソルビタンを添加する。次いで、このスラリーに上記ペクチン混合物を投入し、約15分間攪拌し、その間にスラリーを発泡させる。

この発泡したスラリーを高密度ポリエチレンシートの上に約1.27mmの厚さのシートとして流延させ、空気乾燥させる。乾燥した、そのシートに塩化カルシウムの5%水溶液をスプレーし、得られたシートが約1部の塩化カルシウムを含有するようにする。得られたシートは、白色で、脆い性質のものである。このシートを粉砕して、篩にかけ、米国基準で-30/+100メッシュの粒度の粒子を得る。この材料は、目盛付きシリンジで測定して約0.28g/cm³のタップ密度を有する。元の炭酸カルシウムのタップ密度は、緒のする方法で測定して約0.46g/cm³である。

このようにして入られた炭素マトリックス補充料を用いて、例1で説明したのとほぼ同じ態様で可喫煙補充料材を製造する。

4. 図面の簡単な説明

第1図は、本発明の一実施例のシガレットの縦断面図である。

第2図は、本発明の別の実施例のシガレットの縦断面図である。

第3図は、本発明の更に別の実施例のシガレットの縦断面図である。

第4図は、本発明の更に別の実施例のシガレットの縦断面図である。

10：シガレット

15：可喫煙ロッド

20：可喫煙材（可喫煙補充料）

25：可喫煙ロッドのためのラッパー

30：フィルタ素子

35：第13フィルタセグメントの炭素質フィルタ材

37：ラップ材

40：第2フィルタセグメントのフィルタ材

45：ラップ材

50：プラグラップ

55：チャッピング材

65：パーフォレーション

70：可喫煙材の第1セグメント

75：可喫煙材の第2セグメント

80：加工タバコ材シート

85：第3フィルタセグメントのフィルタ材

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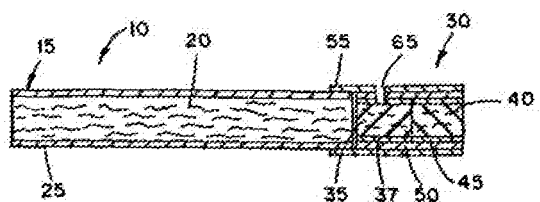


FIG. 1

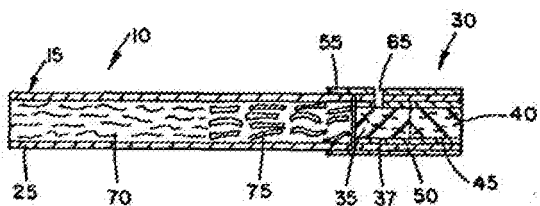


FIG. 2

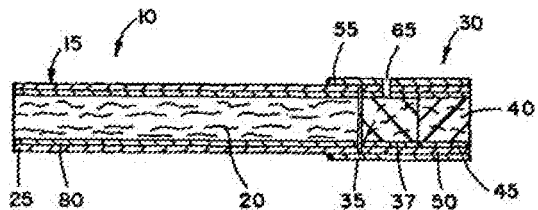


FIG. 3

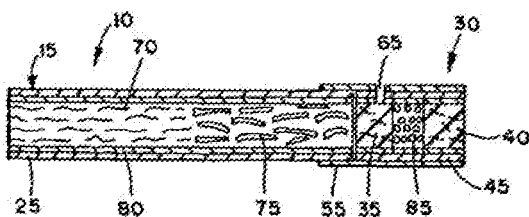


FIG. 4

第1頁の続き

Int. Cl.⁶

D 21 H 27/00

識別記号

庁内整理番号

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US005105836A

United States Patent [19]

Gentry et al.

[11] **Patent Number:** 5,105,836[45] **Date of Patent:** Apr. 21, 1992[54] **CIGARETTE AND SMOKABLE FILLER MATERIAL THEREFOR**

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[73] Assignee: **R. J. Reynolds Tobacco Company**, Winston-Salem, N.C.

[21] Appl. No.: **567,520**

[22] Filed: **Aug. 15, 1990**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 414,833, Sep. 29, 1989.

[51] Int. Cl.⁵ **A24B 15/14; A24D 1/18**

[52] U.S. Cl. **131/359; 131/355; 131/369**

[58] Field of Search **131/359, 369, 355**

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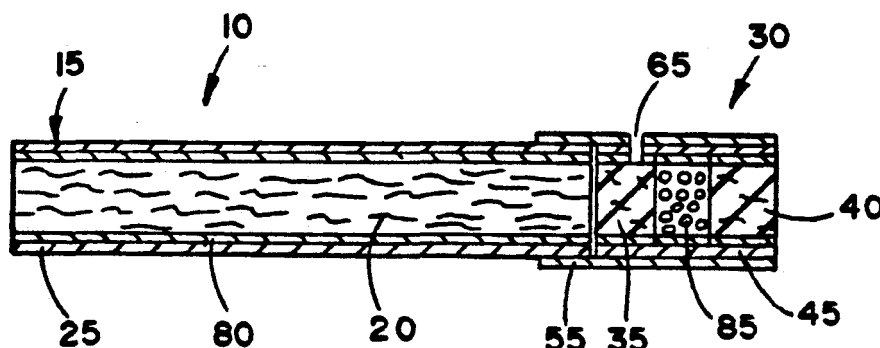
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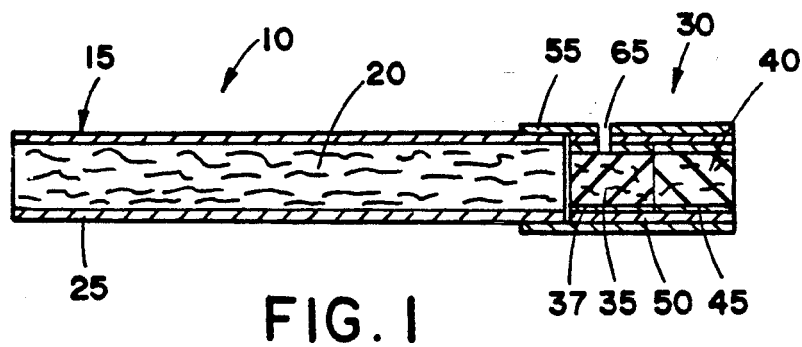
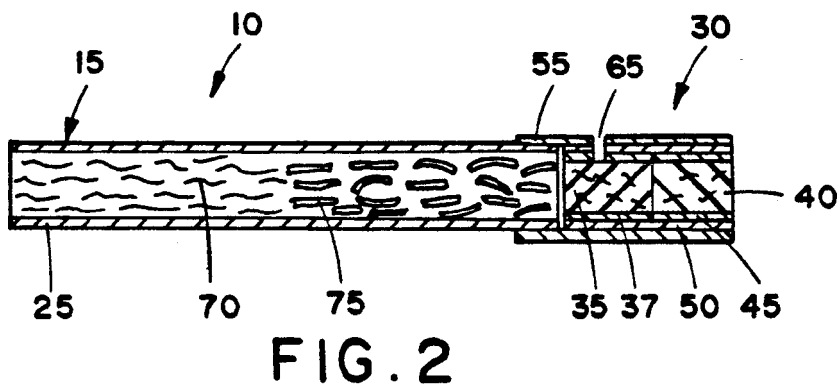
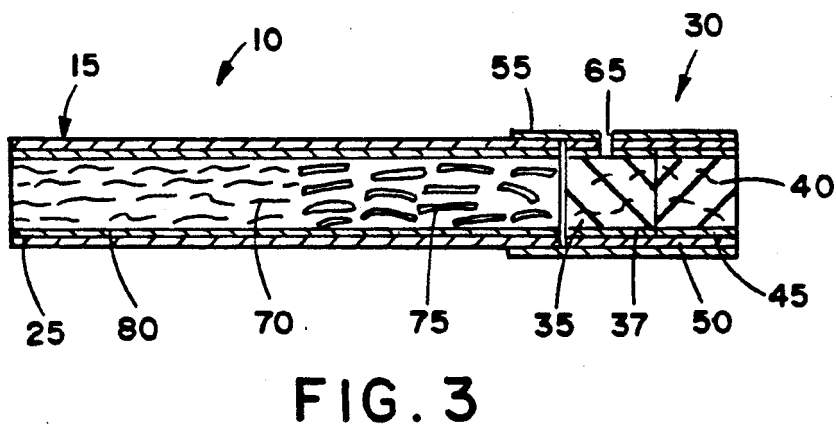
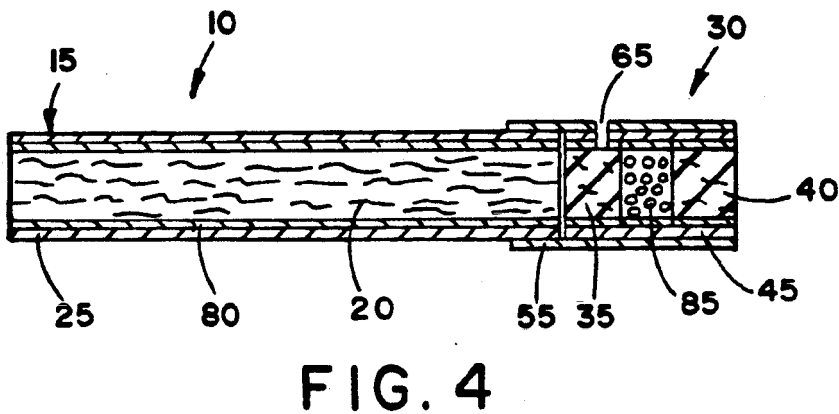
[57] **ABSTRACT**

A combustible smokable filler material includes an agglomerated matrix filler having an inorganic component (e.g., particles of calcium carbonate) and a carbonaceous component (e.g., calcined molasses). The smokable filler material includes a binding agent and an aerosol forming material. Tobacco extracts and/or pieces of tobacco laminae can be incorporated into the smokable filler material, and/or the smokable filler material can be blended with tobacco cut filler. Cigarettes are provided by wrapping the smokable filler material in a paper wrapping material. A typical paper wrapping material has a porosity of less than about 5 CORESTA units.

42 Claims, 1 Drawing Sheet

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CIGARETTE AND SMOKABLE FILLER MATERIAL THEREFOR

CROSS-REFERENCE TO RELATED APPLICATION

This is a continuation-in-part of U.S. Patent application Ser. No. 414,833, filed Sep. 29, 1989, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates to cigarettes and other smoking articles, and in particular to cigarettes, which when smoked, yield relatively low levels of incomplete combustion products, generate low amounts of sidestream "tar" and odor, and sustain smolder during FTC smoking conditions.

Popular smoking articles, such as cigarettes, have a substantially cylindrical rod shaped structure and include a roll or charge of smokable material, such as shredded tobacco material (e.g., in cut filler form), wrapped in a paper wrapper, thereby forming a so-called "smokable rod". Normally, a cigarette has a cylindrical filter element aligned in an end-to-end relationship with the smokable rod. Typically, a filter element includes cellulose acetate tow circumscribed by plug wrap, and is attached to the smokable rod using a circumscribing tipping material.

Typically, cigarettes are employed by the smoker by lighting one end thereof and burning the smokable rod. As such, smoke normally is provided by burning smokable material, which typically is tobacco cut filler. The smoker then receives mainstream smoke (e.g., mainstream tobacco smoke) into his/her mouth by drawing on the opposite end (e.g., the filter end) of the cigarette. As such, the smoker is provided with the pleasures of smoking (e.g., smoking taste, feel, satisfaction, and the like).

During the time that the cigarette is burning, sidestream smoke is generated. Sidestream smoke is smoke which directly enters the atmosphere from the lit end of the cigarette. Sidestream smoke diffuses into the atmosphere, and the characteristic visible nature and odor thereof may be perceived negatively by some individuals. The relative amount of visible sidestream smoke generated by a burning cigarette is related to the amount of sidestream "tar" generated by that burning cigarette. Typical commercially available cigarettes which burn tobacco cut filler, and have lengths of about 84 mm (e.g., having a smokable rod length of about 57 mm and a filter element length of about 27 mm), often yield about 25 to about 35 mg of sidestream "tar" per cigarette. See, Proctor et al, Analyst, Vol. 113, p. 1509 (1988), for an apparatus and technique for determining the sidestream "tar" of a cigarette.

Numerous cigarettes which reportedly yield relatively low levels of visible sidestream smoke have been proposed. See, for example, U.S. Pat. Nos. 4,637,410 to Luke; 4,624,268 to Baker et al; 4,407,308 to Baker; 4,231,377 to Cline et al; 4,420,002 to Cline; 4,450,847 to Owens; 4,108,151 to Martin; 4,225,636 to Cline; 4,433,697 to Cline; 4,461,311 to Mathews et al; and 4,561,454 to Guess.

Through the years, there have been proposed various methods for altering the composition of mainstream tobacco smoke. For example, many tobacco substitute materials have been proposed, and a substantial listing of such materials can be found in U.S. Pat. No.

4,079,742 to Rainer et al. In addition, tobacco substitute smoking materials having the tradenames Cytrel and NSM were introduced in Europe during the 1970's.

Numerous references have proposed articles which generate flavored vapor and/or visible aerosol. Most of such articles have employed a combustible fuel source to provide an aerosol and/or to heat an aerosol forming material. See, for example, the background art cited in U.S. Pat. No. 4,714,082 to Banerjee et al.

Smoking articles which are capable of providing the pleasures associated with cigarette smoking, by heating but not necessarily burning tobacco, and without delivering considerable quantities of incomplete combustion products, are described in U.S. Pat. Nos. 4,714,082 to Banerjee et al; 4,756,318 to Clearman et al; and 4,793,365 to Sensabaugh, Jr. et al. Such smoking articles employ a combustible fuel element for heat generation; and aerosol forming substances positioned physically separate from, and in a heat exchange relationship with, the fuel element. During use, heat generated by the fuel element acts to volatilize the aerosol forming substances, thereby providing an aerosol which resembles tobacco smoke. Such smoking articles yield extremely low levels of visible sidestream smoke as well as low levels of FTC "tar".

It would be desirable to provide a good tasting cigarette which provides good smoking satisfaction, provides relatively low mainstream gas phase yields, provides relatively low levels of incomplete combustion products, sustains smolder during FTC smoking conditions, yields an ash having desirable physical characteristics, and generates low levels of sidestream "tar" and hence the low levels of visible sidestream smoke.

SUMMARY OF THE INVENTION

The present invention relates to smoking articles incorporating tobacco in cut filler form and/or in a processed form. Preferred smoking articles have the form of a cigarette having two essential components: (i) a roll or charge of smokable material, and (ii) an outer wrapping material (e.g., a paper wrapper) circumscribing the roll of smokable material. Cigarettes of the present invention incorporate a smokable filler material (described in greater detail hereinafter) as at least a portion of the smokable material thereof.

The preferred wrapping material, which surrounds the roll of smokable material to thereby form a "smokable rod", is a low air permeability cigarette paper wrapper. Highly preferred wrappers having a low air permeability or low porosity exhibit a porosity below about 5 CORESTA units. A CORESTA unit is a measure of the linear air velocity which passes through a 1 cm² area of wrapper at a constant pressure of 1 centibar. See CORESTA Publication ISO/TC 126/SC I N159E (1986).

One form of smokable material is a tobacco-containing smokable filler material. Such a smokable material of the present invention comprises an intimate mixture of (i) tobacco (e.g., shredded tobacco laminae milled tobacco laminae, pieces of tobacco stems, tobacco fines, tobacco dust, or a tobacco extract or other form of processed tobacco), and (ii) an agglomerated matrix filler. The agglomerated matrix filler has, in intimate contact, a carbonaceous component and an inorganic component. Preferably, the agglomerated matrix filler is provided in particulate form. The smokable filler material includes a binding agent in intimate contact

with the agglomerated matrix filler and tobacco. As such, the binding agent acts to maintain particles of the tobacco and agglomerated matrix filler together to form the smokable filler material. Such a tobacco-containing smokable filler material also can include certain flavoring agents (e.g., cocoa, licorice, organic acids, menthol, and the like) and/or aerosol forming material (e.g., glycerin, propylene glycol, and the like) in intimate contact therewith. The tobacco-containing smokable filler material can be cast as a sheet from an aqueous slurry, provided as a sheet using a paper-making process, or provided in extruded form. Such a tobacco-containing smokable filler material can be employed individually as the sole smokable material of the cigarette, or that tobacco-containing smokable filler material can be physically mixed with (i.e., blended) or otherwise employed with other smokable materials, such as tobacco cut filler.

Another form of smokable filler material of the present invention comprises an agglomerated matrix filler. The agglomerated matrix filler has, in intimate contact, a carbonaceous component and an inorganic component. Preferably, the agglomerated matrix filler is provided in particulate form. The smokable filler material includes a binding agent in intimate contact with the agglomerated matrix filler. As such, the binding agent acts to maintain particles of agglomerated matrix filler together to form the smokable filler material. Such a smokable filler material also can include certain flavoring agents and/or aerosol forming materials in intimate contact therewith. The smokable filler material can be cast as a sheet from an aqueous slurry, provided as a sheet using a paper-making process, or provided in extruded form. Such a smokable filler material can be physically mixed with or otherwise employed with tobacco-containing smokable materials and/or tobacco cut filler.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 through 4 are longitudinal sectional views of smoking articles of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A preferred embodiment of a cigarette and smokable filler material of the present invention is shown in FIG. 1. The cigarette 10 includes a generally cylindrical rod 15. The rod includes a roll of smokable material 20 wrapped in at least one layer of circumscribing outer wrapping material 25 (e.g., paper). The rod 15 is hereinafter referred to as a "smokable rod". The ends of the smokable rod 15 are open to expose the smokable material which is to be burned. The smokable rod is used by lighting one end thereof, and aerosol (e.g., smoke) is provided as a result of the combustion of the burning smokable material. As such, the smokable rod burns from the lit end thereof towards the opposite end thereof.

The cigarette 10 also includes a filter element 30 positioned adjacent one end of the smokable rod 15 such that the filter element and smokable rod are axially aligned in an end-to-end relationship, preferably abutting one another. Filter element 30 has a generally cylindrical shape, and the diameter thereof is essentially equal to the diameter of the smokable rod. The ends of the filter element are open to permit the passage of air and smoke therethrough. The preferred filter element has at least two filter segments. As shown in FIG. 1, a

first filter segment is positioned adjacent the smokable rod, and preferably includes a carbonaceous filter material 35 circumscribed by a wrapping material 37; while a second filter segment is positioned at the extreme mouthend of the cigarette, and preferably includes a filter material 40, such as a gathered non-woven polypropylene web or cellulose acetate tow, circumscribed by a wrapping material 45. The filter material 40 of the segment preferably is a material which provides an aesthetically pleasing, white appearance. Each of the filter segments is manufactured using known filter rod making machinery. The two segments are combined using known plug tube combining techniques, and are held together using circumscribing wrap 50 so as to form the filter element.

The filter element 30 normally is attached to the smokable rod 15 by tipping material 55, which circumscribes both the entire length of the filter element and an adjacent region of the smokable rod. The inner surface of the tipping material 55 is fixedly secured to the outer surface of the plug wrap 50 and the outer surface of the wrapping material 25 of the smokable rod, using a suitable adhesive. The cigarette 10 can be manufactured using known cigarette making techniques and equipment. Optionally, a ventilated or air diluted cigarette is provided with an air dilution means such as a series of perforations 65 which extend through the tipping material 55, plug wrap 50 and wrapping material 37. Such ventilation can be provided to the cigarette using known techniques, such as laser perforation techniques.

Another preferred embodiment of a cigarette and smokable filler material of the present invention is shown in FIG. 2. The cigarette 10 is generally similar to the cigarette described with reference to FIG. 1, except that the smokable material has the form of a blend which is provided in a segmented fashion. At one end of the smokable rod 15 (i.e., at the end of the cigarette to be lit) is located a first segment 70 of smokable material. At the other end of the smokable rod 15 (i.e., at the end of the smokable rod adjacent the filter element) is located a second segment 75 of smokable material. Each segment is defined or identified in terms of its composition (i.e., the composition of each segment is different). The segments are aligned in an abutting end-to-end relationship; however, there can be a certain amount of intermixing of smokable materials in the region where the two segments meet. The length which each segment of smokable material extends along the smokable rod can vary. However, the relative longitudinal length of the first segment relative to the second segment normally ranges from about 1:2 to about 2:1, with about 1:1 being preferred. Such smokable rods can be manufactured using apparatus described in U.S. Pat. Nos. 4,009,722 to Wahle et al and 4,516,585 to Pinkham.

For preferred cigarettes of the type shown in FIG. 2, the first segment 70 normally includes tobacco in some type of smokable form. Such a form of tobacco includes tobacco cut filler (e.g., tobacco laminae, processed tobacco materials, volume expanded tobacco filler, reconstituted tobacco filler materials, and the like, and blends thereof), and blends thereof with other smokable materials. Examples of processed tobacco materials are deproteinated reconstituted tobacco materials described in U.S. Pat. Nos. 4,887,618 to Bernasek et al and 4,941,484 to Clapp et al, which are incorporated herein by reference. Another example of a processed tobacco material is a tobacco material processed according to the methods set forth in U.S. Patent application Ser. No. 484,587,

now U.S. Pat. No. 5,065,775 to Fagg filed Feb. 23, 1990, which is incorporated herein by reference. Preferred cigarettes also have a second segment 75 which includes a smokable material or blend of smokable materials different in overall composition from the overall composition of the smokable material(s) of the first segment 70. The first segment 70 and/or the second segment 75 include at least one smokable filler material of the present invention.

Another preferred embodiment of a cigarette of the present invention is shown in FIG. 3. The cigarette 10 is generally similar to the cigarette described with reference to FIGS. 1 and 2, except that the smokable material 20, which incorporates smokable filler material of the present invention, is wrapped or contained in a processed tobacco sheet 80, or other inner wrapper material. The processed tobacco sheet 80 normally is a reconstituted tobacco sheet which is manufactured using a paper-making process, and a single layer of the sheet circumscribes the smokable material. The smokable material wrapped in the processed tobacco sheet 80 is in turn wrapped in a single layer of circumscribing outer wrapping material 25 (e.g., cigarette paper).

Another preferred embodiment of a cigarette of the present invention is shown in FIG. 4. The cigarette 10 is generally similar to the cigarette described with reference to FIGS. 1, 2 and 3, except that the filter element includes three segments. Segment 85, positioned between first filter material 35 and filter material 40, preferably is composed of a particulate matter such as activated carbon granules, magnesium silicate granules, silica gel particles, or the like.

The smokable material employed in the manufacture of the smokable rod can vary, and most preferably has the form of cut filler. As used herein, the term "cut filler" in referring to smokable materials is meant to include smokable materials which have a form suitable for use in the manufacture of smokable rods for cigarettes. As such, cut filler can include smokable materials which are blended and are in a form ready for cigarette manufacture. Smokable materials normally are employed in the form of strands or shreds as is common in cigarette manufacture. For example, cut filler can be employed in the form of strands or shreds cut from sheet-like or "strip" materials. Such strip materials are cut into widths ranging from about 1/5 inch to about 1/60 inch, preferably from about 1/25 inch to about 1/35 inch. Generally, the resulting strands or shreds have lengths which range from about 0.25 inch to about 3 inches. Cut filler also can have an extruded form (e.g., extruded strands), or other physically processed form.

The smokable rods of cigarettes of the present invention include smokable filler material of the present invention. The smokable filler material can be employed in a cut filler form.

One preferred type of smokable filler material of the present invention comprises an agglomerated matrix filler including an agglomerated matrix of a carbonaceous component and an inorganic component in intimate contact. The agglomerated matrix filler is in turn intimately mixed with a binding agent to provide the smokable filler material. Such a smokable filler material most preferably includes as part of the ultimate mixture, at least one aerosol forming material and/or at least one flavoring agent. If desired, other agents, which have the ability to alter the composition of the aerosol generated by the smokable filler material, can be incorporated into that smokable filler material. The agglomerated matrix

filler normally includes about 80 to about 97, preferably about 90 to about 97 weight percent inorganic component, and about 3 to about 20, preferably about 3 to about 10 weight percent carbon provided by the carbonaceous component. Such a smokable filler material normally includes about 60 to about 95, preferably about 65 to about 90 weight percent agglomerated matrix filler; up to about 20, preferably about 2 to about 10 weight percent binding agent; up to about 20, preferably about 3 to about 10 weight percent aerosol forming material; and sufficient amounts of flavoring agent to provide the desired flavor characteristics. If desired, a further carbonaceous material (e.g., pyrolyzed alpha cellulose) can be incorporated into the smokable filler material, usually in amounts of up to about 10, and sometimes up to about 30 weight percent, based on the total dry weight of the smokable filler material. However, such further carbonaceous material is not a necessary component of the smokable filler material, and the smokable filler material can be absent of such carbonaceous material. The smokable filler material is combustible, and is normally employed with (e.g., blended with) another smokable material (e.g., tobacco cut filler) in order to provide a cigarette of the present invention.

One preferred type of tobacco-containing smokable filler material of the present invention comprises an agglomerated matrix filler including an agglomerated matrix of a carbonaceous component and an inorganic component in intimate contact. The agglomerated matrix filler is in turn intimately mixed with some form of tobacco and binding agent to provide the smokable filler material. Such a tobacco-containing smokable filler material preferably includes as part of the ultimate mixture, at least one aerosol forming material and/or at least one flavoring agent. If desired, other agents, which have the ability to alter the composition of the aerosol generated by the smokable filler material, can be incorporated into that smokable filler material. The agglomerated matrix filler normally includes about 80 to about 97, preferably about 90 to about 97 weight percent inorganic component, and about 3 to about 20, preferably about 3 to about 10 weight percent carbon provided by the carbonaceous component. Such a tobacco-containing smokable filler material normally includes up to about 50, typically up to about 20 weight percent of some form of tobacco; about 45 to about 90, preferably about 50 to about 85 weight percent agglomerated matrix filler; up to about 20, preferably about 2 to about 10 weight percent binding agent; up to about 20, preferably about 3 to about 15 weight percent aerosol forming material; and sufficient amounts of flavoring agent to provide desired flavor characteristics. If desired, a further carbonaceous material (e.g., pyrolyzed alpha cellulose) can be incorporated into the smokable filler material, usually in amounts of up to about 10, and sometimes up to about 30 weight percent, based on the total dry weight of the smokable filler material. However, such further carbonaceous material is not a necessary component of the smokable filler material, and the smokable filler material can be absent of such carbonaceous material. The smokable filler material is combustible and can be employed individually as the sole smokable material of a cigarette of the present invention.

Another preferred type of smokable filler material of the present invention comprises agglomerated matrix filler including an agglomerated matrix of a carbonaceous component and an inorganic component. The

agglomerate matrix filler is intimately mixed with a binding agent and at least one aerosol forming material to provide a smokable filler material. Such a smokable filler material most preferably includes as part of the ultimate mixture, at least one flavoring agent and some form of tobacco. The agglomerated matrix filler normally includes about 80 to about 97, preferably about 90 to about 97 weight percent inorganic component and about 3 to about 20, preferably about 3 to about 10 weight percent carbon provided by the carbonaceous component. Such a smokable filler material normally includes up to about 20, preferably about 3 to about 15 weight percent binding agent; greater than about 20, preferably about 25 to about 80, more preferably about 30 to about 50 weight percent aerosol forming material; and less than about 80, preferably about 30 to about 70 weight percent filler component including the previously described agglomerated matrix filler. In particular, the filler component can include (i) all of the previously described agglomerated matrix filler, or (ii) a blend of the previously described agglomerated matrix filler with an inorganic filler material (e.g., precipitated calcium carbonate) and/or an organic filler material (e.g., tobacco). Amounts of flavoring agent sufficient to provide the desired flavor characteristics to the smokable filler material can be incorporated into that material. If desired, a further carbonaceous material (e.g., pyrolyzed alpha cellulose) can be incorporated into the smokable filler material, usually in amounts of up to about 10, and sometimes up to about 30 weight percent, based on the total dry weight of the smokable filler material. However, such further carbonaceous material is not a necessary component of the smokable filler material, and the filler smokable material can be absent of such carbonaceous material. The smokable filler material is combustible and can be blended with other smokable materials.

The tobacco-containing smokable filler materials of the present invention have some form of tobacco incorporated therein during manufacture. The tobacco which is employed to provide such a tobacco-containing smokable filler material can have a variety of forms, including tobacco extracts, milled tobacco laminae, tobacco fines or dust, shredded or comminuted tobacco laminae, tobacco stems, volume expanded tobacco filler and other forms of processed tobacco, and the like, and combinations thereof. Tobacco extracts are processed forms of tobacco and are provided by extracting a tobacco material using a solvent such as water, carbon dioxide, a hydrocarbon, or a halocarbon, as well as various other organic and inorganic solvents. Tobacco extracts can include spray dried extracts; freeze dried extracts; heat treated extracts, such as those extracts described in U.S. Patent application Ser. Nos. 511,158, filed Apr. 19, 1990 and 452,175, now U.S. Pat. No. 5,060,699 to White, et al., filed Dec. 18, 1989; tobacco essences, such as those essences described in European Patent Application No. 326,370; and aroma oils and extracts described in U.S. Pat. No. 4,506,682 to Mueller and U.S. Patent application Ser. No. 310,413, filed Feb. 13, 1989.

The smokable filler materials of the present invention incorporate a binding agent. Examples of suitable binding agents include hydroxypropylcellulose such as Klucel H from Aqualon Co.; hydroxypropylmethylcellulose such as Methocel K4MS from The Dow Chemical Co.; hydroxyethylcellulose such as Natrosol 250 MRCS from Aqualon Co.; microcrystalline cellulose

such as Avicel from FMC; methylcellulose such as Methocel A4M from The Dow Chemical Co.; and sodium carboxymethylcellulose such as CMC 7HF and CMC 7H4F from Hercules Inc. Especially preferred binding agents include the alginates, such as ammonium alginate, sodium alginate, propylene glycol alginate and potassium alginate. The alginates, and particularly the high viscosity alginates, can be employed in conjunction with controlled levels of free calcium ions. Other binding agents include starches (e.g., corn starch), guar gum, locust bean gum, pectins and xanthan gum. Combinations or blends of binding agents (e.g., a mixture of guar gum and locust bean gum) can be employed.

The smokable filler materials of the present invention can have at least one aerosol forming material and/or at least one flavoring agent incorporated therein. The preferred aerosol forming materials include polyhydric alcohols (e.g., glycerin, propylene glycol or triethylene glycol), any other materials which yield a visible aerosol, or mixtures thereof. The aerosol forming material can be provided as a portion of the binding agent (e.g., when the binding agent is propylene glycol alginate). Combinations of aerosol forming materials can be employed. The flavoring agents can vary, and include menthol, vanillin, citric acid, malic acid, cocoa, licorice, and the like, as well as combinations thereof. See, Lefingwell et al, *Tobacco Flavoring for Smoking Products* (1972).

It is sometimes desirable to incorporate a caramelizing material into the smokable filler materials of the present invention. Caramelizing materials can act to improve (i) the integrity of the ash and fire cone of the cigarette, (ii) the appearance of the smokable filler material, and (iii) the flavor characteristics of the mainstream smoke of the cigarette. The caramelizing material can be incorporated into the smokable filler material during the preparation of that material and/or applied to the surface of that material (e.g., as a powder) after the manufacture thereof. Normally, the amount of caramelizing material which is employed to treat a particular smokable filler material is such that the resulting material which incorporates the caramelizing material includes up to about 20 weight parts, typically up to about 5 weight parts, of caramelizing material and greater than about 80 weight parts of the smokable material which is treated. Examples of suitable caramelizing materials include sugars, such as glucose, fructose and sucrose; and compositions such as Carob Powder Code 1739 from M. F. Neal, Inc.

The smokable filler materials of the present invention can be surface treated with certain substances. For example, the smokable filler materials can have powdered substances applied to the surface thereof. Exemplary substances include cocoa powder, licorice powder, powdered inorganic materials (e.g., potassium carbonate or iron oxide), tobacco dust, finely divided tobacco laminae, or the like, or blends thereof. The surface treatment of the smokable filler materials can provide to those materials improved color and appearance, improved ash characteristics, and improved flavor characteristics.

The previously described agglomerated matrix filler has the form of an agglomerated matrix of an inorganic component and a carbonaceous component. The inorganic component can include particles of calcium carbonate, calcium sulfate, magnesium oxide, and the like. A particularly preferred agglomerated matrix filler is agglomerated calcium carbonate, and most preferably,

agglomerated precipitated calcium carbonate. Such an agglomerated matrix filler can be prepared by providing an aqueous slurry of calcium carbonate particles and a binding material, and drying the slurry to form an agglomerated matrix of calcium carbonate (i.e., a matrix of a plurality of calcium carbonate particles spaced within a continuous or semi-continuous phase of binding material). If desired, the slurry can be volume expanded by incorporating a foaming agent therein. Examples of suitable foaming agents include linear sodium benzene sulfonates, linear alkyl sulfonates and linear alkyl ethoxy sulfates. Calcium carbonate particles which are employed to provide the agglomerated matrix typically exhibit a surface area of less than about 20 m²/g, frequently less than about 10 m²/g, and sometimes less than about 1 m²/g, as determined using the Brunauer, Emmett and Teller (BET) method described in *J. Am. Chem. Soc.*, Vol. 60, p. 309 (1938). Typical binding materials are organic materials, such as cellulosic derivatives (e.g., sodium carboxymethylcellulose), and preferably are sugar containing materials, such as molasses, high fructose corn syrup, or Carob Powder Code 1739 from M. F. Neal, Inc. Other organic materials, such as pectins and alginates, also can be employed.

Preferably, a high solids content aqueous slurry (e.g., about 40 to about 55 weight percent solids content slurry) of calcium carbonate and binding material is spray dried to provide agglomerated particles (e.g., normally spherical particles) of calcium carbonate particles and binding material. Alternatively, the slurry can be dried by the application of heat to provide a solid mass of agglomerated calcium carbonate and binding material, and the solid mass can be ground to yield particles of the desired size. Preferably, the amount of calcium carbonate relative to binding material ranges from about 20:1 to about 2:1, more preferably about 15:1 to about 4:1, on a dry weight basis. Normally, the inorganic particles agglomerated using saccharide and polysaccharide materials tend to lose their agglomerated character when contacted with water under ambient conditions, as a result of the propensity of the saccharide and polysaccharide materials to be soluble in water.

The agglomerated matrix of inorganic component and organic binding material is subjected to heat treatment. As such, volatile components from the organic binding material are expelled, and the organic binding material is calcined to form an essentially water insoluble, clean burning carbonaceous component. Normally, the heat treatment of the agglomerated matrix filler is provided under controlled atmosphere, in order to minimize or prevent oxidation of the binding material. Preferably, the heat treatment provides a binding material which is in the form of a carbonaceous material, and in turn, provides a means for agglomerating the particles of inorganic component into a matrix form. In particular, the particles of agglomerated calcium carbonate and binding material can be heat-treated (e.g., to a temperature of up to about 625° C., and usually up to about 600° C.) using an oven, batch furnace, a fluidized bed, rotary calciner, belt calciner, or the like. For example, particles of spray dried calcium carbonate particles agglomerated using molasses can be heated in a fluidized bed having gaseous nitrogen flowing therethrough, heated at temperatures sufficient to heat the particles from about 300° C. to about 625° C., and collected. The agglomerated matrix of inorganic component and organic binding material can be subjected to heat treatment sufficient to calcine the organic binding material

by subjecting the agglomerated matrix to very high temperatures (e.g., up to about 900° C.) for a short time period and under conditions sufficient to avoid decomposition of the inorganic component (e.g., when the inorganic component is calcium carbonate). However, if the inorganic component is calcium carbonate, and the calcium carbonate undergoes some decomposition during the calcining step, the agglomerated material can be re-carbonated by (i) exposing that material to carbon dioxide atmosphere, or (ii) dispersing that material in water and bubbling carbon dioxide into the dispersion.

After the calcining process, the agglomerated calcium carbonate particles normally have a calcium carbonate content of greater than about 80, frequently greater than about 90 weight percent and a carbon content provided by the carbonaceous component of greater than about 3 weight percent. Normally, the resulting agglomerated particles are screened to sizes of about -50/+325 US Mesh, and often about -80/+200 US Mesh. Preferred agglomerated calcium carbonate particles which have been calcined are essentially insoluble in water, are spherical in shape, are free flowing, and exhibit a bulk density of about 0.1 g/cm³ to about 1.1 g/cm³, frequently about 0.3 g/cm³ to about 1 g/cm³, using mercury intrusion techniques. As such, calcined agglomerated calcium carbonate particles provide an inorganic material having a bulk density less than about 2 g/cm³, and preferably less than about 1 g/cm³, which includes an inorganic component having a bulk density greater than about 2.5 g/cm³. Normally, such calcined agglomerated calcium carbonate particles exhibit a surface area of less than about 30 m²/g, and often about 10 m²/g to about 25 m²/g, as determined using the BET method.

If desired, the bulk density of the calcined agglomerated inorganic filler can be lowered by digesting away part of the inorganic component with an acidulant. For example, calcined agglomerated can be dispersed in water, and an aqueous hydrochloric acid solution can be added to the resulting slurry which is agitated. The acid reacts with the calcium carbonate, and essentially does not react with the carbonaceous component. Thus, the carbonaceous component acts to hold together the remaining calcium carbonate, while a portion of the calcium carbonate reacts to produce carbon dioxide gas and water soluble calcium chloride.

Other inorganic materials can be incorporated as fillers in the smokable filler materials of the present invention. Such inorganic materials often have a fibrous, flake, crystalline, hollow, amorphous or particulate form. Examples of inorganic materials include calcium carbonate, calcium sulfate particles, magnesium oxide, magnesium hydroxide, perlite, synthetic mica, vermiculite, clays, thermally stable carbon fibers, zinc oxide, dawsonite, low density hollow spheres of calcium carbonate, glass spheres, glass bubbles, sodium silicate, thermally stable carbon microspheres, calcium sulfate fibers, hollow ceramic microspheres, alumina, calcium carbonate agglomerated using an organic material, low density processed calcium carbonate, and the like. If desired, organic materials (e.g., grains) can be incorporated as fillers into smokable filler materials of the present invention. Such inorganic and organic fillers are employed to occupy space in the smokable filler materials of the present invention.

Calcium carbonate agglomerated using ammonium alginate is an example of an agglomerated matrix filler having an inorganic component in an organic compo-

nent. Other inorganic components include calcium sulfate, magnesium oxide and magnesium carbonate. Such an agglomerated matrix filler is provided by preparing an aqueous slurry of calcium carbonate particles and hydrated alginate, and drying the slurry to form an agglomerated matrix of calcium carbonate (i.e., a matrix of a plurality of calcium carbonate particles spaced within a continuous or semi-continuous phase of alginate). If desired, the slurry can be volume expanded by incorporating a foaming agent therein. Examples of suitable foaming agents include linear sodium benzene sulfonates, linear alkyl sulfonates and linear alkyl ethoxy sulfates. Preferably, a high solids content aqueous slurry of calcium carbonate and alginate is spray dried to provide agglomerated particles (e.g., normally spherical particles) of calcium carbonate particles and alginate. Alternatively, the slurry can be dried by the application of heat to provide a solid mass of agglomerated calcium carbonate and alginate, and the solid mass can be ground to yield particles of the desired size. Preferably, the amount of calcium carbonate relative to alginate ranges from about 99:1 to about 10:1, on a dry weight basis. Typically, the particles of calcium carbonate agglomerated using alginate are essentially insoluble in water under ambient conditions. In particular, the essentially water insoluble character of the alginate in the agglomerated matrix filler tends to limit to a great degree any propensity of the agglomerated matrix filler to lose its agglomerated character when contacted with water under ambient conditions. The agglomerated matrix filler is rendered insoluble due to the interaction of the alginate with calcium ions of the calcium carbonate. If desired, the agglomerated matrix filler can be treated with a dilute solution of acid to decompose a portion of the calcium carbonate and liberate calcium ions and the resulting calcium ions can act to render insoluble the alginate component of the agglomerated matrix filler.

The agglomerated matrix filler having an inorganic component and an organic component can incorporate a variety of other organic components. For example, the organic component can be pectin, which has a tendency to become essentially water insoluble upon interaction with calcium. Alternatively, agglomerated matrix filler having a polysaccharide organic component can be treated with divalent ions (e.g., calcium, barium, cobalt, iron or manganese ions) or trivalent ions (e.g., iron or aluminum ions) to render the polysaccharide essentially water insoluble. As yet another example, a slurry of polysaccharide material (e.g., ethylcellulose) and inorganic component particles can be provided in a non-aqueous solvent (e.g., alcohol) and dried, resulting in the formation of an agglomerated matrix filler which is essentially water insoluble.

Another type of inorganic material which can be incorporated into smokable filler materials of the present invention is a low density inorganic filler. Such a filler is provided by providing particles of a calcium salt, decomposing the anion of the salt and contacting the particles with carbon dioxide. Examples of suitable salts include calcium propionate, succinate, tartrate, stearate, salicylate, palmitate, oleate, lactate, gluconate, citrate, ascorbate, acetylsalicylate and benzoate. Other suitable salts include calcium salts of saccharides and polysaccharides. Such salts are subjected to conditions sufficient to decompose the anion thereof, which usually involves subjecting the salt to heat treatment under carbon dioxide atmosphere.

One method for providing a low density inorganic filler involves heating calcium lactate particles screened to $-80/+170$ US Mesh at about 600° C. for about 8 hours under a steady 228 ml/min. flow of carbon dioxide gas, so as to provide a material which has undergone about a 65 percent weight loss. About 20 weight parts of the material is charged into about 80 weight parts water, and the resulting slurry is contacted with sufficient hydrochloric acid solution to lower the pH thereof to about 6.8. The material then is removed from the water, washed with water, dried, and screened to a particle size of $-80/+170$ US Mesh. Such material is greater than about 95 weight percent calcium carbonate, and exhibits a bulk density of about 0.4 g/cm^3 , as determined using mercury intrusion techniques.

Typically, the smokable filler materials of the present invention are provided by forming an aqueous slurry of binding agent and the other components of that smokable filler material, casting the slurry as a sheet, and drying the cast material to form a relatively dry, workable sheet. Techniques and equipment for casting a slurry as a sheet will be apparent to the skilled artisan. Other materials, such as calcium acetate, potassium carbonate, pH control agents, urea, amino acids, potassium chloride and/or calcium hydroxide, can be incorporated into the slurry. Sequestering agents (e.g., diammonium hydrogen orthophosphate, potassium hexametaphosphate, sodium citrate or tetrasodium pyrophosphate) can be incorporated into the slurry in amounts sufficient to control the free calcium ion concentration in the slurry. The cast material can be dried at ambient temperatures or at elevated temperatures. Further, an aqueous solution of calcium salts can be applied to the cast slurry. The resulting dried sheet can be cut or broken into "strip" form, and later can be cut or shredded into cut filler form.

The smokable filler materials of the present invention can be provided using a paper-making process. In particular, an aqueous slurry of a cellulosic material (e.g., softwood pulp, hardwood pulp, flax fibers and/or shredded tobacco stems) and the previously described filler can be cast as a mat on a fibrous belt or wire screen, and dried to the desired moisture level. Normally, a slurry, dispersion or solution of flavoring agents, tobacco extracts, tobacco parts, aerosol forming materials, and the like, can be applied to the mat (e.g., as a spray), and the resulting mat can be dried further to form a sheet. The resulting dried sheet can be cut or broken in "strip" form, and later can be cut or shredded into cut filler form. Techniques and equipment for making a paper-type sheet will be apparent to the skilled artisan.

The smokable filler materials of the present invention can be extruded into the desired shape using suitable extrusion techniques. See, for example, the types of processes described in U.S. Pat. No. 4,880,018 to Graves, Jr. et al, which is incorporated herein by reference. Alternatively, an aqueous slurry of the components of the smokable material and an alginate binding agent can be extruded into an aqueous solution of calcium ions (e.g., an aqueous solution of calcium chloride), collected and dried. If desired, extruded smokable filler materials can be physically processed (e.g., subjected to treatment using rollers, etc.) and formed into the desired shape.

The smokable rods of cigarettes of the present invention often include a physical mixture or blend of smokable materials. The blend can include two or more

smokable filler materials of the present invention, or a physical mixture of at least one smokable filler material of the present invention with at least one other smokable material. Certain preferred cigarettes include within such a blend, a sufficient amount of at least one of the smokable filler materials of the present invention such that the smokable material within each cigarette comprises at least about 1 percent of the carbonaceous material, based on the total weight of the blend. In particular, cigarettes having such types of smokable filler materials and having low porosity paper outer wrappers (e.g., having outer wrappers having less than about 5 CORESTA units) have the propensity to sustain smolder (e.g., not self-extinguish), when smoked under FTC smoking conditions. FTC smoking conditions consist of 35 ml puffs of 2 second duration, taken every 60 seconds.

The smokable filler materials of the present invention can be blended with tobacco cut filler. The type of tobacco can vary, and can include flue-cured, Burley, Maryland and Oriental tobaccos, as well as the rare and specialty tobaccos, and blends thereof. Such tobacco cut filler can be provided in the form of tobacco laminae; volume expanded or puffed tobacco laminae; processed tobacco stems such as cut-rolled or cut-puffed stems; reconstituted tobacco materials, such as (i) deproteinized tobacco materials described in U.S. Pat. Nos. 4,887,618 to Bernasek et al and 4,941,484 to Clapp et al, (ii) a phosphate-containing reconstituted tobacco material described in U.S. Pat. Nos. 3,353,541 and 3,420,241 to Hind et al, and 3,386,449 to Hind, as well as U.S. Patent application Ser. Nos. 406,637, filed Sep. 13, 1989 now U.S. Pat. No. 4,987,906 to Young, et al., and 461,216, filed Jan. 5, 1990, (iii) a reconstituted tobacco material described in U.S. Patent application Ser. No. 272,156, now U.S. Pat. No. 4,962,774 to Thomasson, et al., filed Nov. 16, 1988 and *Tobacco Encyclopedia*, edit. by Voges, p. 389, TJI (1984), (iv) the reconstituted tobacco materials described in U.S. Patent application Ser. Nos. 416,332, filed Sep. 29, 1989 and 414,833, filed Sep. 29, 1989; or blends thereof.

Smokable materials can be cased and top dressed as is conventional during various stages of cigarette manufacture. For example, flavoring agents can be applied to the smokable material as is commonly performed when cigarette cut filler is processed. Suitable flavoring agents include vanillin, cocoa, licorice, menthol, and the like. Flavor modifying agents can be applied to the smokable material. A flavor modifying agent in the form of levulinic acid can be applied to the smokable material (e.g., in amounts ranging from about 0.01 to about 2 percent, normally from about 0.1 to about 1 percent, preferably about 0.2 to about 0.6 percent, based on the dry weight of the smokable material). Another flavor modifying agent in the form of potassium carbonate can be applied to the smokable material (e.g., in amounts of less than about 5 percent, normally about 1 to about 3 percent, based on the dry weight of the smokable material). Aerosol forming materials and humectants, such as glycerin and propylene glycol, can be applied to the smokable material. Such components conveniently are applied to the smokable material as casing and top dressing components.

The preferred wrapping material which provides the smokable rod is a cigarette wrapping material having a low air permeability value. Such a wrapping material normally has an air permeability of less than about 5 CORESTA units, often less than about 3 CORESTA

units, and frequently less than about 1 CORESTA unit. Typical wrapping materials are cigarette paper wrappers. Suitable wrapping materials are cigarette paper wrappers available as DD-71-1, DD-71-6, MTR-1021, P-2831-60-2, P-2831-60-3, P-2831-60-4, P-2831-60-5, P-2674-110, P-2831-60-1 and DD-100-2 from Kimberly-Clark Corp. Suitable low porosity cigarette paper wrappers are commercially available, and can have various levels of burn chemicals, fluxing agents, etc., incorporated therein. Particularly preferred are cigarette paper wrappers which include an amount of a polymeric film forming agent sufficient to provide a paper having the desirably low air permeability value. For example, a sufficient amount of a solution of a polymeric (e.g., carboxymethyl cellulose or ethylcellulose) film forming agent can be applied to a paper wrapper. The selection of the polymeric film forming agent will be apparent to the skilled artisan.

The optional polymeric film forming agent can be applied to the paper wrapper during the manufacture of the paper, or applied as a print or paint after manufacture of the paper is complete. Typically, the film forming agent is applied to the paper as a dilute solution (e.g., at a concentration of about 0.2 to about 5 weight percent relative to the solvent) for ease of processing. The amount of film forming agent applied to the paper wrapper depends upon factors such as the permeability of the paper and the film forming capabilities of the film forming agent. Typically, the amount of film forming agents employed ranges from about 1 to about 10 percent, based on the dry weight of the paper. For example, a 5 weight percent solution of ethylcellulose in ethanol or sodium carboxymethylcellulose in water can be applied to cigarette paper using a size press, and the paper can be dried to provide a non-wetting, moisture resistant paper wrapper having a porosity of less than about 1 CORESTA unit, preferably less than about 0.5 CORESTA unit.

The smokable rods and the resulting cigarettes can be manufactured in any known configuration using known cigarette making techniques and equipment. Smokable rods often include smokable material wrapped in a single layer of wrapping material, although a double layer of two types of wrapping materials can be employed. See, for example, U.S. Patent application Ser. No. 528,302, filed May 24, 1990, which is incorporated herein by reference.

Cigarettes having smokable rods which are double wrapped with two layers of wrapping material preferably include one of the previously described low porosity paper wrappers as the outer wrappers. The inner wrapper can vary, but typically is a tobacco-containing wrapping material. Exemplary inner wrappers are paper wrappers which include about 3 parts Java tobacco stem parts and about 1 part wood pulp, and are available from Kimberly-Clark Corp. as P-2249-115 and P-2831-23-3. Other suitable inner wrapping materials include tobacco parts and carbonaceous materials, and are available from Kimberly-Clark Corp. as P-2540-94-A, P-2540-94-C and P-2540-94-D. The inner wrapping materials (i) can include burn chemicals (e.g., potassium citrate, potassium acetate or potassium succinate), and/or (ii) act as a substrate for flavors (e.g., menthol or vanillin) or flavor precursors (e.g., vanillin glucoside or ethylvanillin glucoside).

Typically, the smokable rod has a length which ranges from about 30 mm to about 70 mm, preferably about 35 to about 60 mm; and a circumference of about

17 mm to about 27 mm, preferably about 22 mm to about 25 mm. Short smokable rods (i.e., having lengths from about 30 to about 50 mm) can be employed, particularly when smokable materials having a relatively high packing density are employed.

The packing density of the smokable material contained within the outer wrapping material can vary. Typical packing densities for smokable rods of cigarettes of the present invention range from about 150 to about 400 mg/cm³. Normally, packing densities of such smokable rods range from about 200 to about 380 mg/cm³, frequently about 250 to about 360 mg/cm³, particularly when relatively short (i.e., less than 50 mm long) smokable rods are employed.

The cigarettes of the present invention preferably include a filter element, and most preferably a filter element having more than one segment. For example, a preferred filter element has two or more filter segments. Typically the segments of the preferred filter elements each have lengths which ranges from about 10 mm to about 30 mm; and circumferences of about 17 mm to about 27 mm, preferably about 22 mm to about 25 mm. The plug wrap which circumscribes the filter material of each filter segment typically is a conventional paper plug wrap, and can be either air permeable or essentially air impermeable.

Preferred filter materials of one of the filter segments include carbonaceous materials (e.g., activated carbon particles, charcoal particles, or carbon paper). An example of a particularly preferred filter material is provided by gathering a tobacco/carbon paper available as P-144-BAC from Kimberly-Clark Corp. Such filter materials reduce the levels of certain gas phase components from the mainstream smoke which passes to the mouth of the smoker. As such, preferred filter materials of that segment act to reduce the levels of any smoke components which may provide an off-taste or other undesirable characteristics to the mainstream smoke.

Preferred filter materials of another of the filter segments normally include fibrous materials. An example of a suitable filter material is a gathered nonwoven polypropylene web. A particularly preferred nonwoven polypropylene sheet-like web is available as PP-100-F from Kimberly-Clark Corp. Another example of a suitable filter material is a cellulose acetate tow. Particularly preferred cellulose acetate tow items include (i) 8 denier per filament/40,000 total denier, and (ii) 8 denier per filament/15,000 total denier, (iii) 8 denier per filament/25,000 total denier, and (iv) 8 denier per filament/30,000 total denier. Plasticizers, such as triacetin, propylene glycol or triethyl citrate, can be combined with the filter materials.

Another filter segment can have a filter material in the form of a gathered web of nonwoven thermoplastic (i.e., hydrophobic) fibers in intimate contact with a water soluble tobacco extract so as to provide an extract-containing filter material. A highly preferred web is a nonwoven web of polypropylene fibers available as PP 200 SD from Kimberly-Clark Corp. Exemplary filter segments and filter elements are described in U.S. Patent application Ser. Nos. 414,835, filed Sep. 29, 1989 and 518,597, filed May 3, 1990. Such segments can provide enhanced flavor characteristics to the mainstream smoke which passes therethrough.

Yet another filter segment can include a tobacco paper material as the filter material. For example, a filter material can have the form of a gathered web of

tobacco paper available as P-144-B from Kimberly-Clark Corp.

The filter element segments suitable for use in this invention can be manufactured using known cigarette filter making techniques. Filter elements can be manufactured from cellulose acetate tow using known techniques. Filter elements can be manufactured from carbon paper, tobacco paper and a sheet-like nonwoven polypropylene web using filter making techniques described in U.S. Pat. No. 4,807,809 to Pryor et al, which is incorporated herein by reference. Alternatively, particles of charcoal or activated carbon can be incorporated into the filter element using a so-called "triple filter" configuration by positioning the particles between two segments of suitable filter materials.

The filter elements can have low, moderate or high filtration efficiencies. Preferred filter elements have minimal mainstream aerosol (i.e., smoke) removal efficiencies while maintaining the desirable draw characteristics of the cigarette. Such minimal smoke removal efficiencies are provided by "low efficiency" filter elements. Low efficiency filter elements have a minimal ability to remove mainstream smoke particulates. See, Keith in Schemeltz's *The Chemistry of Tobacco and Tobacco Smoke*, p. 157 (1972). Generally, low efficiency filter elements provide less than about 40 weight percent mainstream smoke particulate removal efficiency.

Tipping material circumscribes the filter element and an adjacent region of the smokable rod such that the tipping material extends about 3 mm to about 6 mm along the length of the smokable rod. Typically, the tipping material is a conventional paper tipping material. Tipping materials of varying porosities can be employed. For example, the tipping material can be essentially air impermeable, air permeable, or treated (e.g., by mechanical or laser perforation techniques) so as to have a region of perforations, openings or vents thereby providing a means for providing air dilution to the cigarette. The total surface area of the perforations and the positioning of the perforations along the periphery of the cigarette can be varied in order to control the performance characteristics of the cigarette.

For air diluted or ventilated cigarettes of the present invention, the amount of air dilution can vary. Typically, the amount of air dilution for an air-diluted cigarette is greater than about 25 percent, and frequently greater than about 40 percent. The upper limit for air dilution for a cigarette typically is less than about 75 percent, more frequently less than about 65 percent. As used herein, the term "air dilution" is the ratio (expressed as a percentage) of the volume of air drawn through the air dilution means to the total volume of air and aerosol (i.e., smoke) drawn through the cigarette and exiting the extreme mouthend portion of the cigarette. See, Selke et al, *Beitr. Zur Tabak. In.*, Vol. 4, p. 193 (1978).

Cigarettes of the present invention, when smoked, provide a flavorful mainstream aerosol. The mainstream aerosol of such cigarettes can yield low levels of incomplete combustion products as well as low levels of gas phase components. The cigarettes burn at an acceptable rate, and maintain static smolder, at least when smoked under FTC smoking conditions. The cigarettes, when smoked, have an ash and fire cone which is not overly cohesive, and hence, is not overly long. However, the cigarettes also provide an ash and fire cone which exhibit good integrity.

Cigarettes of the present invention, when smoked, generally yield less than about 20 mg, preferably less than about 10 mg of sidestream "tar" per cigarette, as determined using the apparatus and techniques described by Proctor et al, *Analyst*, Vol. 113, p. 1509 (1988). Such cigarettes normally provide more than about 5 puffs, preferably more than about 6 puffs per cigarette, when smoked under FTC conditions. Normally, cigarettes of the present invention provide less than about 20 puffs, and often less than about 15 puffs, when smoked under FTC conditions.

The following examples are provided in order to further illustrate the invention but should not be construed as limiting the scope thereof. Unless otherwise noted, all parts and percentages are by weight.

EXAMPLE 1

A. Preparation of a Tobacco-Containing Smokable Filler Material

An agglomerated matrix filler is provided as follows: Into a low shear mixer are charged about 832 parts tap water at ambient temperature, about 757 parts precipitated particulate calcium carbonate available as Albacar 5970 from Pfizer Inc., and about 267 parts molasses. The calcium carbonate has a rosettic structure and an average particle size (i.e., diameter) of about 2 microns. The molasses is available as Refiner's Syrup from Savannah Sugar Co., and has a solids/water content of about 3.7:1. The resulting mixture is agitated for about 5 to about 10 minutes to provide a slurry having a solids content of about 52 percent and a viscosity of about 1,200 cps as measured by a Brookfield LVT viscometer with cylindrical LV spindle No. 4.

The slurry is spray dried by continuously pumping the slurry at about 6 lbs./min. at a feed pressure of about 475 to about 500 psig to a spray dryer. The spray dryer is a Bowen Type commercial unit equipped with an SD-046 nozzle, and operated in a commercial mode. The inlet temperature is about 470° F., and the outlet temperature is about 260° F. The resulting spray dried particles have a generally spherical shape, and a moisture content of below about 2 percent. The particles are screened to a particle size of -70/+200 US Mesh.

The spray dried particles are placed on a 12 inch by 36 inch steel tray to a thickness of about 0.5 inch. The tray then is passed into a continuous belt furnace at a rate of about 8 to about 12 inches/min., and is subjected to heating under nitrogen atmosphere at above about 600° C. for about 10 minutes, and at above about 400° C. for about 20 minutes. The oven is set at about 720° C., and the tray is subjected to a maximum air temperature of about 670° C. during that time. The heated particles are removed from the furnace into a cooling zone for about 1 hour under nitrogen atmosphere, and cooled to ambient temperature.

The calcined particles so collected are black, are spherical in shape, are free flowing, and resist wetting. The particles are about 93 percent calcium carbonate, and exhibit a bulk density of about 0.5 g/cm³. The particles each are an agglomerated matrix of a plurality of precipitated calcium carbonate particles spaced within a carbonaceous material.

The tobacco-containing smokable filler material is provided as follows:

Into tap water at ambient temperature and maintained at high shear in a blender is charged about 2 parts sodium carboxymethylcellulose available as CMC 7HF from Hercules Inc. Then, about 4 parts glycerin is

charged into the water. After a consistent slurry is provided, about 6 parts spray dried tobacco extract is charged into the slurry. Then, about 18 parts of the previously described calcined agglomerated matrix filler particles are folded into the slurry. The resulting slurry, which is an intimate mixture of the aforementioned components, has a solids content of about 25 percent, and exhibits a pH of about 7.

The slurry is cast to about a 0.02 inch thickness onto a high density polyethylene sheet and air dried. The resulting tobacco-containing smokable filler material is a very dark brown sheet having (i) a thickness of about 0.01 inch, (ii) a density of about 0.5 g/cm³, (iii) a moisture content of about 2 to about 6 percent, and (iv) a flexible and pliable character. The sheet is provided in strip form, about 2 inches by about 3 inches in size. The strips are shredded at about 32 cuts per inch to provide a combustible tobacco-containing smokable cut filler.

B. Preparation of a Cigarette

Cigarettes substantially as shown in FIG. 1 are provided as follows:

The cigarettes each have a length of about 84 mm and a circumference of about 24.8 mm, and include a smokable rod having a length of about 57 mm, a first filter segment having a length of about 15 mm and a second filter segment having a length of about 12 mm. The first and second filter segments form a filter element. Each filter segment is attached to each smokable rod using nonporous tipping paper. For each cigarette, the tipping paper circumscribes the filter element and about a 4 mm length of the smokable rod in the region adjacent the filter element. The filter elements are not ventilated.

The smokable rod includes the previously described tobacco-containing smokable filler material in cut filler form.

The first filter segment is provided by gathering a 11.75 inch wide web of tobacco and carbon paper available as P-144-BAC from Kimberly-Clark Corp. using the filter rod forming apparatus described in Example 1 of U.S. Pat. No. 4,807,809 to Pryor et al. The plug wrap for the filter segment is available as Reference No. 5831 from Ecusta Corp. The first filter segment is positioned adjacent the smokable rod.

The second filter segment is provided by gathering a 11.75 inch wide web of non-woven polypropylene web available as PP-100-F from Kimberly-Clark Corp. using the filter rod forming apparatus described in Example 1 of U.S. Pat. No. 4,807,809 to Pryor et al. The plug wrap for the filter segment is available as Reference No. 5831 from Ecusta Corp. The second filter segment is positioned adjacent the first filter segment, at the extreme mouth end of the cigarette.

The cigarette paper wrapper exhibits an air permeability of about 1 CORESTA unit. The cigarette paper is available as MTR-1021 from Kimberly-Clark Corp.

Smokable cigarette rods are provided using known techniques. In particular, the smokable material is circumscribed by a single layer of paper wrap. The weight of the smokable filler material within each cigarette rod is about 0.92 g.

The cigarettes are employed by burning the smokable rod such that the smokable material within the paper wrapper burns to yield smoke. When employed, such cigarettes yield very low levels of visible sidestream smoke and essentially no sidestream odor. Cigarettes smoked and tested in this manner each yield 8.0 puffs,

18.7 mg wet total particulate matter (WTPM), 1.8 mg nicotine, 4.8 mg water and 4.8 mg glycerin, under FTC smoking conditions. The cigarettes do not self-extinguish during the smolder period experienced during FTC smoking conditions.

EXAMPLE 2

A. Preparation of a Smokable Filler Material

Into tap water at ambient temperature and maintained at high shear in a blender is charged about 3 parts sodium carboxymethylcellulose available as CMC 7HF from Hercules Inc. Then, about 6 parts glycerin is charged into the water. After a consistent slurry is provided, about 91 parts of the calcined agglomerated calcium carbonate described in Example 1 is folded into the slurry. The resulting slurry, which is an intimate mixture of the aforementioned components, has a solids content of about 25 percent, and exhibits a pH of about 7.

The slurry is cast to about a 0.02 inch thickness onto a flat high density polyethylene sheet and air dried. The resulting smokable filler material is a very dark brown sheet having (i) a thickness of about 0.01 inch, (ii) a density of about 0.5 g/cm³, (iii) a moisture content of about 2.5 to about 6 percent, and (iv) a flexible and pliable character. The sheet is provided in strip form, about 2 inches by about 3 inches in size. The strips are shredded at about 32 cuts per inch to provide a smokable cut filler.

The smokable filler material has a powder mixture applied to the surface thereof. The powder mixture is about 9 parts cocoa powder and about 1 part iron oxide, and the powder mixture is applied such that the resulting smokable filler material includes about 3 percent of that powder mixture. The powder mixture provides a brown color to the combustible smokable cut filler.

B. Preparation of a Cigarette

Cigarettes substantially as shown in FIG. 3 are provided as follows:

The cigarettes each have a length of about 84 mm and a circumference of about 24.8 mm, and include a smokable rod having a length of about 57 mm, a first filter segment having a length of 15 mm and a second filter segment having a length of about 12 mm. The first and second segments form a filter element. Each filter segment is attached to each smokable rod using nonporous tipping paper. For each cigarette, the tipping paper circumscribes the filter element and about a 4 mm length of the smokable rod in the region adjacent the filter element. The filter elements are ventilated to about 60 percent air dilution by providing a ring of perforations through the tipping paper and plug wrap of the filter element circumscribing the cigarette about 12 mm from the extreme mouthend thereof.

The smokable rod includes two longitudinally positioned segments of smokable material within two layers of wrapper. The inner surface of the outer wrapper directly contacts the outer surface of the inner wrapper. The inner wrapper circumscribes the smokable material. The first segment of smokable material is positioned at the end of the smokable rod which is to be lit, and the second segment of smokable material is positioned at the end of the smokable rod which is adjacent the filter element. Each segment extends about 28.5 mm along the smokable rod.

The first segment of smokable material is about 0.6 g of a blend of about 65 parts of the previously described

smokable filler material and 35 parts tobacco cut filler (strands of tobacco laminae cut at about 32 cuts per inch). The tobacco cut filler portion is a blend of about 30 parts volume expanded flue-cured tobacco, about 20 parts volume expanded Oriental tobacco, about 45 parts flue-cured tobacco, and about 5 parts of a spray dried aqueous Burley tobacco extract. The tobacco cut filler then is top dressed with a mixture of glycerin and potassium carbonate, such that the resulting cut filler includes about 91 percent tobacco, about 3 percent potassium carbonate and about 6 percent glycerin.

The second segment is composed entirely of about 0.6 g of the previously described smokable filler material.

The first filter segment is provided by gathering a 11.75 inch wide web of tobacco and carbon paper available as P-144-BAC from Kimberly-Clark Corp. using the filter rod forming apparatus described in Example 1 of U.S. Pat. No. 4,807,809 to Pryor et al. The plug wrap for the filter segment is available as Reference No. 5831 from Ecusta Corp. The first filter segment is positioned adjacent the smokable rod.

The second filter segment is cellulose acetate tow (8 denier per filament/40,000 total denier) which is plasticized with triacetin, and is circumscribed by nonporous paper plug wrap. The second filter segment is positioned adjacent the first filter segment, at the extreme mouth end of the cigarette.

The cigarette paper outer wrapper of the smokable rod exhibits an air permeability of about 0 CORESTA unit. The paper includes about 4.2 percent potassium citrate and about 1.1 percent sodium carboxymethylcellulose. The cigarette paper is available as P-2831-60-1 from Kimberly-Clark Corp.

The inner wrapper of the smokable rod is a tobacco-containing paper available as P-2831-23-3 from Kimberly-Clark Corp.

The cigarettes are employed by burning the smokable rod such that the smokable material within the paper wrapper burns to yield smoke. When employed, such cigarettes yield very low levels of visible sidestream smoke and essentially no sidestream odor. Cigarettes smoked and tested in this manner each yield 9.5 puffs, 5.2 mg wet total particulate matter (WTPM), 0.5 mg nicotine, 0.5 mg water and 1.5 mg glycerin, under FTC smoking conditions. The cigarettes do not self-extinguish during the smolder period experienced during FTC smoking conditions.

EXAMPLE 3

A smokable filler material is prepared as follows:

Into about 300 ml tap water at ambient temperature is dispersed about 5 g of a high viscosity ammonium alginate available as Amoloid HV from Kelco Division of Merck & Co., Inc. To this is charged about 6 g glycerin, and then about 89 g of the calcined agglomerated calcium carbonate described in Example 1. The resulting slurry is agitated for about 15 minutes using an egg beater type mixer, until the slurry exhibits a smooth texture. The slurry then is cast onto a high density polyethylene sheet at a thickness of about 0.02 inch and air dried. The resulting sheet exhibits good tensile strength, exhibits a flexible and pliable character, is water resistant, and does not undergo any significant amount of cracking during drying. The resulting sheet has a moisture content of about 20 percent, and a thickness of about 0.02 inch. The sheet is shredded at 32 cuts per inch to provide a combustible smokable cut filler.

EXAMPLE 4

A tobacco-containing smokable filler material is prepared as follows:

Into about 300 ml tap water at ambient temperature is dispersed about 5 g of the ammonium alginate described in Example 3. To this is charged about 6 g glycerin, then about 2 g diammonium phosphate, and then about 5 g of a spray dried aqueous extract of Burley tobacco. To this is charged about 82 g of the calcined agglomerated calcium carbonate described in Example 1. The resulting slurry is agitated gently using an egg beater type mixer until the slurry exhibits a smooth texture. The slurry then is cast onto a high density polyethylene sheet surface at a thickness of about 0.02 inch and air dried. The resulting sheet exhibits good tensile strength, exhibits a flexible and pliable character, is water resistant, and does not undergo any significant amount of cracking during drying. The resulting sheet has a moisture content of about 20 percent and a thickness of about 0.02 inch. The sheet is shredded at 32 cuts per inch to provide a combustible smokable cut filler.

EXAMPLE 5

A smokable filler material is prepared as follows:

Into about 300 ml tap water at ambient temperature is dispersed about 5 g of the ammonium alginate described in Example 3. To this is charged about 20 g glycerin, and then about 40 g of the calcined agglomerated calcium carbonate described in Example 1. The resulting slurry is mixed gently for about 15 minutes using an egg beater type mixer. The resulting slurry is extruded at ambient temperature using a 50 ml syringe through a die having a generally circular orifice having a diameter of about 1 mm. The extrudate exits the die into a solution of about 98 parts tap water and about 2 parts calcium chloride ambient temperature. Within about 30 seconds, extrudate is removed from the aqueous calcium chloride solution, and resembles a cylinder having a diameter of 1 mm. The extrudate is dried at ambient conditions. The extrudate is passed through the nip of two closely spaced, smooth surfaced metal rollers to produce ribbon about 2 mm wide and about 0.4 mm thick. The resulting material is suitable for use as a smokable filler material.

EXAMPLE 6

A tobacco-containing smokable filler material is provided as follows:

Into about 320 parts tap water at ambient temperature is dispersed about 4 parts of the ammonium alginate described in Example 3. To this is charged about 10 parts glycerin, then about 5 parts of powdered Java tobacco laminae, and then about 81 parts of the calcined agglomerated calcium carbonate described in Example 1. The resulting slurry is agitated until the slurry exhibits a smooth texture. The slurry is cast onto a flat high density polyethylene sheet at a thickness of about 0.02 inch, and air dried to a moisture content of about 12 percent and a thickness of about 0.012 inch. The resulting sheet is cut at about 32 cuts per inch to provide a combustible smokable cut filler.

EXAMPLE 7

A. Preparation of a Smokable Filler Material

A tobacco-containing smokable filler material is provided using a paper-making process as follows:

Into about 400 parts tap water at ambient temperature is dispersed about 2 parts hardwood pulp having a Canadian Standard Freeness of about 95. A slurry is provided by agitating the mixture in a high shear blender at high speed for about 4 minutes. Into the slurry is charged about 25 parts of the calcined agglomerated calcium carbonate described in Example 1. As such, the amount of cellulose pulp in the slurry is less than about 12 percent, based on the solids content of the slurry. The resulting slurry is agitated gently to provide a uniform, homogeneous slurry.

The homogeneous slurry is cast from a headbox as a mat onto a 100 mesh (U.S.) fabric. The slurry is metered from the headbox using a rotating drum having retractable metering veins which unload the slurry from the drum to the fabric. The rotating drum moves linearly relative to the surface of the fabric. The ratio of the speed of the perimeter of the rotating drum to the linear speed of the drum is about 1.6:1. A vacuum of about 25 inches water is pulled on the bottom of the fabric to provide a mat having a thickness of about 0.02 inch. A mixture of water, glycerin, spray dried aqueous tobacco extract is sprayed onto both sides of the mat. The aqueous spray dried tobacco extract is about 30 parts spray dried Burley tobacco and about 70 parts spray dried flue cured tobacco. Sufficient mixture is sprayed onto the mat so as to provide a sheet having about 20 parts tobacco extract, about 6 parts glycerin and about 74 parts mat, on a dry weight basis. The mat then is maintained overnight at a temperature of about 76° F. and at a relative humidity of about 60 percent to provide a paper-type material.

The mat then is cut into rectangular strips, about 2 inches by about 3 inches in size. The strip is shredded at 32 cuts per inch using a paper shredder available as Model 52 AM from Michael Business Machines Corp. The resulting strands of smokable cut filler then are dried at about 90° C. in an oven to a moisture level of about 3 percent.

B. Preparation of a Cigarette

Cigarettes substantially as shown in FIG. 3 are provided as follows:

The cigarettes each have a length of 84 mm and a circumference of 24.8 mm, and include a smokable rod having a length of 57 mm, a first filter segment having a length of 15 mm and a second filter segment having a length of 12 mm. The first and second segments form a filter element. Each filter element is attached to each smokable rod using nonporous tipping paper. For each cigarette, the tipping paper circumscribes the filter element and a 4 mm length of the smokable rod in the region adjacent the filter element. The filter elements are ventilated to about 63 percent air dilution by providing a ring of perforations through the tipping paper and plug wrap of the filter element circumscribing the cigarette about 12 mm from the extreme mouthend thereof.

The smokable rod includes the previously described smokable filler material wrapped within two layers of wrapper.

The first filter segment is provided by gathering a 11.75 inch wide web of tobacco and carbon paper available as P-144-BAC from Kimberly-Clark Corp. using the filter rod forming apparatus described in Example 1 of U.S. Pat. No. 4,807,809 to Pryor et al. The plug wrap for the filter segment is available as Reference No. 5831 from Ecusta Corp. The first filter segment is positioned adjacent the smokable rod.

The second filter segment is cellulose acetate tow (8 denier per filament/40,000 total denier) which is plasticized with triacetin, and is circumscribed by nonporous paper plug wrap. The second filter segment is positioned adjacent the first filter segment, at the extreme mouth end of the cigarette.

The cigarette paper outer wrapper of the smokable rod exhibits an air permeability of about 0 CORESTA unit. The paper includes about 4.2 percent potassium citrate and about 1.1 percent sodium carboxymethylcellulose. The cigarette paper is available as P-2831-60-1 from Kimberly-Clark Corp.

The inner wrapper of the smokable rod is a tobacco containing paper available as P-2831-22-2 from Kimberly-Clark Corp.

The weight of each cigarette is about 1.26 g.

The cigarettes are employed by burning the smokable rod such that the smokable material within the paper wrapper burns to yield smoke. When employed, such cigarettes yield very low levels of visible sidestream smoke and essentially no sidestream odor. Cigarettes smoked and tested in this manner each yield about 9 puffs, 7.3 mg wet total particulate matter (WTPM), 0.74 mg nicotine, 0.5 mg water and 1.2 mg glycerin, under FTC smoking conditions.

EXAMPLE 8

A smokable filler material is provided as follows:

Into about 240 parts tap water is charged about 4 parts of the ammonium alginate described in Example 3, followed by about 17.5 parts glycerin, then about 17.5 parts propylene glycol, and finally about 61 parts of the calcined agglomerated calcium carbonate described in Example 1. The resulting slurry is agitated using an egg beater type mixer, until the slurry exhibits a smooth texture. The slurry is cast onto a high density polyethylene sheet at a thickness of about 0.015 inch and air dried. The resulting dried sheet has a thickness of about 0.011 inch, an exhibits a density of about 0.745 g/cm³.

Cigarettes are provided from the smokable filler material as follows:

The smokable material is circumscribed by a reconstituted tobacco paper-type wrapper containing Java tobacco stem parts and wood pulp. The inner wrapper is available as P-2831-23-3 from Kimberly-Clark Corp. The inner wrapper then is circumscribed by a paper wrapper available as P-2831-60-1 from Kimberly-Clark Corp. The cigarette includes the filter element and tipping material, substantially as described in Example 7.

EXAMPLE 9

A smokable filler material is provided as follows:

Into about 720 parts tap water is charged about 12 parts of the ammonium alginate described in Example 3, followed by about 48 parts glycerin, and finally about 40 parts of the calcined agglomerated calcium carbonate described in Example 1. The resulting slurry is agitated using an egg beater type mixer, until the slurry exhibits a smooth texture. The slurry is cast onto a high density polyethylene sheet at a thickness of about 0.015 inch and air dried. The resulting dried sheet has a thickness of about 0.007 inch, and exhibits a density of about 0.503 g/cm³.

Cigarettes are provided from the smokable filler material as follows:

The smokable material is circumscribed by a reconstituted tobacco paper-type wrapper containing Java tobacco stem parts and wood pulp. The inner wrapper is

available as P-2831-23-3 from Kimberly-Clark Corp. The inner wrapper then is circumscribed by a paper wrapper available as P-2831-60-1 from Kimberly-Clark Corp. The cigarette includes the filter element and tipping material, substantially as described in Example 7.

EXAMPLE 10

A smokable filler material is provided as follows:

Into about 720 parts tap water is charged about 12 parts of the ammonium alginate described in Example 3, followed by about 24 parts glycerin, then about 24 parts propylene glycol, and finally about 40 parts of the calcined agglomerated calcium carbonate described in Example 1. The resulting slurry is agitated using an egg beater type mixer, until the slurry exhibits a smooth texture. The slurry is cast onto a high density polyethylene sheet at a thickness of about 0.015 inch and air dried. The resulting dried sheet has a thickness of about 0.007 inch, and exhibits a density of about 0.47 g/cm³.

Cigarettes are provided from the smokable filler material as follows:

The smokable material is circumscribed by a reconstituted tobacco paper-type wrapper containing Java tobacco stem parts and wood pulp. The inner wrapper is available as P-2831-23-3 from Kimberly-Clark Corp. The inner wrapper then is circumscribed by a paper wrapper available as P-2831-60-1 from Kimberly-Clark Corp. The cigarette includes the filter element and tipping material, substantially as described in Example 7.

EXAMPLE 11

A tobacco-containing smokable filler material is provided as follows:

Into about 400 ml tap water at ambient temperature is charged about 24.2 g glycerin and about 12.1 g propylene glycol, and the resulting mixture is agitated at a high rate using a high shear blender. To the resulting mixture is added about 7.2 g of the ammonium alginate described in Example 3, and the mixture which results is agitated at high speed using a blender for about 15 minutes in order to disperse the alginate in the liquid and hydrolyze the alginate. About 10 g precipitated calcium carbonate available as Code No. 2A from Pfizer Inc. is dispersed in about 100 ml of tap water; charged into the aqueous slurry of glycerin, propylene glycol and alginate; and the resulting mixture is agitated until a smooth slurry results. The resulting slurry is transferred to an egg beater type mixer, and about 10 g of the agglomerated calcium carbonate described in Example 1 is added to the slurry while the mixture is gently agitated. Into the slurry is added about 36.4 g of a mixture of volume expanded flue-cured and Burley tobacco laminae which has been ground to a particle size of -35/+80 US Mesh, and the mixture is gently agitated. About 3 g diammonium phosphate is dissolved in about 200 g water; charged into the slurry; and the resulting slurry is gently agitated for about 5 minutes.

The resulting slurry is cast to about a 0.03 inch thickness on a high density polyethylene sheet and air dried for about 80 minutes. Then, an aqueous solution of 1 percent calcium chloride is sprayed onto the top side of the cast slurry so as to apply about 1 percent calcium chloride to the cast slurry, on a dry weight basis. The slurry then is allowed to air dry to provide a relatively stiff sheet. The resulting sheet is shredded at about 32 cuts per inch to provide a smokable filler material.

EXAMPLE 12

Particles of calcium carbonate agglomerated with an alginate are provided as follows:

Into a blender is charged about 750 ml tap water, and then about 20 g glycerin. While the mixture is gently agitated, about 10 g of the ammonium alginate described in Example 3 is slowly added thereto, so as to disperse the alginate in the water. The resulting mixture is transferred into a 1 liter jar, sealed, and gently rolled overnight to hydrate the alginate.

A slurry of 250 g precipitated calcium carbonate available as Code No. 2A from Pfizer Inc. in 250 g tap water is provided. Then, the slurry is added to 200 g of the water/glycerin/alginate mixture. The resulting slurry is agitated gently so as to provide a slurry having a smooth texture.

The slurry is cast onto a high density polyethylene sheet at a thickness of about 0.04 inch, and air dried to provide pieces of dried sheet about 6 inches by about 6 inches in size. The resulting dried sheet is hand ground to a fine particle size and screened to -50 US Mesh.

A tobacco-containing smokable filler material is prepared as follows:

Into a high shear blender is charged about 225 ml tap water, and into the water is dispersed about 5 g of the ammonium alginate described in Example 3. The resulting mixture is gently agitated at ambient temperature for about 15 minutes, until the alginate is hydrated. Then, about 20 g glycerin is added to the mixture, followed by about 25 ml tap water. To the mixture is added about 16.7 g of an "American blend" of tobacco cut filler which has been ground to a powder. Then, about 25 ml tap water is added to the mixture. The resulting mixture is agitated until a smooth slurry results. To the slurry is added a mixture of about 13.8 g of the calcined agglomerated calcium carbonate described in Example 1 and about 13.8 g of particles of calcium carbonate agglomerated with ammonium alginate. The resulting slurry is agitated until the slurry exhibits a smooth texture. The resulting slurry is cast onto a high density polyethylene sheet at a thickness of about 0.025 inch and air dried.

EXAMPLE 13

A smokable filler material is provided as follows:

Into about 2,000 ml tap water is charged about 400 g of the calcined agglomerated calcium carbonate described in Example 1. The resulting slurry is agitated using a magnetic stirring bar, and into the slurry is added in a drop-wise manner about 500 ml of a 3 molar aqueous hydrochloric acid solution. The slurry then is filtered and washed with about 4,000 ml water. The resulting digested agglomerated matrix calcium carbonate exhibits a bulk density and weighs about 104 g.

Into a high shear mixer set at high speed containing about 430 g tap water is added about 5 g sodium carboxymethylcellulose available as CMC 7HF from Hercules Inc. Then, about 6 g glycerin is charged into the mixture. Agitation is ceased, and about 89 g of the previously described digested agglomerated matrix calcium carbonate is folded into the mixture. The resulting slurry is gently agitated until a smooth slurry results. The slurry is sieved through a 20 US Mesh screen to remove large clumps therefrom. The slurry is cast at about a 0.02 inch thickness and air dried. The resulting sheet has a thickness of about 0.015 inch, and exhibits a density of about 0.31 g/cm³.

EXAMPLE 14

A tobacco-containing smokable filler material is provided as follows:

Into about 190 ml tap water at ambient temperature is mixed about 24.2 g of glycerin and 12.1 g of propylene glycol. The mixture is agitated using a high shear blender. To this is added about 3.6 g of the ammonium alginate described in Example 3. Agitation is continued for about 15 minutes until the ammonium alginate is completely dispersed and hydrated. Then about 10 g of precipitated calcium carbonate is added slowly and mixed until the material is evenly dispersed and the slurry becomes smooth. Then about 10 g of agglomerated calcium carbonate, as described in Example 1, is added and gently stirred until the mix is uniform. This mixture was cast at 0.02 inches onto a plastic surface. After drying for 1 hour, an aqueous solution of 1 percent calcium chloride is sprayed onto the top side as described in Example 6. This sheet is allowed to dry in air under ambient conditions. Next, into about 300 ml tap water at ambient temperature is added about 3.6 g of ammonium alginate and the mix is agitated until the alginate is dispersed and hydrated. Then about 14.6 g of Burley tobacco powder, about 2.9 g of milled Turkish tobacco, about 18.9 g of milled flue-cured tobacco; and about 13.5 g of propylene glycol is added and mixed until uniform. This mix was cast at about 0.07 inches over the sheet previously described in this Example. The resulting laminated sheet is shredded at 32 cuts per inch.

What is claimed is:

1. A cigarette comprising:

(a) a smokable filler material including an intimate mixture of (i) agglomerated matrix filler in particulate form having particles of inorganic filler spaced within a continuous or semi-continuous phase of a carbonaceous binding material, and (ii) tobacco; and

(b) wrapping material circumscribing the smokable filler material.

2. The cigarette of claim 1 wherein the smokable filler material includes a binding agent.

3. The cigarette of claim 1 wherein the wrapping material is a paper having a porosity of less than about 5 CORESTA units.

4. The cigarette of claim 1 or 3 wherein the agglomerated matrix filler comprises a calcium carbonate component and a carbonaceous component.

5. The cigarette of claim 4 further including tobacco cut filler.

6. The cigarette of claim 4 wherein the agglomerated matrix filler comprises greater than about 90 weight percent calcium carbonate component and greater than about 3 weight percent carbon provided by the carbonaceous component.

7. The cigarette of claim 1 or 3 wherein the agglomerated matrix filler comprises an inorganic component spaced within a continuous or semi-continuous phase of a carbonaceous binding component, and the agglomerated matrix filler is in particulate form exhibiting a particle size of -50/+325 U.S. Mesh.

8. The cigarette of claim 1 further including tobacco cut filler.

9. The cigarette of claim 1 wherein the smokable material includes up to about 50 weight percent tobacco, about 45 to about 90 percent agglomerated matrix filler; up to about 20 weight percent binding agent;

and up to about 20 weight percent aerosol forming material.

10. A cigarette comprising:

(a) smokable filler material including an intimate mixture of (i) agglomerated matrix filler, (ii) tobacco, and (iii) a binding agent which includes ammonium alginate; and

(b) wrapping material circumscribing the smokable filler material.

11. The cigarette of claim 1, 2 or 10 wherein the tobacco has the form of a tobacco extract.

12. The cigarette of claim 11 wherein the smokable filler material includes an aerosol forming material.

13. The cigarette of claim 11 further including tobacco cut filler.

14. A smokable filler material comprising an agglomerated matrix filler material in particulate form having particles of inorganic filler spaced within a continuous or semi-continuous phase of a carbonaceous binding material.

15. The smokable filler material of claim 14 including a binding agent.

16. The smokable filler material of claim 14 or 15 including an aerosol forming material.

17. The smokable filler material of claim 16 wherein the aerosol forming material includes a polyhydric alcohol.

18. The smokable filler material of claim 16 further comprising tobacco.

19. The smokable filler material of claim 14 wherein the agglomerated matrix filler comprises an inorganic component spaced within a continuous or semi-continuous phase of a carbonaceous binding component, and the agglomerated matrix filler is in particulate form exhibiting a particle size of $-50/+325$ U.S. Mesh.

20. The smokable filler material of claim 19 wherein the inorganic component includes particles of calcium carbonate.

21. The smokable filler material of claim 19 wherein the agglomerated matrix filler comprises greater than about 90 weight percent inorganic component and greater than about 3 weight percent carbon provided by the carbonaceous component.

22. The smokable filler material of claim 21 further comprising tobacco.

23. The smokable filler material of claim 19 including about 60 to about 95 weight percent agglomerated matrix filler, up to about 20 percent binding agent, and up to about 20 weight percent aerosol forming material.

24. The smokable filler material of claim 23 further comprising tobacco.

25. The smokable filler material of claim 19 consisting essentially of about 60 weight percent agglomerated matrix filler, up to about 20 weight percent binding agent, and up to about 20 weight percent aerosol forming material.

26. The smokable filler material of claim 25 further comprising tobacco.

27. The smokable filler material of claim 22, 24 or 26 wherein the tobacco has the form of a tobacco extract.

28. The smokable filler material of claim 22, 24 or 26 including up to about 50 weight percent tobacco, about 45 to about 90 weight percent agglomerated matrix filler, up to about 20 weight percent binding agent, and up to about 20 weight percent aerosol forming material.

29. The smokable filler material of claim 14 or 19 wherein the agglomerated matrix filler is (i) in particulate form, and (ii) exhibits a bulk density of less than about 1 g/cm^3 .

30. The smokable filler material of claim 14, 15 or 19 further comprising tobacco.

31. The smokable filler material of claim 30 wherein the tobacco has the form of an extract.

32. A cigarette comprising:

(a) smokable filler material including agglomerated matrix filler in particulate form having particles of inorganic filler spaced within a continuous or semi-continuous phase of a carbonaceous binding material; and

(b) wrapping material circumscribing the smokable filler material.

33. The cigarette of claim 32 wherein the smokable filler material includes a binding agent.

34. The cigarette of claim 32 wherein the smokable material includes an aerosol forming material.

35. The cigarette of claim 32 wherein the wrapping material is a paper having a porosity of less than about 5 CORESTA units.

36. The cigarette of claim 32 or 35 wherein the agglomerated matrix filler comprises a calcium carbonate component and a carbonaceous component.

37. The cigarette of claim 36 wherein the smokable filler material comprises about 60 to about 95 weight percent agglomerated matrix filler, up to about 20 weight percent binding agent, and up to about 20 weight percent aerosol forming material.

38. The cigarette of claim 36 wherein the agglomerated matrix filler comprises greater than about 90 weight percent calcium carbonate component and greater than about 3 weight percent carbon provided by the carbonaceous component.

39. The cigarette of claim 32 or 35 wherein the agglomerated matrix filler comprises an inorganic component spaced within a continuous or semi-continuous phase of a carbonaceous binding component, and the agglomerated matrix filler is in particulate form exhibiting a particle size of $-50/+325$ U.S. Mesh.

40. The cigarette of claim 35 further including tobacco cut filler.

41. A cigarette comprising:

(a) smokable filler material including (i) agglomerated matrix filler, and (ii) a binding agent including ammonium alginate; and

(b) wrapping material circumscribing the smokable filler material.

42. The cigarette of claim 32, 33 or 41 further including tobacco cut filler.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 5,105,836
DATED : April 21, 1992
INVENTOR(S) : Jeffery S. Gentry, et al.

It is certified that error appears in the above—identified patent and that said Letters Patent is hereby corrected as shown below:

In the Title Page under [75] Inventors:

Line 3, after "Mead; insert --of New Jersey--.

Page 2 following U.S. PATENT DOCUMENTS, add:

--OTHER PUBLICATIONS, APV Anhydro Bulletin No. 165 and
APV Anhydro Bulletin No. 701--.

Col. 24, line 62, "80" should be --30--.

Col. 27, line 55, after "60" insert --to about 90--.

Signed and Sealed this

Twenty-first Day of September, 1993



Attest:

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

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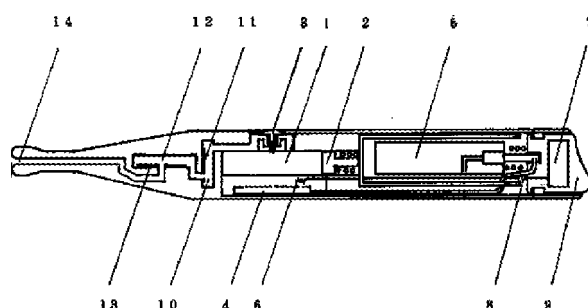
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(54) 【発明の名称】 ニコチン喫気器

(57) 【要約】

【目 的】 タバコの出す公害は煙、ほく(灰)、吸い殻にあり、健康阻害要因はタール分にあると見て、それらを出さないタバコの開発。

【構 成】 〔請求項1〕 ニコチンを加熱して蒸気とし、それを適量適量の空気と混ぜて吸入(喫気)しうるようにした、そして携帯しうるように小型にした、機械タバコ(メカタバコ)と呼ぶべき、ニコチン喫気器。



【特許請求の範囲】

【請求項1】ニコチン（常態では油状液体）を加熱して蒸気とし、それを適量適量の空気と混ぜて吸入（喫気）しうるようにした、そして携帯しうるように小型にした、機械タバコ（メカタバコ）と呼ぶべき、ニコチン喫気器。

【請求項2】（イ） シリンダーとピストンとスプリングとから成り、過熱防止装置の一部としても機能するようにした、ニコチンを密封して加熱しうるようにした罐（ニコチン汽罐）を設ける。

（ロ） そのニコチン汽罐を加熱するようにガス・ライターを空気採入口と共に設ける。

（ハ） （喫気者が）吸い口を吸うと適量の空気に混じって適量のニコチン蒸気（この両者を以って萇気と呼ぶ）が吸えるように開栓し、それを中止すると自動的に閉栓するようにした栓（吸動 自動復帰空気採入・ニコチン蒸気取出一体化栓（通常は吸動・自動復帰ニコチン蒸気取出栓と呼ぶ））を萇気の通る道孔（気道孔）とニコチン汽罐とに一体的に機能しうるように双方に亘って設ける。

（ニ） ニコチン汽罐のシリンダーが一定気圧に加熱されるとピストンがスプリングの弾力に勝って作動し、その作用で以ってガス・ライターの操作ボタンを消火の方向に押して（喫気者の）操作動作を中止させて操作ボタンを復帰させてガス・ライターの火を消してニコチン汽罐の破裂を惹起する過熱を防止しうるようにして過熱防止装置を設ける。

（ホ） ニコチン汽罐が（喫気者の）喫気中に上下左右に過傾斜してニコチン液が吸動・自動復帰ニコチン蒸気取出栓の設けられている（今は開栓している）ニコチン蒸気取出口を塞いで噴漏出する前の一定傾斜になると、吸動・自動復帰ニコチン蒸気取出栓が自動的に復帰して施栓してニコチン液の噴漏出を予防するように（喫気者の）喫気を中止させるように気道孔の適当な箇所に気道孔を自動的に閉塞しうる、そしてニコチン汽罐がその一定傾斜の前の傾斜に復すると、（喫気者が）再び喫気しうるように自動的に気道孔を開通させうる常直垂吊蓋栓（振子栓）に負うニコチン液漏出予防装置を一は上下用にもう一は左右用に設ける。

（ヘ） 以上の各構成要素を携帯性のあるタバコパイプ型のパイプ（本体）に（喫気者が）その本体を親指と中指とで火傷することなく支え持って人差指でガス・ライターの操作ボタンを操作しうるようにその操作ボタンが本体の先端となるように特に配慮してニコチン喫気器としての機能性を連係して持つように配設しうるようにその本体を設ける。以上の如く構成された、機械タバコ（メカタバコ）と呼ぶべき、携帯用ニコチン喫気器。

【発明の詳細な説明】

四半世紀前くらいから、タバコは肺ガンの原因になるとの報告が多くなり、少しインテリ気質の人達からは敬遠

され始めた。特にタバコに含まれているタール分には強い嫌疑が掛けられて来た。しかしタバコを若い折から死ぬまで吸い続けた人でも肺ガンなどにはならず、長生した人は多い。タバコの永い歴史からは、タバコは格別寿命を縮めるものでは無く、さして寿命には影響の無いものだと言うことが証明されているのではなからうか。しかしながらタバコには中毒性があり、そこから習慣性が付き、一旦始めると止めようの無いもので、不必要に家計を圧迫するものだと思われているようである。私は若い折には一日に50本は吸う仲々のヘビー・スモーカーであった。しかし30歳を少し過ぎた頃ぶつ切りと止めた。しかし中毒症状から起こる苦しみと言うものは何も無かった。タバコの中毒性と言うものは薬理的なものより遥かに精神的なものだと思えて宜いのではあるまいか。人は心が一つのピークに達すると、それを何らかの方法で緩和したくなるものである。それをタバコで以って行い始めた人はずっとタバコで以ってするようになるのではあるまいか。社会の進歩の未だ低い時代即ち生活環境の中に自然が多く存在していた時代には、勿論現代であっても未開の程度の強い社会では、タバコは時と処を選ばず何時でも何処でもその心のピークの気軽な解放剤として用いられるそれは手軽で効果的な嗜好品であった。その手軽さはコーヒーや紅茶やお茶などを喫して一服する場合と比べればよく判る。今日先進各国は都会化がどんどん進み、生活環境は極めて非自然的即ち人工的となっている。タバコの出す煙や臭やほくや吸い殻などを吸収して自然に返す機能は極めて低下している。したがってタバコの出すこれら疎嫌要因は総て公害と化すようになった。一般的にそういう公害は殆ど総て公共が処理しなくてはならない。街の車道や歩道で、駅のホームで、ビルの廊下やロビーなどで、タバコ公害が発生すると、総てこれらは誰かの手で清掃されねばならない。しかし今日の生活水準と意識水準の向上した社会において一体誰がその作業を引受けようか。そういう作業を厭わずやってくれる人がありさえすれば、タバコに掛かる税金は現在1本につき5円余りであるが、これを6円にしさえすれば、財源は確保出来るのだから、その清掃が出来ないと言うことは無いのである。しかし一般的に言ってそういう疎嫌作業は機械化を以ってする以外になくなって来ている。原子力産業などにおいてもその産業内の疎嫌作業には従事してくれる人は殆どいなくなって来ており、その所為で欧米では原子力産業そのものが成り立たなくなって来ていると、IEA（国際エネルギー機関）などは報じているようなことなのである。これが時代の進歩と言うものであるので、どうしようも無いことである。したがってタバコはどうしても公害を出さないものとなって、その疎嫌作業を発生させないものとならなくてはならない。このタバコの進化が進まない限り、タバコ産業は所有方面から攻撃を受けることになる。病気の原因となるなどから始まっているいろいろな社会運動まで所

有手段を以って社会から追放されかねないことになる。私はこれまでそのことを厳正に認識して、疎嫌作業を出さないタバコは開発出来ないかと、いろいろ考えて来た。煙の殆ど出ないタバコとか、水を掛ければ、吸い殻が溶解してしまうものとか、いろいろ発想したが、これはと言うものに結晶しなかった。しかし此度タバコの煙はニコチン吸入上の副産物であって、それはタール煙や水蒸気などであり、そこにタバコの本質があるのでは無いことに気が付き、タバコはニコチンの蒸気を純粋に吸うもので宜しいことに思い至った。蚊取線香に電子蚊取器が発明されたように、タバコにも電子タバコがあれば宜しいのである。ニコチンは精製されたものは不快臭を持つほど無色な油状の液体だと言う。そしてその沸点は247度Cである。これらから考えると、精製ニコチンを加熱して蒸気とし、それを適量な空気に混ぜて吸おうとすれば、決して不可能では無いことが容易に判るのである。勿論それだけでは味が不味ければ、ニコチンの沸点以下の沸点を持つ何らかの精製物質を香味料として混入すれば宜しい訳である。しかしながらその香味料を用いなくても、薄荷油などは別であるが、結構行けるのでは無いかと思っている。こういう次第で発明したのが本発明である。本発明の構成は「特許請求の範囲」に簡潔に述べられている。「請求項1」の発明は本発明の基本発明であり、「請求項2」の発明は本発明の具体的な実施例発明である。その実施例発明を以って本発明の機能を説明する。本メカタバコを親指と中指に挟んで持ち、吸い口をくちびるに挟む。そしてライターの操作ボタンを人差指で軽快に押すと、ガス・ライターが作動して、ガスが燃え出し、ニコチン汽罐を加熱する。そのまゝの状態を暫し過ごし、徐に吸い口を吸うと、吸動・自動復帰ニコチン蒸気取出栓が開いて、空気とニコチン蒸気を吸入出来る。斯くて一服目を吸う。一服を終って吸入を止めると、吸動・自動復帰ニコチン蒸気取出栓は自動復帰して閉じる。人差指は依然としてライターの操作ボタンを押している。したがってライターは依然ニコチン汽罐を加熱し続けている。二服目を吸う。一服目と同様に吸動・自動復帰ニコチン蒸気取出栓が開いて、又一服吸うことが出来る。一服を終えると、又自動的に吸動・自動復帰ニコチン蒸気取出栓は閉じる。人差指は尚ライターの操作ボタンを押し続けている。ニコチン汽罐は過熱するかも知判らない。過熱したとすると、過熱防止装置であるニコチン汽罐のピストンが押し出されて、接続棒を介してライターの操作ボタンを人差指の圧力とは反対の方向に押す。人差指でそれを感じて人差指の力を抜く（実際は力を抜くことを等閑しても押し戻される）と、ライターの操作ボタンは自動復帰して、ガス・ライターの火は消える。斯くて加熱が中止されると、過熱状態は瞬間的に止まる。勿論過熱防止装置のピストンの作動も瞬間的に止まる。そのまゝで三服目を吸っても宜しい。又吸動・自動復帰ニコチン蒸気取出栓が開いて、一服吸

うことが出来る。四服目もそのまゝで可能かも知判らない。しかし五服目はニコチン汽罐が加熱されていない状態のまゝであるから、ニコチン汽罐の圧力が低下し、ニコチン蒸気が旨く吹き出さず、空気だけを吸うことになるかも知判らない。それが判れば、再び徐にライターの操作ボタンを人差指で押してガス・ライターを点火し、ニコチン汽罐を加熱して、最初の一服のようにこのメカタバコを吸うことになる。本メカタバコを吸う場合、それを水平に或はそれに近い状態に保てれば、何ら問題はないが、時として本メカタバコの先端を上げたり下げたり或は横に捻ったりすることもあろう。そうすると、吸動・自動復帰ニコチン蒸気取出栓のあるニコチン蒸気出口がニコチン蒸気ではなくニコチン液で塞ってしまい、ニコチン汽罐内に高圧が掛かっている場合、ニコチン液がその口から噴出することになる。それが丁度吸気している折であると、一度に大量のニコチンを摂ることになり、大変危険である。そこである一定限度以上に本メカタバコが傾くと、それを自動的に感知して吸気状態を中止させて、吸動・自動復帰ニコチン蒸気取出栓が自動復帰して、ニコチン液の噴漏出を予め防止するようにした。このニコチン液漏出予防装置は出来るだけ簡単な機構であることが好ましく、幸にも極めてシンプルなものを考え付きえて喜んでいる。それは「図2」と「図3」で以って示されているようなもので、本体の一定限度傾斜内（ニコチン液の噴漏出することのない傾斜の範囲内）で本体の気道孔を開通させるように孔を垂直線上に設け、その本体の一定限度傾斜外傾斜ではその孔以外の部分が本体の気道孔を閉塞するように出来ている、本体の傾斜に関係無く垂直に垂れ下がっている板状振子栓の機能に負うものである。勿論このニコチン液漏出予防装置は上下傾斜に対するものと左右傾斜に対するものと二つが必要である。したがって本メカタバコを吸入中何かの拍子に本体が上下左右のどちらかに可成りひどく傾いた場合、本体の気道孔が垂直状態を保っている振子栓の孔と外れて、振子栓の孔で無い部分に塞がれることになり、吸入が出来なくなる。そうすると、瞬間的に吸動・自動復帰ニコチン蒸気取出栓が自動復帰して、ニコチン蒸気出口は塞がって、ニコチン液の噴漏出を予防する。そこで又本メカタバコを上下左右に水平に近く戻し保つと、本体の気道孔は振子栓の孔と合うことになって、又再び吸入操作を行えば、継いでメカタバコを喫することが出来ることになる。本メカタバコの実物はどのくらいの大きさになるかと言うと、大体「図1」の大きさくらいとなる。その大きさだと、900ミリグラムのニコチン液が可成りの余裕を以って装入出来る。今日の巻タバコは大変軽くなって来ている。中には一本のニコチンの含有量がたったの0.6ミリグラムと言うものもある。煙害となるタールの含有量を極力減らそうとすれば、そうなるようである。しかしながらニコチンに少々中毒気味な人には一回の喫気で1ミリグラムは必要

であろう。したがって900ミリigramは一般的には900回の喫気分と言うことになる。一日30回喫気する人には30日分と言うことでもある。巻タバコ本現在11円から12円であるから、ニコチン液900ミリigram入りの本メカタバコは平均1万円で市販すればよいことになる。この価格であれば、本メカタバコは立派なものとなって、十分従来の愛煙家の嗜好に應え得よう。ところでニコチンは殺虫剤などにも使われる程に猛毒である。その致死量は体重1キログラム当たり0.04グラムと言われている。体重45キログラムの女性は1.8グラムで、体重65キログラムの男性は2.6グラムで死に至ることになる。しかしながら本メカタバコのニコチン装入量は先の900ミリigram(0.9グラム)くらいがその携帯上の使用性からの図体の大きさから見ると限度であるのであるが、それは女性の致死量の半分くらいの量でしかないので、本メカタバコは薬剤関係法からの市販制約を受けることはあるまい。現在タバコ会社は世界では数十社もある。それぞれ特色を出して、激烈な販売競争を行なっている。本発明をそれらタバコ会社が採用するにも、やはりそれぞれが特徴特色を出したかろう。それぞれが無害な添加剤を開発して、自社の特色を出して貰いたいものである。したがって本発明が普及しても従来からのタバコの銘柄名が無くなることはあるまい。1990年で少し古いが、世界の巻タバコの生産本数は5兆1000億本に達している。日本は2681億本であるが、近年アメリカのタバコに押されて減少傾向にある。そのアメリカは年々増加の傾向を辿って来て、7013億本である。このような規模の巻タバコが総て本発明に転換するとは思えないが、アメリカやヨーロッパ諸国や日本などの先進国では行く行くはその半分が本発明に換って行こう。前段で述べたように巻タバコの公害は都会型の国家では耐え難いからである。それら先進国で巻タバコ1兆本分が本発明に転換するとすれば、それは本発明11億本分に当たる。その金額は11兆円にも昇る。何方かに宜しきエージェントをお願いして、JTを始め世界のタバコ会社に採用して貰うべく交渉を進めたい。そして本メカタバコが社会の休息と団欒の場で昔日の巻タバコの如く何らの疎嫌感を持たれず享受されるようになることを祈っている。そして当然そうなるものと確信している。こゝに先願の発明であるCO₂公害の解決策である空中の炭酸ガスと地上の水とからアルコールを採る着想である「加水分解式二酸化炭素固定化利用法」やNO_x公害の解決策である自動車などの排気を消石灰に接触させてその中の酸化窒素を消石灰に化合吸収させる着想である「自動車煤煙浄化器」に続いてタバコ公害の解決策である本発明が提案出来たことは市井の発明家に過ぎない私にとっては洵に誇りである。何らの資金的な或は環境的な援助や助成を全く受けることなく、私とは逆に所有分野において資金的にも環境的にも十分過ぎる程の援助と助成を享受している公共や民

間の組織内研究開発家にこれら国家存亡に係る白眉の急務の課題で勝ち得たことは私のような市井の発明家にとっては最も矜持とするところである。日本の文化と政治を真に担って来て、日本近代現代の真の基礎を創って来ていた大江系の長井永井の家系に真に大輪の花を添えて、今日まで私を疎外して来た下層支配を目差す的な同和人権思想の人には気の毒であるが、洵に以って欣快である。文明と文化を真に新しく開き拓き得る者は新しき者ではなくやはり古き良き伝統の十分に詰まっている古き家系の者に在ることがこれら私の多くの真に実用的な発明考案の創造を以って真に証明しえて洵にうれしい。余計ではあるが、私はもう一方の伝統である政治の面で多大の努力を為すに拘らずその地位を仲々与えられない。今日の民主主義の政治体制においても国民を代表する政治家は自己の人生に他人に誇り得る研鑽実績とある程度の財産を築いた者であるべきだと考えている。国民を代表する政治家と先ずなって、知恵知識と財力を築こうとするのは邪道だと思う。そういう人は無き者であるからどうしても知恵も知識も財産も金銭も有る者から盗ろうとするようにならざるを得ないからである。しかし今日の民主主義政治では大多数の無き者不十分な者の先頭に立って有る者から盗らんとすれば、人気政治家となる。国家の人道の大道は正に地に落ち破壊のまゝとなる。こういうところに真の文明と文化の創造は生まれようもない。真に新しき文明と文化の弛まぬ創造無くして、どうして我国は立ち行こうか。具体的に見れば、一体何を以って食糧や資源やエネルギーなど生活基礎物資と交易しようと言うのか。本発明など私の多くの発明考案が世に出て、ある程度の資金が持てるようになったならば、私は是非従来に不正的なしがらみの殆ど無い真に新しい国造りの出来る政党を興したい。祖の一大江広元が新しい武家政治を開いて、今日の我国の社会文化の基礎を創ったように、私もこの行き詰まった今日の我国の政治経済に他人から精神的に物質的に泥棒をすることによって罪の意識に自己を叱んでいる多くの国民に真の自立の途を与え、心からの禊(みそぎ)の上に新しい途の政治を開いて与えたい。何が何でも私の発明しているポスト石油時代のエネルギーのエースである太陽熱で空気を暖めてその空気を高い煙突に流して空気の急流を作りその急流を以って発電を行なうと言う「太陽熱風力発電装置(空気力発電システム)」や先の炭酸ガスアルコール化法などを以って真に新しい安定的な経済を開いて、こうして西洋文明文化の模倣の時代が完結して、全く途方に暮れている今日の経済の本質的な行き詰まりを打破したい。真に新しい時代を招来する。国民の多くはその新時代においては福祉と対策の政治から脱却して自立に向って新生な精神を持とうとするであろう。その心と心の融合連帯の上に罪意識の無い従って無闇に人権思想を以って他人を攻撃することの少ない平和な社会を出現構築したい。その政治経済社会の実現の先頭に立つ我

政党こそ「自由開明党」としたい。他人を攻撃しなくては喰って行けない人を作り出さ無い真に主体的な腕のある労働を求める「明日を開き拓き」といと命名したものである。

【図面の簡単な説明】

【図 1】本発明における「請求項 2」の発明である実施例発明の簡単な横臥縦断面図である。大体において実物大であり、発熱部位などを考慮し、斯くあらんとするものである。

【図 2】「図 1」のメカタバコニコチン液漏出予防装置の振子栓の機能的在様を示す横断断面図であり、メカタバコの本体が傾斜していなく、本体の気道孔に振子栓の孔が合って、本予防装置が作動していない場合である。

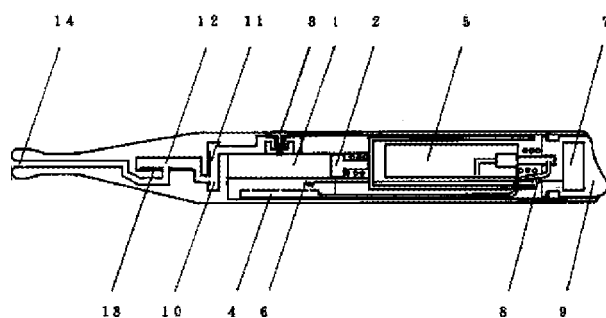
【図 3】「図 2」と同様な横断断面図であり、メカタバコの本体が傾斜しており、本体の気道孔が振子栓の孔から外れて、振子栓の孔で無い部分が本体の気道孔を塞い

で、本予防装置が作動している場合である。

【符号の説明】

- 1 はニコチン汽罐
- 2 はニコチン汽罐の過熱防止装置のピストン
- 3 はニコチン汽罐の吸動 自動復帰ニコチン蒸気取出栓
- 4 はガス・ライターの火口
- 5 はガス・ライターのガス ポンペ
- 6 はガス・ライターの点火フィラメント
- 7 はガス・ライターの電池
- 8 はガス・ライターの点火スイッチ
- 9 はガス・ライターの操作ボタン
- 10 はニコチン汽罐の左右傾斜に対するニコチン液漏出予防装置
- 11 は 10 の装置の振子栓
- 12 はニコチン汽罐の上下傾斜に対するニコチン液漏出予防装置
- 13 は 12 の装置の振子栓 14 は吸い口

【図 1】



【図 2】



【図 3】



Patent/Publication: JP9075058A

Bibliography

DWPI Title

Portable nicotine inhaling device performs mixing of nicotine vapour with proper amount of air

Original Title

NICOTINE INHALATOR

Assignee/Applicant

Standardized: NAGAI MASAYA

Original: NAGAI MASAYA

Inventor

NAGAI MASAYA,

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1997-03-25 (A)

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JP1995276123A / 1995-09-18

Priority Number / Date / Country

JP1995276123A / 1995-09-18 / JP

Abstract

Abstract

PROBLEM TO BE SOLVED: To obtain a tobacco without discharging smoke, HOKU (ash) and cigarette butts regarded as causing pollutions originating from tobacco and tar contents considered as factors injuring the health.

SOLUTION: This nicotine inhaler to be called a mechanical tobacco is obtained by heating, vaporizing nicotine, mixing the resultant vapor with a suitable amount of air, enabling the inhaling (smoking) thereof and miniaturizing the inhaler so as to be portable.

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F 2 3 Q 2/28	1 2 1	F 2 3 Q 2/28 1 2 1 A

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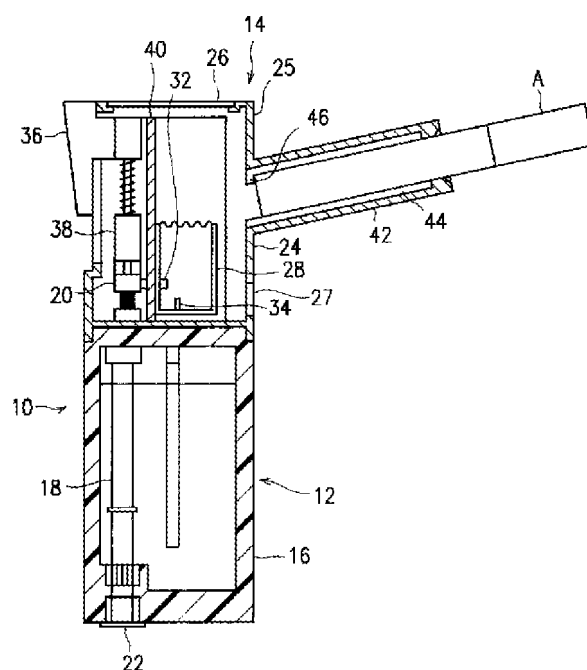
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(54) 【発明の名称】 非燃焼型香味生成品用ヒータユニット

(57) 【要約】

【課題】 簡単な構成且つ安価な加熱源を備えた非燃焼型香味生成品のためのヒータユニットを提供する。

【解決手段】 ヒータユニットは、ユニットケーシング10の上下に設けられた着火燃焼部14、可燃性ガスの燃料タンク部12及び着火ボタン36を備えており、着火燃焼部14は昇温室25及び香味生成品Aのためのチューブホルダ42を備えている。着火ボタン36の押し下げに伴い、昇温室25内にて可燃性ガスに着火され、その燃焼により加熱された空気がチューブホルダ42内の香味生成品Aの外周面に導かれ、この香味生成品Aを燃焼することなく加熱する。



【特許請求の範囲】

【請求項1】 縦軸線を有するユニットケーシングと、前記ユニットケーシング内に設けられた昇温室と、前記ユニットケーシングに備えられ、燃料を蓄える燃料室部と、前記燃料室部から導かれた燃料を前記昇温室内にて燃焼し、前記昇温室内の空気を加熱する燃焼加熱手段と、前記ユニットケーシングに設けられ、前記昇温室内の加熱空気を利用して加熱すべき非燃焼型香味生成品を保持するチューブホルダとを備え、前記燃焼加熱手段は、操作時のみ前記燃料を着火させる着火ボタンを含むことを特徴とする非燃焼型香味生成品用ヒータユニット。

【請求項2】 前記チューブホルダは、前記昇温室内の加熱空気を前記非燃焼型香味生成品の外周面にも導くことを特徴とする請求項1に記載の非燃焼型香味生成品用ヒータユニット。

【請求項3】 前記チューブホルダは、前記昇温室内の加熱空気を前記非燃焼型香味生成品の外周面のみに導くことを特徴とする請求項1に記載の非燃焼型香味生成品用ヒータユニット。

【請求項4】 前記チューブホルダは、前記ケースの縦軸線に対し上方に向けて傾斜していることを特徴とする請求項1に記載の非燃焼型香味生成品用ヒータユニット。

【請求項5】 前記昇温室内の加熱空気と熱交換する熱交換手段を更に備え、この熱交換手段は前記熱交換により加熱した外気を前記チューブホルダ内の前記非燃焼型香味生成品に向けて供給可能とすることを特徴とする請求項1に記載の非燃焼型香味生成品用ヒータユニット。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、香味の吸引や疑似的な喫煙に供される香味生成品を燃焼させることなく、加熱するための非燃焼型香味生成品用ヒータユニットに関する。

【0002】

【関連する背景技術】この種の非燃焼型香味生成品用ヒータユニットは例えば特開平7-184627号公報に開示されている。この公知のヒータユニットは、たばこ香味料入りの疑似的なシガレットを電気発熱体により加熱し、シガレットからたばこの味や薫り、また他の成分を蒸気又はエアゾールの形態にして喫煙者の口内に供給するものとなっている。

【0003】このようなヒータユニットによれば、シガレット自体を燃焼させるものではないので、シガレットからの副流煙や灰の発生がなく、周囲環境を維持する上で好適するものとなる。

【0004】

【発明が解決しようとする課題】しかしながら、上述の

ヒータユニットはシガレットを電気発熱体により加熱するものであるため、その加熱源が構造的に複雑になり、また、ヒータユニットの携帯性を考慮すると、電気発熱体への通電のために充電式の蓄電池を必要とする。一般的に、この種の蓄電池は消費電力の少ない電気機器への通電には好適するものの、電気発熱体への通電には不向きである。それ故、その蓄電池は専用のものにならざるを得ないし、蓄電池の充電のためにも専用の充電器が必要となり、シガレット1本当たりの喫煙に要するコストは非常に高い。

【0005】この発明は上述の事情に基づいてなされたもので、その目的とするところは簡単且つ安価な構成にて、疑似的なシガレット等の香味発生品の加熱に好適した非燃焼型香味生成品用ヒータユニットを提供することにある。

【0006】

【課題を解決するための手段】上記の目的はこの発明によって達成され、請求項1の非燃焼型香味生成品用ヒータユニットは、ユニットケーシング内に昇温室及び燃料室部を設けるとともに、ユニットケーシングに非燃焼型香味生成品を保持するチューブホルダを設け、そして、その着火ボタンが操作されているときに、燃焼室部の燃料を昇温室内にて燃焼させる燃焼加熱手段を備えている。

【0007】上述の請求項1のヒータユニットによれば、ユーザにて燃焼加熱手段の着火ボタンが操作されているときのみ、昇温室内にて燃料が燃焼され、この燃焼により昇温室内の空気を加熱し、この加熱空気を利用してチューブホルダ内の非燃焼型香味生成品を燃焼することなく加熱する。従って、ユーザは、香味生成品の香味が蒸気やエアゾールの形態で、その吸い口端から吸い込み可能となる。

【0008】一方、着火ボタンの操作が解除されると、昇温室内での燃料の燃焼が停止され、非燃焼型香味生成品の加熱もまた停止される。チューブホルダは、非燃焼型香味生成品の外周面にも昇温室からの加熱空気を導き可能な構造を有しているか（請求項2）、または、その外周面のみに加熱空気を導き可能な構造となっている（請求項3）。これらの場合、昇温室内での燃料の着火燃焼中に、香味生成品の吸い口端から空気を吸引すると、この吸引に伴い、昇温室の加熱空気が香味生成品の外周面に亘って導かれ、この結果、香味生成品が良好に加熱され、その香味は蒸気やエアゾールの形態にて空気とともに香味生成品の吸い口端からユーザの口内に吸い込まれる。

【0009】チューブホルダは、ユニットケーシングの縦軸線に対し上方に向けて傾斜している（請求項4）。この場合、ヒータユニットのユーザは、そのユニットケーシングを片手で把持したとき、香味生成品の吸い口端が上方を向くことになり、その吸い口端をくわえ込みが

容易となる。更に、ヒータユニットは、昇温室内の加熱空気との熱交換を行う熱交換手段を更に含むことができ、この熱交換手段は熱交換により加熱した外気を香味生成品に向けて供給可能である（請求項５）、この場合、昇温室内にて発生する燃焼ガスが香味生成品側に導かれることはなく、熱交換により得た外気が香味生成品側に供給される。

【００１０】

【発明の実施の形態】図１及び図２を参照すると、非燃焼型香味生成品用ヒータユニットは、ユニットケーシング１０を備えている。このユニットケーシング１０は上下に延びる長手軸線を有し、片手にて把持が容易な形状を有している。このユニットケーシング１０は上下に２つの部分からなり、その下部は燃料タンク部１２、そして、その上部は着火燃焼部１４となっている。

【００１１】燃料タンク部１２はタンクシェル１６を備えており、このタンクシェル１６は例えば耐熱性を有した合成樹脂からなり、ユニットケーシング１０の下部を構成している。タンクシェル１６内は燃料室として形成され、その内部には燃料として液化した状態で可燃性ガスが蓄えられている。タンクシェル１６内には給排チューブアセンブリ１８が収容されており、この給排チューブアセンブリ１８は、タンクシェル１６からの可燃性ガスの送出や、タンクシェル１６内への液化可燃ガスの再充填をなす機能を有している。即ち、給排チューブアセンブリ１８の上端は着火燃焼部１４内に突出してガス送出ヘッド２０を構成し、その下端はガス注入エンド２２としてタンクシェル１６の底面に露出されている。

【００１２】なお、給排チューブアセンブリ１８は一般的な充填型ガスライターに内蔵されている給排チューブアセンブリと同様な構造であるので、その内部構造の図示及びその説明は省略する。一方、着火燃焼部１４は、耐熱性を有したトップシェル２４を備えており、このトップシェル２４はユニットケーシング１０の上部を構成し、例えばタンクシェル１６の上端に嵌合して相互に接続されている。トップシェル２４はその上面に排気口を有し、この排気口にスリットリッド２６が装着されている。トップシェル２４の外周壁にはその下部に複数の給気孔２７が貫通して形成されており、これら給気孔２７はトップシェル２４の周方向に間隔を存して分布されている。

【００１３】トップシェル２４内は昇温室２５として形成されており、この昇温室２５には火炎フード２８が配置されている。この火炎フード２８はその上端が開口した円筒状をなし、トップシェル２４の底壁中央から上方に向けて延びている。火炎フード２８の外周壁には一部分を除き、多数の孔（図示しない）が分布して形成され、また、その上端にはネット３０が装着されている。

【００１４】火炎フード２８内には、前記孔を有していない内壁部分に向けてガス噴出ノズル３２が突出してお

り、このガス噴出ノズル３２は前述した給排チューブアセンブリ１８のガス送出ヘッド２０に接続されている。ガス噴出ノズル３２から可燃性ガスが噴出されたとき、そのガス噴出流により火炎フード２８内が負圧となり、この負圧は給気孔２７を通じて外気を吸い込み、これにより、火炎フード２８内にて可燃性ガスと空気との混合ガス流が作られるようになっている。

【００１５】なお、火炎フード２８の外周壁の全域に孔が分布して形成されている場合、前述した給気孔２７はガス噴出ノズル３２に対し背向側の領域に位置付けるのが好ましい。また、火炎フード２８内には着火電極３４が配置されており、この着火電極３４はガス噴出ノズル３２の近傍に位置付けられている。

【００１６】一方、トップシェル２４の外周面にはその上部に着火ボタン３６が取付けられており、この着火ボタン３６はトップシェル２４に対し上下方向に移動可能に支持されている。トップシェル２４内にて、着火ボタン３６と前述したガス送出ヘッド２０とは伸縮可能な着火ロッドアセンブリ３８を介して連結されている。この着火ロッドアセンブリ３８は、着火ボタン３６を常時上方に向けて付勢しており、その付勢力に抗し、着火ボタン３６の押し下げとともに収縮を伴い、ガス送出ヘッド２０を押圧する。この押圧はガス送出ヘッド２０内の弁（図示しない）を開き、これにより、タンクシェル１６内の可燃ガスが給排チューブアセンブリ１８及びガス噴出ノズル３２を通じて火炎フード２８内に噴出される。

【００１７】また、着火ロッドアセンブリ３８には圧電素子（図示しない）が内蔵されており、この圧電素子は前述した着火電極３４に電気的に接続されている。圧電素子は、着火ロッドアセンブリ３８の収縮時、加圧されて高い起電力を発生し、この起電力は着火電極３４とガス噴出ノズル３２との間に火花放電を生起させる。この結果、ガス噴出ノズル３２から噴出される可燃ガスは火花放電により着火され、そして、可燃ガスの燃焼は着火ボタン３６が押し下げられている間継続する。なお、着火ロッドアセンブリ３８に関しても、その構成は一般的なガスライターのものと同様であるから、具体的な図示及び説明は省略する。

【００１８】更に、昇温室２５内には必要に応じて遮熱カバー４０を配置することができる。この遮熱カバー４０は耐熱性を有し、着火ボタン３６側の部材と火炎フード２８との間に介在する半割の管状をなしている。この場合、ガス噴出ノズル３２及び着火電極３４は火炎フード２８に加え、遮熱カバー４０を介してガス送出ヘッド２０及び圧電素子にそれぞれ機械的又は電気的に接続されることになる。

【００１９】そして、トップシェル２４の外周壁からはチューブホルダ４２が延びており、このチューブホルダ４２は耐熱性材料からなり、前述した昇温室２５に連通している。チューブホルダ４２は、トップシェル２４と

一体にして形成されるか、または、トップシェル42にねじ込み式にして接続される。チューブホルダ42は棒状の香味生成品Aをほぼ密着状態にして差し込み可能な内径を有するが、その内周面には複数の縦溝44が形成されている。これら縦溝44はチューブホルダ42の周方向に間隔を存して配置され、そして、チューブホルダ42の先端部を残し、その軸線方向に延びている。それ故、チューブホルダ42内に香味生成品Aを差し込んで保持したとき、図3に示されているように香味生成品Aの回りには複数の軸方向通路が形成されることになる。

【0020】また、チューブホルダ42の内周面には、トップシェル24の外周壁側に位置してストッパ46が突設されている。このストッパ46は、香味生成品Aの差し込み長さを制限し、香味生成品Aの先端が昇温室25内に突出し、そして、その吸い口端がチューブホルダ42内に没入してしまうのを防止する。なお、チューブホルダ42の先端開口はその周縁がテーパ状に形成され、これにより、香味生成品Aの差し込みが容易となる。

【0021】更に、図1及び図2から明らかなようにチューブホルダ42はその軸線が上方に向けて傾斜し、また、トップシェル24の周方向でみてチューブホルダ42及び着火ボタン36は互いに直径方向に離間している。なお、ユニットケーシング10の横断面に対し、チューブホルダ42の傾斜角 α （図1参照）は例えば10°～60°の範囲にある。

【0022】ここで、香味生成品Aに関し、図4及び図5を参照して説明する。図4の香味生成品Aは例えば、エアゾール生成物質を含む基材Bを通気性を有した巻紙Cにより包み込んでロッドとし、そして、このロッドの一端に円筒状のフィルタプラグDをチップペーパーEの巻き付けを介して接続したものである。基材Bは、再生たばこの刻みや、刻みたばこ又はたばこ紙などからなり、エアゾール生成物質は基材に担持されたグリセリン、たばこ抽出物、香味料等である。なお、この種の香味生成品Aは例えば特開平6-189733号公報に詳しく例示されている。

【0023】また、図5の香味生成品Aは図4の香味生成品の先端に非通気性のプラグFを配置し、このプラグFと前記ロッドとを通気性を有する巻紙Gにより接続し、この後、フィルタプラグDを同様にして接続したものである。なお、香味生成品Aとしては前述した特開平7-184627号公報に開示されているようなシガレットであってもよいし、その具体的な構成に制約を受けるものではない。

【0024】上述のヒータユニットによれば、ユーザはまず、ユニットケーシング10のチューブホルダ42内に例えば図4の香味生成品Aを差し込み、そのユニットケーシング10を片手で把持するとともに、香味生成品Aの吸い口端を口で加え込む。この状態で、その片手の

親指で着火ボタン36を押し下げ、火炎フード28内にて可燃性ガスに着火し、この可燃性ガスの燃焼により、昇温室25内の空気を加熱する。この加熱と同時に、ユーザが香味生成品Aの吸い口端から空気を吸い込めば、チューブホルダ42の先端部と香味生成品Aの外周面の間はその全周に亘って密着していることから、昇温室25内にて昇温された加熱空気は香味生成品Aの先端面のみならず、チューブホルダ42の縦溝44内、つまり、軸方向通路内に導かれ、そして、香味生成品Aの外周面からも香味生成品A内に流入し、その基材及びエアゾール発生体を所定の温度に加熱する。この結果、香味生成品Aの香味が蒸気やエアゾールの形態で発生し、これらは加熱空気とともに香味生成品Aの吸い口端からユーザの口内に流入する。ここで、ユーザの口内に流入する加熱空気の温度は、常温～40℃の範囲となるように火炎フード28内での可燃性ガスの燃焼が調整されており、これにより、ユーザは通常のシガレットの喫煙と同様な喫味を味わうことができ、ユーザに違和感を与えることもない。

【0025】ユーザは香味生成品Aの上述した吸い込みを1回行った後、着火ボタン36の押し込みを解除すれば、火炎フード28内での燃焼が停止される。それ故、トップシェル24、チューブホルダ42及び香味生成品Aが過熱されることもない。燃料としての可燃性ガスは電気加熱に比べて安価であるとともに、タンクシェル16内に充填される量の液化可燃性ガスだけでも、その燃焼回数を十分に確保することができる。

【0026】また、可燃ガスの供給及びその着火に要する機構部分は一般的なガスライターと同様な機構を採用できるから、その機構部分は簡単となり、また、安価に提供可能である。更に、チューブホルダ42は上方に向けて傾斜しているから、ユニットケーシング10を垂直に把持した状態で、香味生成品Aの吸い口端をくわえ込み易く、そして、このようにユニットケーシング10が垂直姿勢にあると、着火ボタン36の押し込み操作が容易に行える。チューブホルダ42の傾斜角 α が60°を超えると、香味生成品Aの吸い込み時、ユーザはユニットケーシング10の排気口、即ち、スリットリッド27から排出される熱を受け易く、これに対し、その傾斜角 α が10°よりも小さいと、吸い込み時、ユーザの口に対するユニットケーシング10の把持レベルが高くなり過ぎてしまい、ユーザの負担が大となる。

【0027】上述の実施例では、タンクシェル16内の液化可燃性ガスを再充填可能な方式としたが、タンクシェル16自体を新たなタンクシェルに交換可能な方式としてもよい。また、可燃性ガスの着火には、圧電素子と着火電極との組み合わせの着火方式に限らず、火打ち石方式のものであってもよく、着火ボタン36も押し下げ式のみならず、押し込み式のものであってもよい。

【0028】ヒータユニットが図5の香味生成品Aに適

用される場合、ヒータユニットは図6に示されるようにチューブホルダ42の内端に耐熱性を有した止めディスク48を備えることができる。この止めディスク48はその外周縁にチューブホルダ42の各縦溝44と連通する複数の切欠50を有し、その中央部は香味生成品Aの先端面に密着し、この先端面を閉塞する面となっている。即ち、図6に示されているようにチューブホルダ42に香味生成品Aが挿入されたとき、香味生成品Aはその先端が止めディスク48に密着して当接することで、前述したストッパ46として機能する。この場合、昇温室25内にて加熱された空気は、チューブホルダ42の縦溝44を通じて香味生成品Aの外周面に導かれ、この外周面のみから香味生成品A内に流入することができる。この場合、可燃性ガスの燃焼による火災は止めディスク48を直接加熱するものであってもよい。

【0029】図7のヒータユニットの場合、このヒータユニットはトップシェル24の昇温室25内に加熱室52を区分して備えている。この加熱室52は、トップシェル24の内周面に固定された耐熱性のカバー54により確保されており、このカバー54は昇温室25内に臨むチューブホルダ42の内端開口を気密に覆っている。そして、この場合、前述した遮熱カバー40の代わりに中空円筒状の伝熱カバー56が設けられており、この伝熱カバー56の外周壁には複数の細管58が巻き付けられている。これら細管58の一端はトップシェル24の外周壁を貫通して外気に接続されており、それらの他端はカバー54を貫通して加熱室52に連通している。なお、この場合、前述した給気孔27は連通管60を介して伝熱カバー56内に接続されることになる。

【0030】図7のヒータユニットによれば、昇温室25内の加熱空気と細管58を通じて加熱室52内に導かれる外気との間にて熱交換を行うことが可能であり、この熱交換により加熱された外気が香味生成品Aの先端面及びその外周面の少なくとも一方に導かれる。それ故、ユーザによる香味生成品Aの吸い込み時、昇温室25内の加熱空気、即ち、燃焼ガスが香味生成品A側に供給されることはなく、香味生成品Aから発生する香味が燃焼ガスにより阻害されることはない。

【0031】最後に、この発明を実施するにあたり、上述の各実施例の構成を任意に組み合わせることも勿論可能である。

【0032】

【発明の効果】以上説明したように請求項1の非燃焼型香味生成品用ヒータユニットによれば、燃料の燃焼を利用して非燃焼型香味生成品の加熱を行うようにしたから、その加熱源の構成が簡単になるばかりでなく、その加熱源を安価に提供でき、また、燃料の燃焼はその着火ボタンが操作されているときのみに行われるから、非燃焼型香味生成品が不所望に加熱され続けたり、また、その香味生成品及びヒータユニット内が過熱されるようなこともない。

【0033】請求項2、3のヒータユニットによれば、昇温室内の加熱空気が香味生成品の先端面及び外周面の少なくとも一方に導かれるから、香味生成品の加熱を効果的に行うことができる。請求項4のヒータユニットによれば、そのチューブホルダが上方に向けて傾斜しているので、ユーザによる香味生成品のくわえ込みが容易になり、請求項5のヒータユニットによれば、ユーザは香味生成品を通じて燃焼ガスを吸い込むこともない。

【図面の簡単な説明】

【図1】一実施例のヒータユニットの斜視図である。

【図2】図1のヒータユニットの縦断面図である。

【図3】図1のヒータユニットにおけるチューブホルダの横断面図である。

【図4】香味生成品の一例を示した断面図である。

【図5】香味生成品の他の例を示した断面図である。

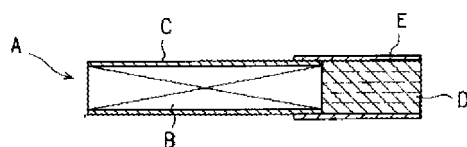
【図6】チューブホルダの変形例を示した縦断面図である。

【図7】ヒータユニット内での熱交換のための構成を示した図である。

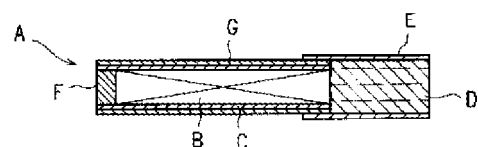
【符号の説明】

- 10 ユニットケーシング
- 12 燃料タンク部
- 14 着火燃焼部
- 32 ガス噴出ノズル
- 34 着火電極
- 36 着火ボタン
- 42 チューブホルダ
- 44 縦溝
- 48 止めディスク
- 52 加熱室
- 58 細管
- A 香味生成品

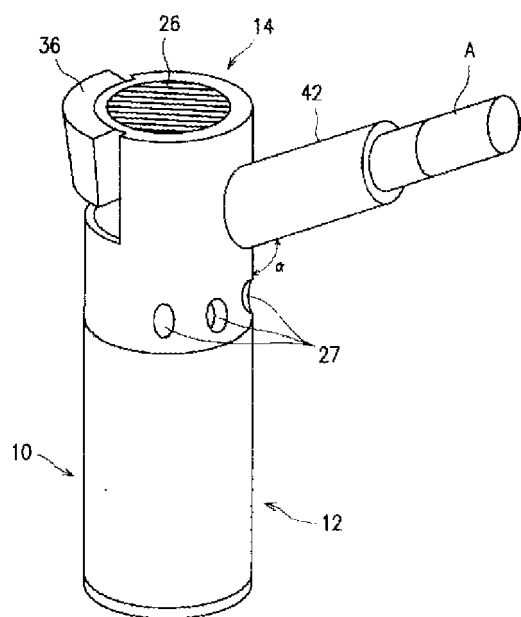
【図4】



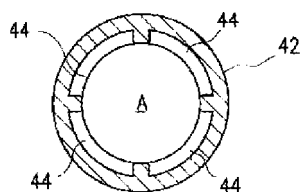
【図5】



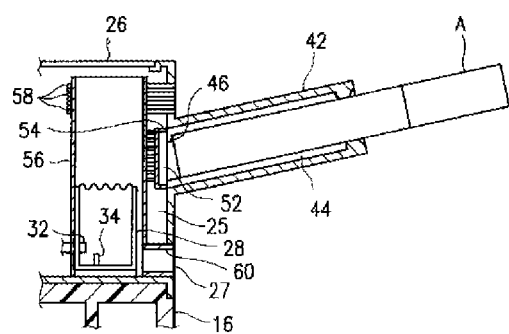
【図1】



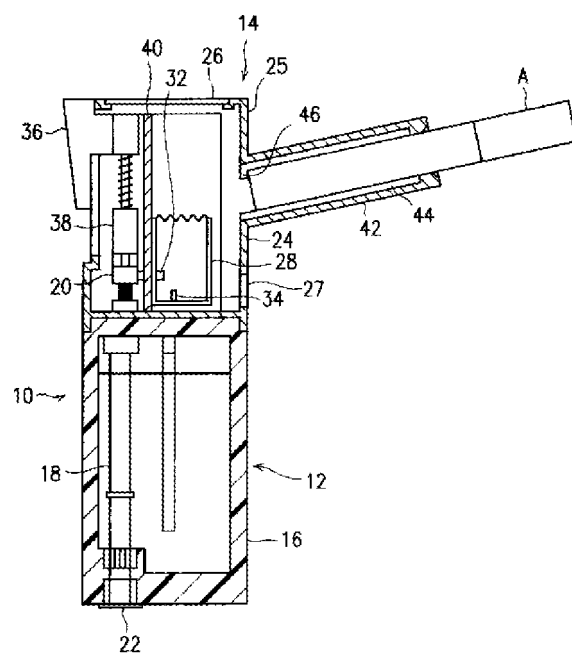
【図3】



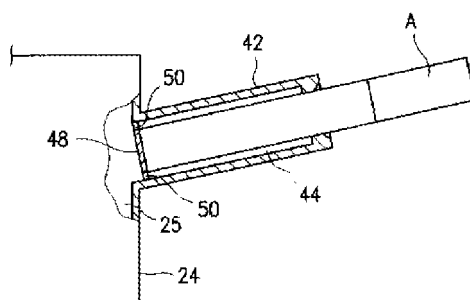
【図7】



【図2】



【図6】



Patent/Publication: JP11178563A

Bibliography

DWPI Title

Cigar lighter for non-combustion type flavor generation goods combusts fuel for lighting dummy cigarette held in tube holder, by operating firing button

Original Title

HEATER UNIT FOR NONCOMBUSTIBLE-TYPE FLAVOR-EMISSIVE ARTICLE

English Title

HEATER UNIT FOR NONCOMBUSTIBLE-TYPE FLAVOR-EMISSIVE ARTICLE

Assignee/Applicant

Standardized: JAPAN TOBACCO INC

Original: JAPAN TOBACCO INC

Inventor

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Abstract

Abstract

PROBLEM TO BE SOLVED: To provide the subject heater unit having a simple constitution and equipped with an inexpensive heating source.

SOLUTION: This heater unit has an ignition burning section 14 set up on a unit casing 10, a fuel tank section 12 for combustible gas, and an ignition button 36; wherein the ignition burning section 14 is equipped with a temperature-raising chamber 25 and a tube holder 42 for a flavor-emissive article A. This heater unit works as follows: as the ignition button 36 is pushed down, a combustible gas is ignited in the chamber 25, and the resulting heated air is guided onto the outer peripheral surface of a flavor-emissive article A inside the tube holder 42, heating the article A without its combustion.

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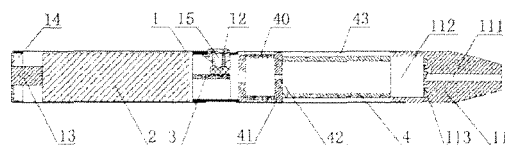
权利要求书 1 页 说明书 5 页 附图 6 页

(54) 发明名称

蒸发式电子烟

(57) 摘要

本发明公开了一种蒸发式电子烟,包括壳体(1)和设于壳体(1)内的电池(2)、控制单元(3),壳体(1)的一端设有吸嘴(11),壳体(1)上设有用于控制电热片(41)工作状态的控制开关(12),控制开关(12)与控制单元(3)相连,壳体(1)内还设有用于放置烟草组合物的烤箱(4),烤箱(4)上设有进气孔(42)和用于蒸发烟草组合物的电热片(41),烤箱(4)与吸嘴(11)连通,电池(2)通过控制单元(3)与电热片(41)电连接。本发明具有口感真实、吸烟时不产生一氧化碳及焦油、不产生二手烟、体积小巧、使用方便的优点。



1. 一种蒸发式电子烟,包括壳体(1)和设于壳体(1)内的电池(2)、控制单元(3),所述壳体(1)的一端设有吸嘴(11),所述壳体(1)上设有用于控制电热片(41)工作状态的控制开关(12),所述控制开关(12)与控制单元(3)相连,其特征在于:所述壳体(1)内还设有用于放置烟草组合物的烤箱(4),所述烤箱(4)上设有进气孔(42)和用于蒸发烟草组合物的电热片(41),所述烤箱(4)与吸嘴(11)连通,所述电池(2)通过控制单元(3)与电热片(41)电连接。

2. 根据权利要求1所述的蒸发式电子烟,其特征在于:所述烤箱(4)上设有用于检测烤箱(4)温度的温度传感器(43),所述温度传感器(43)与控制单元(3)相连,所述控制单元(3)在工作状态时根据温度传感器(43)检测的温度控制所述电热片(41)的加热状态使烤箱(4)的工作温度保持在 $180^{\circ}\text{C}\sim 240^{\circ}\text{C}$ 之间,当温度传感器(43)检测的温度到达 240°C 时控制单元(3)控制电热片(41)停止加热,当温度传感器(43)检测的温度低于 180°C 时控制单元(3)控制电热片(41)进行加热。

3. 根据权利要求2所述的蒸发式电子烟,其特征在于:所述烤箱(4)为桶状,所述电热片(41)构成所述烤箱(4)的桶底,所述进气孔(42)设于所述电热片(41)上,所述壳体(1)上设有通孔(16),所述进气孔(42)与通孔(16)相连通。

4. 根据权利要求3所述的蒸发式电子烟,其特征在于:所述控制单元(3)设于电池(2)和电热片(41)之间,所述控制单元(3)和电热片(41)之间设有用于隔热保护控制单元(3)并支承电热片(41)的隔热支撑云母片(40)。

5. 根据权利要求1或2或3或4所述的蒸发式电子烟,其特征在于:所述吸嘴(11)上设有吸嘴孔(111),所述吸嘴(11)与壳体(1)套接,所述吸嘴(11)套接壳体(1)的一端设有与吸嘴孔(111)连通的凹槽(112),所述凹槽(112)与烤箱(4)的开口端相对布置且所述凹槽(112)与烤箱(4)的内腔连通,所述凹槽(112)的底部设有用于防止烟草组合物从吸嘴孔(111)漏出的镍丝网(113)。

6. 根据权利要求5所述的蒸发式电子烟,其特征在于:所述控制单元(3)包括用于控制电热片(41)加热状态的开关电路(31),所述电热片(41)通过开关电路(31)与电源相连。

7. 根据权利要求6所述的蒸发式电子烟,其特征在于:所述壳体(1)上设有USB充电接口(13),所述电池(2)为可充电的锂离子电池,所述控制单元(3)上设有用于调节充电电流和电压的充电电路,所述电池(2)通过所述充电电路与USB充电接口(13)相连。

8. 根据权利要求7所述的蒸发式电子烟,其特征在于:所述充电电路为BUCK充电电路。

9. 根据权利要求8所述的蒸发式电子烟,其特征在于:所述壳体(1)上设有用于指示所述充电电路充电状态的充电指示灯(14)和用于指示电热片(41)的加热状态的加热指示灯(15),所述充电指示灯(14)与USB充电接口(13)相连,所述加热指示灯(15)的控制单元(3)相连。

10. 根据权利要求9所述的蒸发式电子烟,其特征在于:所述电热片(41)为厚膜电热片。

蒸发式电子香烟

技术领域

[0001] 本发明涉及电子香烟,具体涉及一种利用蒸发的方式替代传统燃烧方式的电子香烟。

背景技术

[0002] 目前世界上有超过十亿的吸烟者,而抽烟的过程中产生的主要成分包括尼古丁、一氧化碳、焦油等,而香烟的有效成分是尼古丁,其他成分绝大部分都对人体有害,所以每年都会有很多人因为抽烟而死亡。所以许多公共场合都是禁止抽烟,甚至有些国家全民禁烟,但是对于抽烟成瘾的人又不得不抽烟,针对这种需求市场上出现了各式各样的电子香烟,但是电子香烟跟纸烟味道差别太大,依然不能满足吸烟者的需求。

发明内容

[0003] 本发明要解决的技术问题是提供一种口感真实、吸烟时不产生一氧化碳及焦油、不产生二手烟、体积小、使用方便的蒸发式电子香烟。

[0004] 为了解决上述技术问题,本发明采用的技术方案为:

一种蒸发式电子香烟,包括壳体和设于壳体内的电池、控制单元,所述壳体的一端设有吸嘴,所述壳体上设有用于控制电热片工作状态的控制开关,所述控制开关与控制单元相连,所述壳体内还设有用于放置烟草组合物的烤箱,所述烤箱上设有进气孔和用于蒸发烟草组合物的电热片,所述烤箱与吸嘴连通,所述电池通过控制单元与电热片电连接。

[0005] 作为上述技术方案的进一步改进:

所述烤箱上设有用于检测烤箱温度的温度传感器,所述温度传感器与控制单元相连,所述控制单元在工作状态时根据温度传感器检测的温度控制所述电热片的加热状态使烤箱的工作温度保持在 180℃~240℃之间,当温度传感器检测的温度到达 240℃时控制单元控制电热片停止加热,当温度传感器检测的温度低于 180℃时控制单元控制电热片进行加热。

[0006] 所述烤箱为桶状,所述电热片构成所述烤箱的桶底,所述进气孔设于所述电热片上,所述壳体上设有通孔,所述进气孔与通孔相连通。

[0007] 所述控制单元设于电池和电热片之间,所述控制单元和电热片之间设有用于隔热保护控制单元并支承电热片的隔热支撑云母片。

[0008] 所述吸嘴上设有吸嘴孔,所述吸嘴与壳体套接,所述吸嘴套接壳体的一端设有与吸嘴孔连通的凹槽,所述凹槽与烤箱的开口端相对布置且所述凹槽与烤箱的内腔连通,所述凹槽的底部设有用于防止烟草组合物从吸嘴孔漏出的镍丝网。

[0009] 所述控制单元包括用于控制电热片加热状态的开关电路,所述电热片通过开关电路与电源相连。

[0010] 所述壳体上设有 USB 充电接口,所述电池为可充电的锂离子电池,所述控制单元上设有用于调节充电电流和电压的充电电路,所述电池通过所述充电电路与 USB 充电接口

相连。

[0011] 所述充电电路为 BUCK 充电电路。

[0012] 所述壳体上设有用于指示所述充电电路充电状态的充电指示灯和用于指示电热片的加热状态的加热指示灯,所述充电指示灯与 USB 充电接口相连,所述加热指示灯的与控制单元相连。

[0013] 所述电热片为厚膜电热片。

[0014] 本发明具有下述优点:

1、本发明通过电热片加热烟草组合物蒸发形成雾滴供吸烟者吸食,通过蒸发烟草组合物替代传统电子香烟的燃烧烟液的形式,相对传统电子香烟而言具有口感真实的优点。

[0015] 2、本发明的壳体内还设有用于放置烟草组合物的烤箱,烤箱上设有用于蒸发烟草组合物的电热片和进气孔,电池通过控制单元与电热片电连接,通过电热片加热烟草组合物蒸发形成雾滴,通过蒸发的方式替代传统的燃烧方式,吸烟时不产生一氧化碳、焦油等有害物质,而且由于蒸发出来的是雾滴不是烟而且需要吸食才能吸出烟嘴外,不会产生二手烟,而且本发明仅有传统香烟大小,体积小巧、使用非常方便。

附图说明

[0016] 图 1 为本发明实施例的立体结构示意图。

[0017] 图 2 为本发明实施例的剖视结构示意图。

[0018] 图 3 为本发明实施例中控制单元及其外围电路的框架结构示意图。

[0019] 图 4 为本发明实施例中充电电路的电路原理示意图。

[0020] 图 5 为本发明实施例中加热指示灯的电路原理示意图。

[0021] 图 6 为本发明实施例中控制单元及其外围电路的电路原理示意图。

[0022] 图 7 为本发明实施例中开关电路的电路原理示意图。

[0023] 图 8 为本发明实施例中控制单元稳压电路的电路原理示意图。

[0024] 图 9 为本发明实施例中温度传感器的电路原理示意图。

[0025] 图例说明:1、壳体;11、吸嘴;111、吸嘴孔;112、凹槽;113、镍丝网;12、控制开关;13、USB 充电接口;14、充电指示灯;15、加热指示灯;16、通孔;2、电池;3、控制单元;31、开关电路;4、烤箱;40、隔热支撑云母片;41、电热片;42、进气孔;43、温度传感器。

具体实施方式

[0026] 如图 1、图 2 和图 3 所示,本实施例的蒸发式电子香烟包括壳体 1 和设于壳体 1 内的电池 2、控制单元 3,壳体 1 的一端设有吸嘴 11,壳体 1 上设有用于控制电热片 41 工作状态的控制开关 12,控制开关 12 与控制单元 3 相连,壳体 1 内还设有用于放置烟草组合物的烤箱 4,烤箱 4 上设有进气孔 42 和用于蒸发烟草组合物的电热片 41,烤箱 4 与吸嘴 11 连通,电池 2 通过控制单元 3 与电热片 41 电连接。在工作状态时,控制单元 3 控制电热片 41 发热将烟草组合物蒸发形成的雾滴,吸烟者通过吸嘴 11 吸食烟草混合液蒸发形成的雾滴,由于本实施例通过蒸发的方式替代传统的燃烧方式,由于蒸发出来的是雾滴而不是烟雾,因此不产生一氧化碳、焦油等有害物质,而且不吸烟时也不会产生二手烟,使用非常方便。

[0027] 本实施例中烟草组合物主要由烟草粉末和调和添加剂配制而成的半固态混合物,

烟草组合物在 $180^{\circ}\text{C} \sim 240^{\circ}\text{C}$ 的加热范围内蒸发形成雾滴而且不产生一氧化碳、焦油等有害物质。烟草组合物中,烟草粉末的粒度约为 1mm 左右,烟草粉末与调和添加剂的质量比可为 $(2 \sim 3) : 1$,本实施例中烟草粉末与调和添加剂的质量比可为 $2 : 1$;其中调和添加剂配制为混合溶液态,调和添加剂包括用作混合溶液溶质的丙二醇和用作溶剂的甘油,甘油与丙二醇的质量比可为 $(3 \sim 5) : 1$,本实施例中甘油与丙二醇的质量比具体为 $3 : 1$ 。此外调和添加剂中还包含有天然香料,天然香料的含量可根据需要进行调整,本实施例中天然香料与甘油的质量比为 $1 : 3$ 。

[0028] 如图 1、图 2 和图 3 所示,吸嘴 11 上设有吸嘴孔 111,吸嘴 11 与壳体 1 套接,吸嘴 11 套接壳体 1 的一端设有与吸嘴孔 111 连通的凹槽 112,凹槽 112 与烤箱 4 的开口端相对布置且凹槽 112 与烤箱 4 的内腔连通,凹槽 112 的底部设有用于防止烟草组合物从吸嘴孔 111 漏出的镍丝网 113。本实施例中,由于凹槽 112 与烤箱 4 的开口端相对布置形成的内腔,使得放置烟草组合物的空间更大,一次性能放置的烟草组合物更多,镍丝网 113 则能够防止烤箱 4 内的烟草组合物从吸嘴孔 111 中漏出;进气孔 42 的孔径大小为 0.5mm 左右,能够防止烟草组合物中粒度约为 1mm 的烟草粉末从进气孔 42 中漏出。

[0029] 如图 1 和图 2 所示,壳体 1 上设有 USB 充电接口 13,电池 2 为可充电的锂离子电池,控制单元 3 上设有用于调节充电电流和电压的充电电路,电池 2 通过充电电路与 USB 充电接口 13 相连。电池 2 可以循环充电使用,能够降低使用成本。此外,电池 2 也可以根据需要采用其他类型的充电电池,或者采用普通的碱性电池。

[0030] 如图 4 和图 6 所示,本实施例的充电电路为 BUCK 充电电路,BUCK 充电电路的 PWM 控制端与 STC12C5204AD 单片机的 17 号引脚相连,BUCK 充电电路的 BAT+ 和 BAT- 与电池 2 相连。BUCK 充电电路为一种降压斩波电路,相对传统的充电电路而言具有电路简单,成本低,充电效率高等优点。

[0031] 如图 1、图 2、图 3 和图 5 所示,壳体 1 上设有用于指示充电电路充电状态的充电指示灯 14 和用于指示电热片 41 的加热状态的加热指示灯 15,充电指示灯 14 与 USB 充电接口 13 相连,加热指示灯 15 的与控制单元 3 相连。本实施例的充电指示灯 14 为与 USB 充电接口 13 相连的发光二极管,加热指示灯 15 为具有双色显示功能的发光二极管。加热指示灯 15 包括 LED3 和 LED4 共两个发光二极管,其中 LED3 为红色发光二极管,LED4 为绿色发光二极管,当 LED3 发光时代表当前烤箱 4 的温度低于 180°C ,当 LED4 发光时代表当前烤箱 4 的温度处于 $180^{\circ}\text{C} \sim 240^{\circ}\text{C}$ 的区间内。

[0032] 如图 2、图 3 和图 6 所示,本实施例中控制单元 3 为基于 STC12C5204AD 单片机实现的控制电路板,STC12C5204AD 单片机内置 8 路 10bit AD 采集模块可以将温度、电压等模拟信号转换为数字信号。STC12C5204AD 单片机的 4 号引脚与 LED3 相连,STC12C5204AD 单片机的 5 号引脚与 LED4 相连。控制开关 12 即为图中的 S1,与 STC12C5204AD 单片机的 23 号引脚相连;STC12C5204AD 单片机通过 26 号引脚(CONT1)与开关电路 31 相连,通过开关电路 31 来控制电热片 41。

[0033] 如图 2、图 3 和图 7 所示,本实施例的控制单元 3 包括用于控制电热片 41 加热状态的开关电路 31,电热片 41 通过开关电路 31 与电源相连,此外控制单元 3 也可以通过驱动电路的形式来直接驱动电热片 41 的加热状态。本实施例中,开关电路 31 基于高电平驱动 MOS 管 Q2 实现,MOS 管 Q2 的控制端通过电阻 R3 与 STC12C5204AD 单片机的 26 号引脚

相连。按一下开关 S1, 则 STC12C5204AD 单片机的 26 号引脚由低电平变为高电平, 从而驱动 MOS 管 Q2 导通, 电热片 41 通电并开始发热。当温度传感器 43 检测到温度达到设置温度后, STC12C5204AD 单片机的 26 号引脚变为低电平, MOS 管 Q2 断开停止加热。

[0034] 如图 8 所示, 本实施例中控制单元 3 采用 HT7530 稳压 IC 芯片(U1)作为稳压电路实现电源供给, HT7530 稳压 IC 芯片将电池电压稳定在 3V 通过 OUT+ 引脚给 STC12C5204AD 单片机供电, 同时起到为单片机内部的 AD 采集模块提供电压基准的作用。

[0035] 如图 2 所示, 本实施例的控制单元 3 设于电池 2 和电热片 41 之间, 控制单元 3 和电热片 41 之间设有用于隔热保护控制单元 3 并支承电热片 41 的隔热支撑云母片 40。隔热支撑云母片 40 能够对控制单元 3 起到隔热保护的作用, 防止电热片 41 的热量传递到控制单元 3 影响电路板上的电路元器件; 同时隔热支撑云母片 40 还对电热片 41 以及烤箱 4 起到支撑固定的作用。

[0036] 如图 2 所示, 本实施例的烤箱 4 为桶状, 电热片 41 构成烤箱 4 的桶底, 进气孔 42 设于电热片 41 上, 壳体 1 上设有通孔 16, 进气孔 42 与通孔 16 相连通, 通孔 16 设于壳体 1 上对应隔热支撑云母片 40 的位置; 当吸烟时, 壳体 1 外部的空气从设于壳体 1 上的通孔 16 进去壳体 1 的内腔, 然后通过进气孔 42 进入烤箱 4 的内腔, 将烤箱 4 内腔中蒸发形成的雾滴通过吸嘴孔 111 带入吸烟者的口腔。本实施例中, 烤箱 4 的桶壁采用钢管制成, 构成烤箱 4 桶底的电热片 41 与构成烤箱 4 桶壁的钢管焊接成桶状。本实施例中, 电热片 41 为厚膜电热片, 此外电热片 41 也可以根据需要采用其他类型的加热器。

[0037] 如图 2 和图 9 所示, 烤箱 4 上设有用于检测烤箱 4 温度的温度传感器 43, 温度传感器 43 与控制单元 3 相连, 控制单元 3 在工作状态时根据温度传感器 43 检测的温度控制电热片 41 的加热状态使烤箱 4 的工作温度保持在 $180^{\circ}\text{C} \sim 240^{\circ}\text{C}$ 之间, 当温度传感器 43 检测的温度到达 240°C 时控制单元 3 控制电热片 41 停止加热, 当温度传感器 43 检测的温度低于 180°C 时控制单元 3 控制电热片 41 进行加热。温度传感器 43 为负温度系数的热敏电阻 RT (负温度系数的热敏电阻 RT 的阻值与温度成反比, 温度越高则阻值越低), 温度传感器 43 设于烤箱 4 的桶壁上, STC12C5204AD 单片机通过 18 号引脚(ADCT)采集热敏电阻 RT 的电压, 通过输入的电压计算出热敏电阻 RT 的阻值, 再查表得出温度。当温度低于 180°C 时打开电热片 41 进行加热, 当温度高于 240°C 时关闭电热片 41 停止加热, 采用这种方法来达到恒温控制的效果, 从而使烤箱 4 的工作温度保持在 $180^{\circ}\text{C} \sim 240^{\circ}\text{C}$ 之间, 防止烟草组合物受热产生一氧化碳、焦油等有害物质。

[0038] 本实施例的工作过程如下:

(1) 充电: 需要充电时将 DC-5V 电源插头插到壳体 1 底部的 USB 充电接口 13 上, USB 充电接口 13 处的充电指示灯 14 则立即亮起, 同时 BUCK 充电电路控制电池 2 的充电电流和充电电压开始给电池 2 充电。充电过程中, 控制单元 3 上的单片机采集电池 2 的电量, 充电过程中充电指示灯 14 保持亮起, 当电池 2 的电量充满后控制单元 3 立即控制 BUCK 充电电路停止给电池 2 充电, 同时控制充电指示灯 14 熄灭。

[0039] (2) 使用: 取适量的烟草组合物放入烤箱 4 内并将本实施例装配好, 按一下控制开关 12, 则控制单元 3 控制电热片 41 通电开始加热, 此时加热指示灯 15 显示为红色, 同时控制单元 3 上的单片机通过温度传感器 43 获取烤箱 4 的温度。当温度传感器 43 检测到烤箱 4 的温度加热到 240°C 时, 控制单元 3 上的单片机控制电热片 41 停止加热, 同时控制加热指

示灯 15 的显示由红色变为绿色 ; 当温度传感器 43 检测到烤箱 4 的温度低于 180℃ 时控制单元 3 上的单片机控制电热片 41 通电加热, 同时控制加热指示灯 15 的显示由绿色变为红色 ; 这样循环往复, 使烤箱 4 的工作温度保持在 180℃ ~ 240℃ 之间, 烟草组合物在该温度区间内蒸发产生雾滴, 同时不会产生一氧化碳、焦油等有害物质 ; 而且不吸时烟草组合物蒸发形成的雾滴不会流出吸嘴 11 的外部形成二手烟。

[0040] 以上所述仅是本发明的优选实施方式, 本发明的保护范围并不仅局限于上述实施例, 凡属于本发明思路下的技术方案均属于本发明的保护范围。应当指出, 对于本技术领域的普通技术人员来说, 在不脱离本发明原理前提下的若干改进和润饰, 这些改进和润饰也应视为本发明的保护范围。

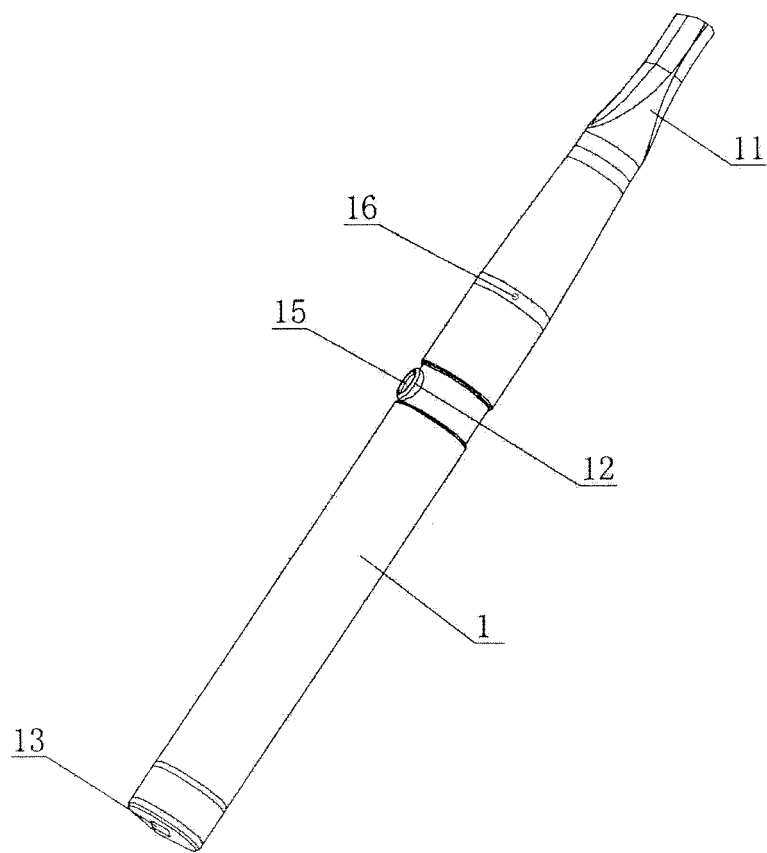


图 1

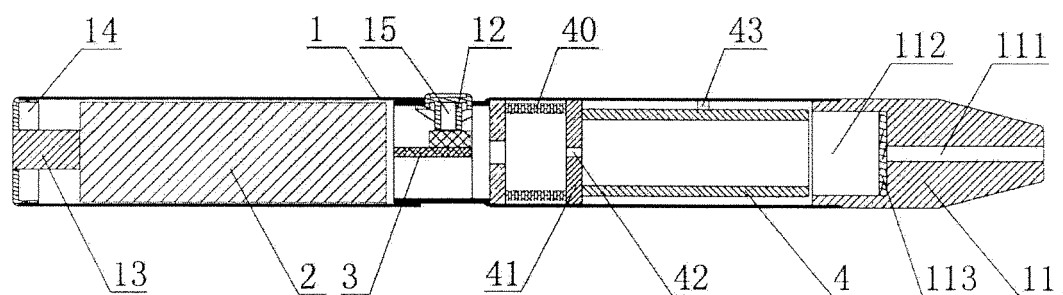


图 2

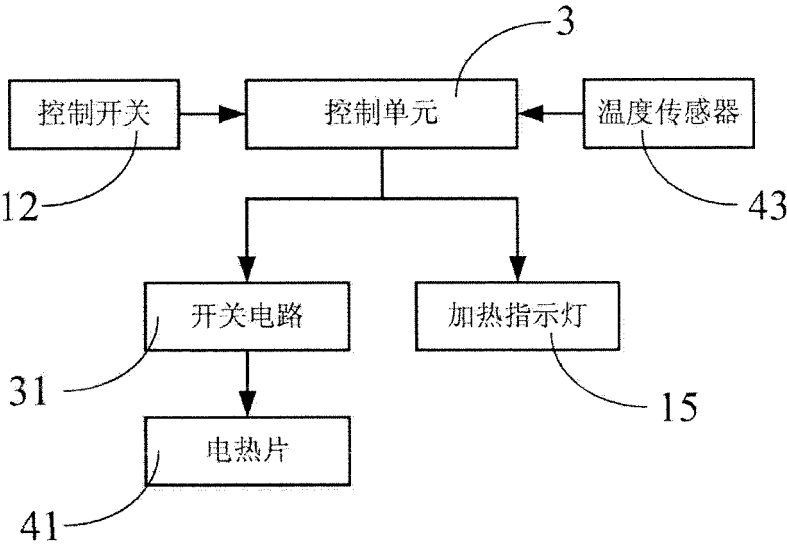


图 3

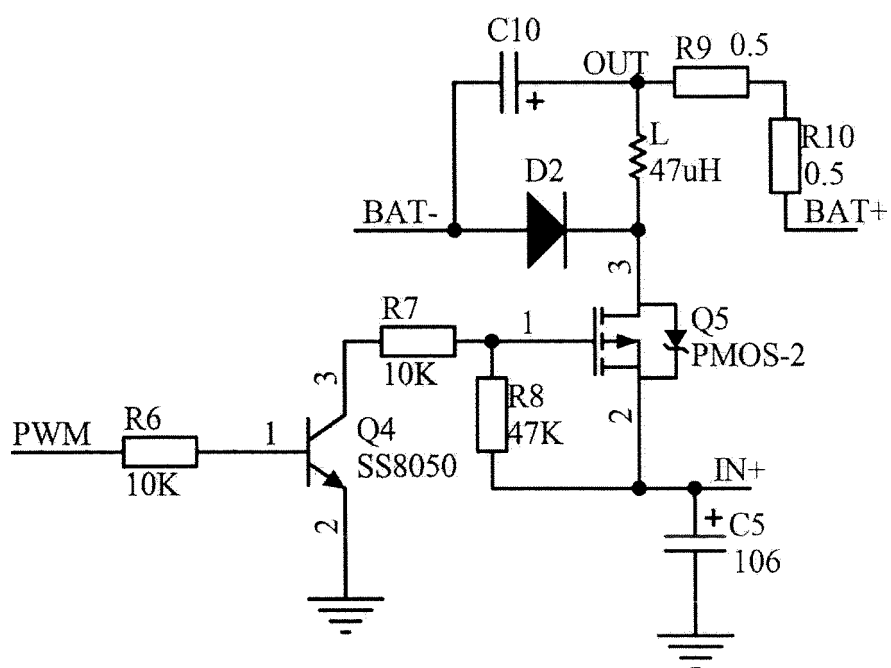


图 4

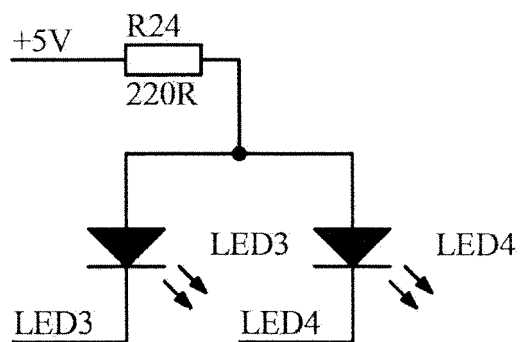


图 5

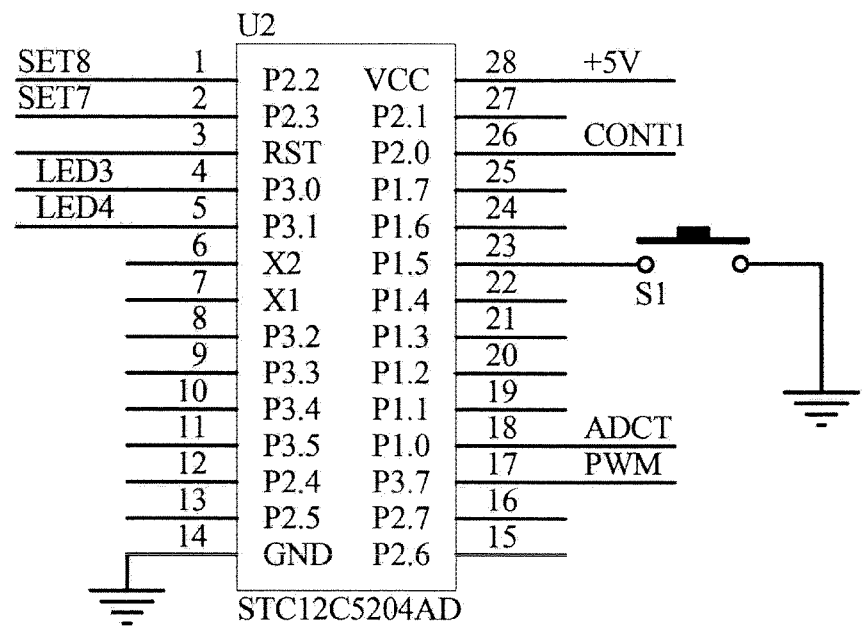


图 6

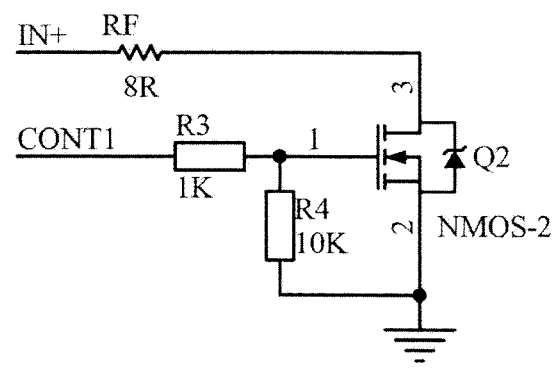


图 7

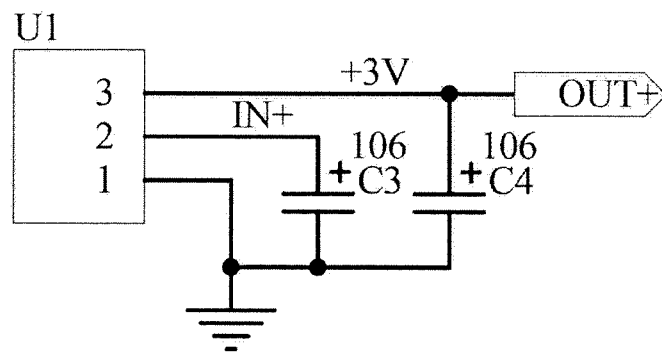


图 8

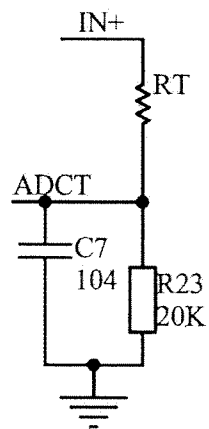


图 9

Patents

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Inventors [龙功运](#)
Applicant [龙功运](#)
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[Referenced by](#) (1), [Classifications](#) (1), [Legal Events](#) (2)

External Links: [SIPO](#), [Espacenet](#)

Evaporation type electronic cigarette
CN 102754924 A

Abstract

The invention discloses an evaporation type electronic cigarette which comprises a casing (1), a battery (2) and a control unit (3), wherein the battery (2) and the control unit (3) are arranged in the casing (1). One end of the casing (1) is provided with a suction nozzle (11), a control switch (12) for controlling a working state of an electric heating piece (41) is arranged on the casing (1) and is connected with the control unit (3), an oven (4) for placing tobacco compositions is further arranged in the casing (1), an air inlet hole (42) and the electric heating piece (41) for evaporating the tobacco compositions are arranged on the oven (4), the oven (4) is communicated with the suction nozzle (11), and the battery (2) is electrically connected with the electric heating piece (41) through the control unit (3). The evaporation type electronic cigarette has the advantages of being real in taste, small in volume and convenient to use, free of carbon monoxide, tar and passive smoking in combustion.

Claims(10) translated from [Chinese](#)

A method of evaporative electronic cigarette, comprising a housing (I) and located in the housing (I) the battery (2), the control unit (3), said housing (I) with one end of the nozzle (11), said housing (I) is provided for controlling the heater (41) operating state control switch (12), said control switch (12) and the control unit (3) is connected, characterized in that: the said housing (I) is also a composition for placing tobacco oven (4), said oven (4) is provided with inlet port (42) and means for heating the composition evaporation tobacco sheet (41), The oven (4) and the nozzle (11) communicates, said battery (2) by a control unit (3) and Heater (41) are electrically connected.

(2) as claimed in claim 1 wherein evaporative electronic cigarette, characterized in that: the oven (4) is provided for detecting the oven (4) a temperature sensor (43), said temperature sensor (43) and the control unit (3) is connected to said control unit (3) in the working condition of the temperature sensor (43) detects the temperature control of the heater (41) heating state of the oven (4) the operating temperature maintained at 180 ° C ~ 240 ° C, and when the temperature sensor (43) detects the temperature reaches 240 ° C when the control unit (3) controls the thermal plate (41) to stop heating, when the temperature sensor (43) detects a temperature below 180 ° C to control unit (3) controls the thermal sheet (41) for heating.

3 according to claim 2, wherein said evaporative electronic cigarette, characterized in that: the oven (4) of the barrel, said heater (41) constituting said oven (4) of the barrel end, the intake air hole (42) provided in the heating plate (41), said housing (I) is provided with a through hole (16), said air inlet port (42) and the through hole (16) connected to pass.

As claimed in claim 3, wherein the evaporative electronic cigarette, characterized in that: said control unit (3) provided in the battery (2) and the heater (41), said control unit (3) and Heater (41) is provided between heat protection control unit (3) and supporting the heating plate (41) supporting mica insulation (40).

5 according to claim 1 or 2 or 3 or 4, wherein the evaporative electronic cigarette, characterized in that: said nozzle (11) is provided with a nozzle hole (111), the nozzle (11) and the shell Body (I) socket, the nozzle (11) socket housing (I) and the nozzle end of a hole (111) communicating the recess (112), said recess (112) and the oven (4) disposed opposite the open end and said recess (112) and the oven (4) communicating the inner cavity, said recess (112) at the bottom of a composition for preventing tobacco from the nozzle hole (111) leakage nickel screen (113).

As claimed in claim 5, wherein said electronic cigarette evaporative, wherein: said control unit (3) comprises means for controlling heating plate (41) a heated state switching circuit (31), said heater (41) through the switching circuit (31) connected to the power.

As claimed in claim 6, wherein the electronic cigarette evaporative, wherein: said housing (I) is provided with a USB charging port (13), said battery (2) is a rechargeable lithium ion battery, the the control unit (3) is provided for adjusting the charging current and voltage charging circuit, said battery (2) through said charging circuit and the USB charging port (13) is connected.

As claimed in claim 7, wherein the evaporative electronic cigarette, wherein: said charging circuit for the BUCK charging circuit.

(10) according to claim 8, wherein the electronic cigarette evaporation, characterized in that: said housing (I) is provided with a charging circuit for indicating the state of charge of said charge indicator (14) and means for indicating Heater (41) of the heating state of the heating indicator (15), said charge indicator (14) with a USB charging port (13) connected to said heating indicator (15) with the control unit (3) is connected.

A process according to claim 9, wherein the evaporative electronic cigarette, characterized in that: said heater (41) is a thick film heater.

Description translated from Chinese

Electronic cigarette evaporative

Technology

[0001] The present invention relates to electronic cigarettes, specifically relates to a means of evaporation burning alternative to traditional methods of electronic cigarettes.

BACKGROUND

[0002] Today there are more than one billion smokers, and smoke produced during the main ingredients include nicotine, carbon monoxide, tar, etc., and the active ingredient in cigarettes is nicotine, most of the other ingredients are harmful, so Every year there are a lot of people died because of smoking. Therefore, smoking is prohibited in many public places, and even some national referendum smoking, but smoking addicts had to smoke, appeared on the market demand for such a wide range of electronic cigarettes, electronic cigarettes with cigarettes but taste the difference too, still can not meet the needs of smokers.

SUMMARY OF THE INVENTION

[0003] The present invention solves the technical problem is to provide a true taste of smoking does not produce carbon monoxide and tar, no smoke, compact, easy to use evaporative electronic cigarettes.

[0004] In order to solve the above problems, the present invention adopts the technical scheme is:

One kinds of evaporative electronic cigarette, comprising a housing and a battery located in the housing, a control unit, a nozzle at one end of said housing, said housing is provided with a heater for controlling the operating state of the control switch, the said control switch is connected with the control unit, the housing is also a composition for placing tobacco oven, the oven is provided with inlet port and means for heating the composition evaporate tobacco sheet, said nozzle communicating with the oven , the battery through the control unit is electrically connected with the heater.

[0005] As a further improvement of the technical proposal:

The oven oven temperature for detecting a temperature sensor, the temperature sensor is connected to the control unit, the control unit in the working condition detected by the temperature sensor controls the heater temperature heating state of the operating temperature of the oven maintained at $180^{\circ}\text{C} \sim 240^{\circ}\text{C}$, and when the temperature sensor detects the temperature reaches at 240°C the control unit controls the heater stops heating when the temperature sensor detects a temperature below 180°C when the control unit controls the heater for heating .

[0006] for the barrel of the oven, the oven heater constitutes the bottom of the barrel, said air inlet port is provided on the heater, said housing has a through hole, said air inlet port and through-hole.

[0007] The control unit is provided between the battery and the heater, said control unit and an electric insulating protective film is provided between the control unit and supporting the heater support mica insulation.

[0008] The nozzle is provided with a nozzle hole of the nozzle and the socket housing, one end of the nozzle socket housing has a recess communicating with the nozzle hole, said recess and disposed opposite the open end of the oven and the oven cavity and said groove communicates with the bottom of said recess for preventing tobacco compositions leaking from the nozzle hole nickel screen.

[0009] The control unit includes a heater for controlling the heating state of the switching circuit, said heater is connected to the power supply through the switching circuit.

[0010] The housing is provided with a USB charging port, the battery is a rechargeable lithium-ion battery, said control unit is provided for adjusting the charging current and voltage charging circuit, the battery through the charging circuit with USB charging connector.

[0011] BUCK of the charging circuit is a charging circuit.

[0012] provided on said housing for indicating charge status of the charging circuit and the charging indicator is used to indicate the state of heater heating heat indicator, the charging indicator light and USB charging port is connected to the heating indicator is connected to the control unit.

[0013] The electric heater is thick slice.

[0014] The present invention has the following advantages:

I, the present invention through the heater heating the tobacco evaporation of the droplet composition for smokers and smoking, the tobacco composition by evaporation alternative to traditional electronic cigarette burning in the form of liquid smoke, compared to the traditional electronic cigarette, with a taste of the real advantages.

[0015] 2, the housing of the present invention is also a composition for placing the tobacco in the oven, the oven is provided for evaporating the tobacco composition and inlet heater, the battery via the control unit and heater electrically connected through electric heating the tobacco sheet droplet evaporation of the composition, by means of evaporation alternative to the traditional way of burning, smoking does not produce carbon monoxide, tar and other harmful substances, and out of the droplet due to evaporation and need not smoke cigarette smoking in order to suck out above, is not will produce second-hand smoke, and the invention is only the size of traditional cigarettes, compact and easy to use.

BRIEF DESCRIPTION

[0016] Figure I of the present invention schematic perspective view of an embodiment.

[0017] Figure 2 is a sectional view of embodiment of the invention structure diagram.

[0018] Figure 3 is an embodiment of the invention the control unit and the peripheral circuit schematic diagram of frame structure.

[0019] Figure 4 is an embodiment of the invention a circuit schematic diagram of the charging circuit.

[0020] Figure 5 is an embodiment of the invention a circuit schematic diagram of the heating lamp.

[0021] Figure 6 is a embodiment of the invention the control unit and its peripheral circuits of the circuit diagram.

[0022] Figure 7 is an embodiment of the invention a circuit schematic diagram of the switching circuit.

[0023] Figure 8 is an embodiment of the invention the control unit circuit schematic diagram of the regulator circuit.

[0024] Figure 9 is an embodiment of the invention a circuit schematic diagram of the temperature sensor.

[0025] Legend: 1, shell; 11, nozzle; 111, nozzle holes; 112, the groove; 113, nickel wire mesh; 12, control switches; 13, USB charging port; 14, charging indicator light; 15, the heating light; 16, the through hole; 2, the battery; 3, the control unit; 31, open

OFF circuit; 4, oven; 40, mica insulation support; 41, heater; 42 intake; 43, the temperature sensor.

Specific embodiments

[0026] Figure I, as shown in Figure 2 and Figure 3, this embodiment includes a housing evaporative electronic cigarette located in the housing I 1 and the battery 2, the control unit 3, the housing has a suction end of I nozzle 11, the case I is provided with a heater 41 for controlling the operating state of the control switch 12, a control switch 12 is connected to the control unit 3, the housing I is also a composition for placing tobacco oven 4, 4 provided on the oven inlet 42 and a tobacco composition for evaporating heating sheet 41, the nozzle 11 communicates with the oven 4, cell 2 by the control unit 3 and the heater 41 are electrically connected. In operation, the control unit 3 controls the heater 41 heating the tobacco droplet evaporation of the composition, by the suction nozzle 11 smokers smoked tobacco droplet evaporation of the mixture, of this embodiment by means of evaporation to replace traditional combustion, due to evaporation out of the mist instead of smoke, so no carbon monoxide, tar and other harmful substances, and do not smoke when it does not produce smoke, use very convenient.

[0027] This embodiment mainly by the composition of tobacco in the tobacco powder and reconcile additives prepared from semi-solid mixture of the tobacco composition is $180^{\circ}\text{C} \sim 240^{\circ}\text{C}$ within the range of the heating and evaporation of the droplet does not produce carbon monoxide, tar and other harmful substances. Tobacco composition, the tobacco powder particle size of about about Imm, tobacco powder and additives, the mass ratio of harmonic may be (2-3): 1, in this embodiment the tobacco powder and the weight ratio of additive to reconcile for 2: 1; wherein the mixed solution is formulated additive harmonic state, harmonic additive comprises a mixed solution of the solute used as the solvent of propylene glycol and glycerol, propylene glycol and the mass ratio may be (3-5): 1, in this embodiment of glycerol and propylene glycol Specifically mass ratio of 3: 1. Furthermore harmonic additive also contains natural spices, natural flavors content can be adjusted according to need, in the present embodiment, the natural flavor and the mass ratio of glycerin 1: 3.

[0028] Figure 1, Figure 2 and Figure 3, the suction nozzle 11 is provided with a nozzle hole 111, the suction nozzle 11 and the socket casing 1, the suction nozzle 11 the socket end of the housing is provided with a suction I nozzle hole 111 communicating the groove 112, the groove 112 and the oven 4 and is disposed opposite the open end of the groove 112 communicates with the oven cavity 4, the groove 112 with the bottom of the composition for preventing tobacco leaking from the nozzle holes 111 nickel wire mesh 113. In this embodiment, since the recess 112 opposite the open end of the oven 4 to form the cavity disposed so that the tobacco composition placed more space, one composition can be placed more tobacco, nickel screen 113 can be prevented 4 oven from the tobacco composition in leakage nozzle holes 111; inlet port 42 is a pore size of 0.5 μm so, the composition can be prevented tobacco particle size of about 1 μm tobacco powder leakage from the inlet port 42 .

[0029] Figure 1 and Figure 2, the casing is provided with a USB charging port 13, the battery 2 is a rechargeable lithium ion battery, the control unit 3 is provided for adjusting the charging current and voltage charging circuit, the battery 2 through the charging circuit 13 is connected with a USB charging port. Rechargeable battery 2 can be used to reduce the cost. In addition, the battery 2 may also need to use other types of rechargeable batteries, or to use ordinary alkaline batteries.

[0030] Figure 4 and Figure 6, the charging circuit of this embodiment of the charging circuit BUCK, BUCK charging circuit STC12C5204AD PWM control terminal connected to the pin 17 of the microcontroller, BUCK charging circuit BAT + and BAT-and battery 2 is connected. BUCK charging circuit as a step-down chopper circuit, compared to conventional charging circuit having a circuit in terms of simple, low cost, high efficiency charging.

[0031] Figure 1, Figure 2, Figure 3 and Figure 5, the housing 1 is provided to indicate the charging state of the charging circuit 14 and the charge indicator 41 for indicating the heater lamp 15 heating a heated state The charging indicator 14 is connected with a USB charging port 13, the heating lamp 15 is connected with the control unit 3. Charge indicator of the present embodiment 14 is connected with USB charging interface 13 of the light emitting diodes, the heating lamp 15 to have a color display LEDs. Heating LED3 and LED4 LED 15 includes two light emitting diodes of which the red light-emitting diodes LED3, LED4 for the green light emitting diode emits light when LED3 4 represents the current temperature of the oven is lower

than 180 ° C, when the oven LED4 emits light of current 4 the temperature is 180 ° C ~ 240 ° C within the range.

[0032] Figures 2, 3 and 6, in the present embodiment, the control unit 3 is based STC12C5204AD MCU control circuit board, STC12C5204AD microcon-8 IObit AD acquisition module can be temperature, voltage analog signal a digital signal. STC12C5204AD microcontroller the 4th pin LED3 connected, STC12C5204AD microcontroller pin 5 is connected with LED4. Control switch 12 is diagram SI, and STC12C5204AD microcontroller 23 connected to the pin; STC12C5204AD microcontroller through the 26th pin (CONT1) and the switching circuit 31 is connected through the switching circuit 31 to control the heater 41.

[0033] Figure 2, Figure 3 and Figure 7, this embodiment includes a control unit 3 for controlling the heater 41 heating-state switch circuit 31, heater 31 through the switching circuit 41 is connected to the power supply, in addition to the control unit 3 through the drive circuit can be driven directly in the form of heated state of heater 41. In this embodiment, the switching circuit 31 based on the high drive implementation of the MOS transistor Q2, MOS transistor Q2 is a control terminal via a resistor R3 and STC12C5204AD connected to pins 26 of the microcontroller. Click the switch SI, then STC12C5204AD microcontroller 26 pin from low to high, thereby driving MOS transistor Q2 is turned on, heater 41 is energized and begin to heat. When the temperature sensor 43 detects the temperature reaches the set temperature, STC12C5204AD microcontroller 26 pin goes low, MOS transistor Q2 is off to stop heating.

[0034] Figure 8 shows, in this embodiment the control unit 3 using HT7530 regulator IC chip (UI) is supplied as a voltage supply circuit, HT7530 cell voltage regulator IC chip will stabilize at 3V to STC12C5204AD pin through OUT + MCU power supply, also play for the internal microcontroller AD acquisition module provides voltage reference role.

[0035] Figure 2, the present embodiment is provided in the battery control unit 3 and the heater 41 of 2, the control unit 3 and the heater heat shield 41 is provided between the control unit 3 and supports the heater 41 mica insulation support 40. Mica insulating support 40 of the control unit 3 can play a role in protection insulation, to prevent heating of the heat transfer sheet 41 to the control unit 3, a circuit board components affected; while mica insulating support sheet 40 is also of the heating 41 and the fixing oven 4 play a supporting role.

[0036] Figure 2, the present embodiment 4 of the barrel oven, electric oven sheet 41 constituting the bottom of the barrel 4, into the hole 42 is provided in the heater 41, the housing is provided with a through-hole 16 I, inlet 42 is connected through the through holes 16, through hole 16 provided in the corresponding housing I mica insulating support 40 position; when smoke, the housing I provided in the outside air from the through-hole housing I I, into the housing cavity 16, and then through the inlet 42 into the oven cavity 4, the oven cavity 4 formed by evaporation of the droplet in the nozzle hole 111 through the mouth into the smoker. In this embodiment, four bucket wall oven made of steel pipe to form an electric oven 4 barrel end piece 41 and constitute oven 4 steel welded into the barrel of the tank wall. In this embodiment, electric heater 41 is a thick film, in addition to heater 41 may also need to use other types of heaters.

[0037] Figure 2 and Figure 9, the oven 4 is 4 for detecting a temperature of the oven temperature sensor 43, temperature sensor 43 is connected to the control unit 3, the control unit 3 is in the working state, the temperature sensor 43 detects the temperature of the control heater 41 is heated state to the operating temperature of the oven 4 maintained at $180^{\circ}\text{C} \sim 240^{\circ}\text{C}$, and when the temperature sensor 43 detects the temperature reaches 240°C when the control unit 3 controls the heater 41 stops heating when the temperature sensor 43 detects the temperature below 180°C when the control unit 3 controls the heater 41 for heating. Temperature sensor 43 is a negative temperature coefficient thermistor RT (negative temperature coefficient thermistor resistance RT is inversely with temperature, the higher the resistance, the lower the temperature), a temperature sensor 43 located in the barrel wall on the oven 4, STC12C5204AD microcontroller through the 18th pin (ADCT) collected thermistor RT voltage input voltage is calculated through the thermistor resistance RT, and then look-up table derived temperatures. When the temperature is below 180°C the heater 41 is heated to open when the temperature at 240°C closed heating heater 41 is stopped, the use of this method to achieve the effect of temperature control, so that the operating temperature of the oven kept at $180^{\circ}\text{C} \sim 240^{\circ}\text{C}$ between the heated composition to prevent the tobacco to produce carbon monoxide, tar and other harmful substances.

[0038] The operation of this embodiment is as follows:

(I) Charging: Charging needed when the DC-5V power supply plug into the bottom of the housing 1 USB charging port 13, USB charging port 13 of the charge indicator 14 is lit immediately, control the battery charging circuit while BUCK 2 charge current and charge voltage begins to charge the battery 2. Charging process, the control unit 3 SCM Acquisition battery 2 battery, the charging process the charging indicator 14 remains lit when the battery is fully charged after 2 immediate control of the control unit 3 BUCK charging circuit stops charging the battery 2, while controlling Charging indicator 14 is off.

[0039] (2) Use: Take appropriate amount of tobacco compositions within the oven 4 and assembled this embodiment, click the control switch 12, the control unit 3 controls the heater 41 is energized start heating, then heat indicator 15 is shown in red, while the control unit 3 on the microcontroller through the temperature sensor 43 to obtain the temperature of the oven 4. When the temperature sensor 43 detects the temperature of the oven 4 is heated to 240°C , the control unit 3 of the SCM control heater 41 stop heating, heating lamp 15 while controlling the display changes from red to green; when the temperature sensor 43 detects 4 Oven temperature below 180°C when the control unit 3 controls the chip heating heater 41 is energized, while controlling the display of the heating lamp 15 from green to red; this cycle, the working temperature of the oven 4 is maintained at $180^{\circ}\text{C} \sim 240^{\circ}\text{C}$ between the tobacco composition is produced by evaporation of the droplet temperature range, but does not produce carbon monoxide, tar and other harmful substances; And when you do not smoke tobacco composition is formed by evaporation of the droplet does not flow nozzle 11 formed outside the smoke.

[0040] The above description is only preferred embodiments of the present invention, the scope of the present invention is not limited to the embodiment described above, where a part of the present invention is the technical solution idea of the present invention belong to the scope of protection. It should be noted that for the technical field of ordinary skill, without departing from

the principle of the invention under the premise of improvements and modifications, these improvements and modifications should also be regarded as the protection scope of the present invention.

Referenced by

Citing Patent	Filing date	Publication date	Applicant	Title
<u>WO2014047953A1</u> *	Sep 29, 2012	Apr 3, 2014	Wu Changming	Electronic smoking device

* Cited by examiner

Classifications

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Legal Events

Date	Code	Event	Description
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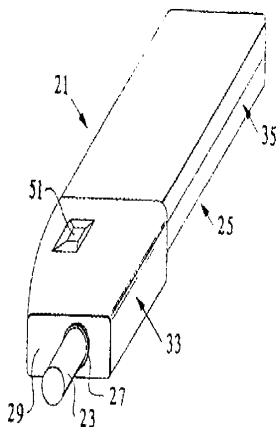
代理人 杨国旭

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[54]发明名称 传送烟香的电吸烟系统及其制造方法

[57]摘要

在本发明的吸烟系统中,含有烟香物质的可更换烟卷到安装在打火机内的一组电加热件的加热释放出蒸气或烟雾形式的烟草香味或其它成分供给吸烟者。本发明的烟卷和打火机可以提供通过该吸烟系统的各种气流流型,使空气横向往流入烟卷。这些流型改善了对吸烟者的烟雾和香味的供给,也减少了该吸烟系统中滞留在加热件区的蒸气或烟雾的凝聚。



(BJ)第 1456 号

权 利 要 求 书

1. 一种用于将烟草香味送给吸烟者的至少具有一个电加热器的吸烟系统的烟卷,其特征是所述烟卷包括:

一个承载管,所述承载管具有纵向相互分开的第一和第二端部和具有第一和第二表面,第一表面在第一和第二端部之间围出一个腔,第二表面有一个用来贴靠在一个电加热器上的区域;以及

一层烟香物质层,所述烟香物质层配置在承载管第一表面上,在受到加热时在腔内产生送给吸烟者的烟草香味,

其中所述承载管和烟香物质层允许横向气流流入腔内。

2. 一种送给吸烟者烟草香味的吸烟系统,其特征是所述吸烟系统包括:

一支可换烟卷,所述烟卷包括:

一个承载管,所述承载管具有纵向相互分开的第一和第二端部和具有第一和第二表面,第一表面在第一和第二端部之间围出一个腔,以及

一层烟香物质层,所述烟香物质层配置在承载管第一表面上,用来在腔内产生烟草香味;

一个打火机,所述打火机包括:

一个加热器,所述加热器通过第一端部接纳可换烟卷,以及

- 1 -

一组加热件,所述这组加热件配置在加热器内,每个加热件都有一个用来贴在烟卷第二表面上的表面,加热件用来加热烟香物质层,使得在腔内产生烟草香味;以及

驱动装置,所述驱动装置用来逐个驱动加热件,使得在腔内产生大小预定的烟草香味,

其中所述承载管和烟香物质层允许横向气流流入腔内。

3. 权利要求1或2所提出的烟卷,其特征是:其中所述承载管呈圆筒形,第一表面形成内表面,第二表面形成外表面。

4. 权利要求1、2或3所提出的烟卷,其特征是所述烟卷还包括;

一个自由气流过滤器,所述过滤器与承载管第二端部邻接,用来为烟卷提供结构支承和允许纵向气流出腔外;以及

一个后气流过滤器,所述过滤器与承载管第一端部邻接,用来为烟卷提供结构支承和限制纵向气流通过烟卷。

5. 权利要求4所提出的烟卷,其特征是:其中所述自由气流过滤器和后气流过滤器都是圆柱形的,每个都有一个圆腔表面。

6. 权利要求4所提出的烟卷,其特征是:所述烟卷还包括一个过滤嘴。

7. 权利要求6所提出的烟卷,其特征是:所述烟卷还包括包裹过滤嘴和至少一部分承载管的包端纸,用来将过滤嘴固定在承载管上。

8. 权利要求4所提出的烟卷,其特征是:所述烟卷还包括一个与第一自由气流过滤器邻接的第二自由气流过滤器,第一自由气流过滤器和第二自由过滤器上都开有纵向通道,第二自由气流过滤器的纵向通道的内径大于第一自由气流过滤器的纵向通道的内径。

9. 权利要求1至8中任何权利要求所提出的烟卷,其特征是:所述烟卷还包括包裹承载管的烟卷纸。

10. 权利要求1至9中任何权利要求所提出的烟卷,其特征是:其中所述承载管包括一层非织制碳纤维垫层。

11. 权利要求1至10中任何权利要求所提出的烟卷,其特征是:其中所述烟香物质层包括烟草物质。

12. 权利要求1至11中任何权利要求所提出的烟卷,其特征是:其中所述烟香物质层包括一片连续的烟草物质。

13. 权利要求1至11中任何权利要求所提出的烟卷,其特征是:其中所述烟香物质层包括一种经干燥的烟草浆物质。

14. 权利要求1至13中任何权利要求所提出的烟卷,其特征是:其中有一组气孔开在承载管和烟香物质层上,保证吸烟期间的所需横向气流。

15. 权利要求1至14中任何权利要求所提出的烟卷,其特征是:其中承载管和烟香物质层的透气率是预定的,保证所需的横向气流。

16. 一种在将烟草香味送给吸烟者的吸烟系统中与所换烟卷结合使用的打火机,其特征是所述打火机包括:

一个加热器,所述加热器通过第一端部接纳可换烟卷,具有向至少烟卷的某一部分提供气流的装置;

一组电加热件,所述这组电加热件配置在加热器内,每个加热件具有一个用来贴在烟卷供有气流那部分的表面上的表面;以及

一个驱动装置,所述驱动装置用来逐个驱动加热件,使得在烟卷内产生大小预定的烟草香味,当吸烟者抽吸插入打火机的烟卷时就有空气横向流入烟卷内。

17. 权利要求2或16所提出的打火机,其特征是:其中所述加热器包括安装在第一端部的盖帽,所述盖帽有一个敞开的端部,用来接纳烟卷。

18. 权利要求17所提出的打火机,其特征是:其中所述盖帽与烟卷压配合。

19. 权利要求17或18所提出的打火机,其特征是:其中所述提供气流的装置包括一个或几个开在盖帽上的气道。

20. 权利要求19所提出的打火机,其特征是:其中所述一个或几个气道是穿过盖帽的孔。

21. 权利要求19所提出的打火机,其特征是:其中所述一个或几个气道是开在盖帽内壁上的槽,这些槽将被插在打火机内的烟卷盖住。

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22. 权利要求17、18、19或20所提出的打火机,其特征是:其中所述加热器包括一个与盖帽围着一个接纳至少烟卷一个部分的空间的圆筒形壁。

23. 权利要求22所提出的打火机,其特征是:其中所述提供气流的装置包括一个或几个开在盖帽上、允许气流流入所述空间的气道。

24. 权利要求2或16所提出的打火机,其特征是:其中所述加热器包括一个围出一个接纳至少烟卷一个部分的空间的圆筒形壁。

25. 权利要求24所提出的打火机,其特征是:其中所述打火机中插有烟卷时,空气允许流入圆筒形壁和烟卷之间。

26. 权利要求24或25所提出的打火机,其特征是:其中所述提供气流的装置包括一个或几个穿过圆筒形壁的气道。

27. 权利要求26所提出的打火机,其特征是:其中所述一个或几个气道开在靠近加热器第一端部处。

28. 权利要求26所提出的打火机,其特征是:其中所述一个或几个气道开在靠近加热器第二端部处。

29. 权利要求26所提出的打火机,其特征是:其中有一组穿过圆筒形壁的分布气道。

30. 一种用于将烟草香味送给吸烟者的吸烟系统的加热件,其特征是所述加热件包括:

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一个第一端部、一个第二端部、以及一组处在第一端部与第二端部之间用来增加所述加热件电阻的弯曲区,所述加热件用具有基本处于一个平面内的第一和第二表面的电阻性材料制成,具有总长度 L 、总宽度 W 和厚度 T ,所述加热件的有效电长度大于 L 而有效电横截面积则小于 W 和 T 的乘积。

31. 权利要求30所提出的加热件,其特征是:其中所述这组弯曲区包括一组相互连接的S形区。

32. 权利要求31所提出的加热件,其特征是:所述加热件包括 N 个相互连接的S形区,其中 N 大于3而小于12。

33. 权利要求32所提出的加热件,其特征是:其中 N 大于6而小于10。

34. 权利要求30至33中任何权利要求所提出的加热件,其特征是:其中所述加热件的电阻大约在0.8欧至2.1欧的范围内。

35. 权利要求30至34中任何权利要求所提出的加热件,其特征是:其中所述电阻性材料包括一种在高达熔点的80%左右的温度下表面稳定的材料。

36. 权利要求30至35中任何权利要求所提出的加热件,其特征是:其中所述电阻性材料包括一种超级合金。

37. 权利要求36所提出的加热件,其特征是:其中所述超级合金基于至少一种从包括镍、铁和钴的组中选出的材料。

38. 权利要求30至35中任何权利要求所提出的加热件,其

特征是:其中所述电阻性材料是一种金属化合物。

39. 权利要求38所提出的加热件,其特征是:其中所述电阻性材料包括一种基于至少一种从包括镍的铝化物和铁的铝化物的组中选出的材料的抗氧化金属化合物。

40. 权利要求37所提出的加热件,其特征是:其中所述电阻性材料含有高于1%左右的铝。

41. 权利要求30至40中任何权利要求所提出的加热件,其特征是:其中所述第一和第二端部都伸出弯曲区组,而第一和第二端部以及弯曲区组是由一个单片材料形成的。

42. 权利要求30至41中任何权利要求所提出的加热件,其特征是:其中所述第一和第二端部以及弯曲区组的纵向中心线相互对准。

43. 权利要求30至42中任何权利要求所提出的加热件,其特征是:其中所述第一端部与弯曲区组之间的过渡区以及所述第二端部与弯曲区组之间的过渡区均都倒成斜角。

44. 权利要求30至43中任何权利要求所提出的加热件,其特征是:其中所述弯曲区组的邻接第一和第二端部的端部曲线朝向同一方向。

45. 一种制造一个用于将烟草香味传给吸烟者的吸烟系统的一体化加热组件的方法,其特征是所述方法包括以下工序:

将一片电阻性材料切割成至少在一端相互连结的一组加热

件;以及

将该片弯成圆筒形。

46. 权利要求 45 所提出的方法,其特征是:所述方法还包括将各加热件弯成至少一个部分朝圆筒形的中心线向内躬起的工序。

47. 权利要求 45、46 所提出的方法,其特征是:所述方法还包括将加热件边缘打光的工序。

48. 权利要求 45、46 或 47 所提出的方法,其特征是:在所述打光工序,加热件被电抛光。

49. 权利要求 45、46、47 或 48 所提出的方法,其特征是:其中所述材料片在被切割成加热件组后弯成一个圆筒形。

50. 权利要求 45 至 49 中任何权利要求所提出的方法,其特征是:所述方法还包括将连接各加热件的连接部的两个边缘焊接在一起的工序。

51. 权利要求 50 所提出的方法,其特征是:在所述焊接工序,所述边缘用一种激光焊接。

52. 权利要求 51 所提出的方法,其特征是:其中所述激光是钕铝石榴石(YAG)激光。

53. 权利要求 45 至 52 中任何权利要求所提出的方法,其特征是:在所述切割工序,所述电阻性材料片用一种激光加以切割。

54. 权利要求 53 所提出的方法,其特征是:其中所述激光是二

氧化碳(CO₂)激光。

55. 权利要求 45 至 52 中任何权利要求所提出的方法,其特征是:在所述切割工序,所述电阻性材料片采用冲压切割。

56. 权利要求 45 至 52 所提出的方法,其特征是:在所述切割工序,所述电阻性材料片采用精密冲压切割。

57. 权利要求 45 至 52 所提出的方法,其特征是:在所述切割工序,所述电阻性材料片采用化学研磨切割。

58. 权利要求 45 至 52 所提出的方法,其特征是:在所述切割工序,所述电阻性材料片采用化学蚀刻切割。

59. 一种烟卷,其特征是所述烟卷包括:

一片导热基片,所述导热基片弯成圆筒形,具有一个接收热量的外表面和一个内表面;以及

一层烟香物质层,所述烟香物质层配置在至少部分内表面上,当基片外表面受热时,烟香物质就释放出烟草香味。

60. 权利要求 59 所提出的烟卷,其特征是所述烟卷还包括包裹在外表面上的烟卷纸。

61. 一种适宜与一个离散热源配合的烟草制品,其特征是:所述烟草制品包括一片碳纤维和烟草纤维的基片和一层沿基片的第一表面配置的烟香物质层,碳纤维垫层适合接收在第二表面的至少一个部位处的热能并把该热能的绝大部分传送给烟香物质层的靠近该部位的部分部分。

62. 权利要求 61 所提出的烟草制品,其特征是:其中所述基片呈一个具有一个内腔的中空基片筒。

63. 权利要求 62 所提出的烟草制品,其特征是所述烟草制品还包括:

一个自由气流过滤器,所述过滤器与基片筒的第二端部邻接,用来为基片筒提供结构支承和允许纵向气流流出腔外;以及

一个后气流过滤器,所述过滤器与基片筒的第一端部邻接,用来为基片筒提供结构支承和限制纵向气流流出腔外。

64. 权利要求 63 所提出的烟草制品,其特征是:其中所述自由气流过滤器后气流过滤器都是圆柱形的,都有一个围腔表面。

65. 权利要求 63 或 64 提出的烟草制品,其特征是:所述烟草制品还包括一个与自由气流过滤器邻接的过滤嘴。

66. 权利要求 65 所提出的烟草制品,其特征是:所述烟草制品还包括包裹过滤嘴和至少一部分基片筒的包端纸,用来将过滤嘴固定在基片筒上。

67. 权利要求 63、64、65 或 66 所提出的烟草制品,其特征是:所述烟草制品还包括一个与第一自由气流过滤器邻接的第二自由气流过滤器,第一自由气流过滤器和第二自由气流过滤器上都开有纵向通道,第二自由气流过滤器的纵向通盖的内径大于第一自由气流过滤器的纵向通道的内径。

68. 权利要求 63 至 67 中任何权利要求所提出的烟草制品,

其特征是:所述烟草制品还包括包裹基片筒的烟卷纸。

69. 权利要求 63 至 68 中任何权利要求所提出的烟草制品,其特征是:其中所述基片筒上开有一组气孔,保证吸烟期间所需的横向气流。

70. 权利要求 63 至 69 中任何权利要求所提出的烟草制品,其特征是:其中所述基片筒的透气率是预定的,保证所需的横向气流。

71. 一种用于一个将烟草香味送给吸烟者的吸烟系统的可更换烟卷,该吸烟系统包括一个具有配置在一个长期性腔内的电加热装置的打火机,所述可更换烟卷的特征是它包括:

一个承载管,所述承载管具有一个第一端部和一个第二端部和具有一个第一表面和一个第二表面,第一表面在第一端部和第二端部之间围出一个用来产生烟草香味的致香腔,而第二表面用来贴靠在电加热装置上;

一层烟香物质层,所述烟香物质层配置在承载管的第一表面上,当电加热装置受到驱动时,烟香物质层的受到加热装置加热的相应部分产生大小预先确定的烟草香味送给吸烟者;以及

过滤装置,所述过滤装置用来对送给吸烟者前的烟草香味进行过滤。

72. 权利要求 71 所提出的可更换烟卷,其特征是其中所述过滤装置包括:

一个自由气流过滤器,所述过滤器与承载管第二端部邻接,适合配置在致香腔与吸烟者的嘴之间,用来为烟卷提供结构支承;以及

一个后气流过滤器,所述过滤器与承载管第一端部邻接,用来过滤烟草香味的向后气流,使得残余烟草香味凝聚在打火机的加热装置和长期性腔的一些部分上的凝聚量大大减少。

73. 权利要求 72 所提出的可更换烟卷,其特征是:其中所述承载管形成一个具有一个内表面和一个外表面的中空圆筒,电加热装置就贴靠在承载管的外表面上,而所述烟香材料层配置在圆筒形承载管的内表面上,在承载管内产生烟草香味。

74. 权利要求 73 所提出的可更换烟卷,其特征是:其中所述自由气流过滤器和后气流过滤器都是圆柱形的,都有一个形成承载管致香腔相应部分的表面。

75. 权利要求 74 所提出的可更换烟卷,其特征是:所述可更换烟卷还包括一个与承载管同心、直径大于承载管的圆筒形烟雾阻挡管,阻挡管的内表面与承载管的外表面围出一个容纳电加热装置的区域,阻挡管减少了残余烟草香味在打火机长期性腔的各部分上的凝聚量。

76. 权利要求 75 所提出的可更换烟卷,其特征是:其中所述圆筒形烟雾阻挡管由一个用具有高抽吸阻力的材料制成的套环卡到自由气流过滤器上,套环限定了所述可更换烟卷的加热件接纳

区的大小。

77. 权利要求 76 所提出的更换烟卷,其特征是所述可更换烟卷还包括:

一个与自由气流过滤器邻接的圆柱形过滤嘴;以及

包裹烟雾阻挡管和过滤嘴的烟卷纸,所述烟卷纸将过滤嘴固定到烟雾阻挡管上。

78. 权利要求 76、77 所提出的可更换烟卷,其特征是:其中所述承载管包括一个非织制的碳纤维垫层。

79. 权利要求 78 所提出的可更换烟卷,其特征是:其中所述碳纤维垫层的定量大约为 6 克/米² 至 12 克/米²。

80. 权利要求 79 所提出的可更换烟卷,其特征是:其中所述烟香物质层包括烟草物质。

81. 权利要求 80 所提出的可更换烟卷,其特征是:其中所述烟香物质层包括一片连续的烟草物质。

82. 权利要求 80 所提出的可更换烟卷,其特征是:其中所述烟香物质层包括一种泡沫烟草物质。

83. 权利要求 80 所提出的可更换烟卷,其特征是:其中所述烟香物质层包括一种烟草物质的凝胶。

84. 权利要求 80 所提出的可更换烟卷,其特征是:其中所述烟香物质层包括一种经干燥的烟草物质的浆液。

85. 权利要求 80 所提出的可更换烟卷,其特征是:其中所述

烟香物质层包括一种经干燥的烟草物质的喷涂浆液。

86. 权利要求 72 至 85 中任何权利要求所提出的可更换烟卷,其特征是:其中所述承载管形成一个具有一个内表面和一个外表面的中空圆筒,电加热装置配置在承载管的内部,而所述烟香物质层配置在圆筒形承载管的外表面上,在承载管的外部产生烟草香味。

87. 权利要求 86 所提出的可更换烟卷,其特征是:其中所述自由气流过滤器和后气流过滤器都是环形的,都有一个形成产生烟草香味的致香腔的相应部分的表面。

88. 权利要求 87 所提出的可更换烟卷,其特征是:所述可更换烟卷还包括一个圆筒形的随烟雾阻挡管一个用来产生烟草香味的腔,所述阻挡管减少了残余烟草香味在打火机的长期性腔的一些部分上的凝聚量。

89. 权利要求 88 所提出的可更换烟卷,其特征是:所述可更换烟卷还包括一个用一种具有高抽吸阻力的材料制成的圆柱形柱塞,用来塞柱自由气流过滤器的空的中央部分。

90. 权利要求 89 所提出的可更换烟卷,其特征是所述可更换烟卷还包括:

一个与自由气流过滤器邻接的圆柱形过滤嘴;以及

包裹烟雾阻挡管和过滤嘴的烟卷纸,用来将过滤嘴到烟雾阻挡管上。

91. 权利要求 72 至 90 中任何权利要求所提出的可更换烟卷,其特征是:其中所述烟香物质层包括一层随部位改变的烟香物质层,使得送给吸烟者的烟草香味股股有选择性地改变。

92. 权利要求 71 所提出的可更换烟卷,其特征是:所述可更换烟卷还包括一个向吸烟者指示烟卷曾插入过打火机的标记。

93. 权利要求 92 所提出的可更换烟卷,其特征是:其中所述标记必需从烟卷上取下才能将烟卷插入打火机。

94. 权利要求 92 所提出的可更换烟卷,其特征是:其中所述标记是烟卷上的一个在烟卷插入打火机时会遭到机械性改变的区域。

95. 权利要求 71 所提出的可更换烟卷,其特征是:所述可更换烟卷还包括一个向吸烟者指示烟卷曾被加热过的标记。

96. 权利要求 95 所提出的可更换烟卷,其特征是:其中所述标记受热后颜色改变,指示烟卷已被加热过。

97. 权利要求 71 所提出的可更换烟卷,其特征是:其中所述承载管包括一个非织制碳纤维垫层,垫层的电阻率按特定烟卷类型预先选定,使得打火机的一个控制系统可以对不同类型的烟卷加以区别。

98. 一种制造用于一个将烟草香味送给吸烟者的吸烟系统的可更换烟卷的方法,该吸烟系统包括一个具有配置在一个长期性腔内的电加热装置的打火机,所述方法的特征是它包括以下工序:

a)提供一条具有一系列烟香物质区域的承载管基片;

b)在承载管基片的表面上涂上一系列分别处在相互隔开的烟香物质区之间的粘合剂区;

c)将这过滤器材料附着在承载管基片表面的各粘合剂区上;

d)将承载管基片围着过滤器材料包裹起来,形成一根过滤器材料区和烟香物质区相互交替的连续棒;以及

e)将连续棒在各过滤器材料区处切断,形成一支可更换烟卷。

99. 权利要求 98 所提出的方法,其特征是:其中所述过滤器材料附着工序是将圆柱形的过滤器材料附着上去。

100. 权利要求 99 所提出的方法,其特征是:其中所述过滤器材料附着工序是交替将自由气流过滤器材料和后气流过滤器材料附着到粘合剂区上,形成不断重复的自由气流过滤器材料、烟香物质、后气流过滤器材料、烟香物质的区域。

101. 权利要求 98、99 或 100 所提出的方法,其特征是:其中所述连续棒切断工序是将每个过滤器材料区从中间切断,交替形成一对后气流过滤器和一对自由气流过滤器。

102. 权利要求 101 所提出的方法,其特征是:所述方法还包括对可更换烟卷进行加工以在后气流过滤器上形成一个弯曲插入端的工序。

103. 权利要求 101 或 102 所提出的方法,其特征是:所述方法还包括在每个自由气流过滤器上加一个直径大于连续棒的直径、

长度等于切下的烟卷的长度的圆筒形烟雾阻挡管的工序。

104. 权利要求 102 或 103 所提出的方法,其特征是所述方法还包括以下工序:

在每个自由气流过滤器上加一个过滤嘴;

用包装材料将每个烟雾阻挡管及其相应过滤嘴包裹起来。

105. 一种用来制造用于一个将烟草香味送给吸烟者的吸烟系统的可更换烟卷的设备,该吸烟系统包括一个具有配置在一个长期性腔内的电加热装置的打火机,所述设备的特征是它包括:

供料装置,用来提供一条具有一系列烟香物质区的承载管基片;

粘合剂施加装置,用来在承载管基片的表面上涂上一系列分别处在相隔开的烟香物质区之间的粘合剂区;

过滤器附着装置,用来将过滤器附着在承载管基片表面的各粘合剂区上;

包裹装置,用来将承载管基片围着过滤器包裹起来,形成一根过滤器区和烟香物质区相互交替的连续棒;以及

切断装置,用来将连续棒在各过滤器区处切断,形成一支可更换烟卷。

106. 权利要求 105 所提出的设备,其特征是:其中所述过滤器附着装置用来附着圆柱形过滤器。

107. 权利要求 106 所提出的设备,其特征是:其中所述过滤

器附着装置用来交替地将自由气流过滤器和后气流过滤器附着到粘合区上,形成不断重复的自由气流过滤器、烟香物质、后气流过滤器、烟香物质的区域。

108. 权利要求 105、106 或 107 所提出的设备,其特征是:其中所述切断装置用来将每个过滤器从中间切断。

109. 权利要求 108 所提出的设备,其特征是:所述设备还包括在后气流过滤器上形成一个弯曲插入端的装置。

110. 权利要求 108 所提出的设备,其特征是:所述设备还包括在每个自由气流过滤器上加一个直径大于连续棒直径、长度等于切下的烟卷的长度的圆筒形烟雾阻挡管的装置。

111. 权利要求 110 所提出的设备,其特征是所述设备还包括:过滤嘴附加装置,用来在每个自由气流过滤器上加一个过滤嘴;以及

包裹装置,用来用包装材料将每个烟雾阻挡管及其相应过滤嘴包裹起来。

112. 一种用于一个将烟草香味送给吸烟者的吸烟系统的长期性加热器,所述加热器是吸烟系统中的打火机的一个部件,吸烟系统具有一支可更换烟卷,可更换烟卷具有配置在一个具有相反的第一表面和第二表面的承载管的互一表面上的烟香物质层,所述长期性加热器的特征是它包括:

一个加热件基座,所述基座限定一个接纳一支可更换烟卷的

腔的一个第一端,这个腔具有一个从第一端到第二端的气道,允许空气从中通过;以及

一组长期性电加热件,所述加热件组配置在加热件基座上,每个加热件都有一个用来贴靠在承载管第二表面上的表面,当电加热装置被驱动时,烟香物质层的受到加热装置加热的相应部分产生大小预先确定的烟草香味送给吸烟者。

113. 一种将烟草香味送给吸烟者的吸烟系统,其特征是所述吸烟系统包括:

一个长期性加热器,所述加热器包括一个限定一个接纳一支可更换烟卷的腔的一个第一端的加热件基座,这个腔有一个从第一端到第二端的气道,允许空气从中通过;

一组长期性电加热件,所述电加热件组配置在加热件基座上,每个加热件都有一个用来贴靠在可更换烟卷上的表面;

一个电源,所述电源用来向工长期性加热件提供电能;

一个控制装置,所述控制装置用来将电能加到长期性加热件上,有选择地加热长期性加热件组中的至少一个加热件;以及

一支可更换烟卷,所述可更换烟卷容纳在加热件腔内,贴靠在长期性加热件组上,

在所述吸烟系统中,当任一个电加热件被驱动时,烟香物质层中受到该加热件加热的相应部分产生一股大小预先确定的烟草香味送给吸烟者。

114. 权利要求 112 或 113 所提出的长期性加热器,其特征是:
其中所述腔是圆柱形的,而所述加热器包括一组配置成从加热件
基座第一端伸出的细长的支承指,每个支承指都有一个内表面和
一个外表面,这些支承指排列成限定一个圆柱表面。

115. 权利要求 114 所提出的长期性加热器,其特征是:其中
所述长期性加热件组安装在加热件支承指的内表面上。

116. 权利要求 115 所提出的长期性加热器,其特征是:其中
所述腔用来接纳一个后气流过滤器,该过滤器配置在一个加热件
基座气道与长期性加热件之间。

117. 权利要求 116 所提出的长期性加热器,其特征是:其中
所述后气流过滤器是圆柱形的。

118. 权利要求 112 或 113 所提出的长期性加热器,其特征是:
其中所述腔是圆环形的,而所述加热器还包括一组配置成从加热
件基座第一端伸出的细长的支承指,每个支承部有一个内表面和
一个外表面,这些支承指排列成限定一个圆柱表面。

119. 权利要求 118 所提出的长期性加热器,其特征是:其中
所述长期性加热件组安装在加热件支承指的外表面上。

120. 权利要求 119 所提出的长期性加热器,其特征是:其中
所述加热件基座的腔用来接纳一个后气流过滤器,该过滤器配置
在一个加热件基座气道与长期性加热件组之间。

121. 权利要求 120 所提出的长期性加热器,其特征是:其中

所述后气流过滤器是圆环形的。

122. 权利要求 115 所提出的长期性加热器,其特征是:其中
所述长期性加热件组包括硅半导体材料。

123. 权利要求 122 所提出的长期性加热器,其特征是:其中
所述硅半导体材料掺有磷杂质,浓度为 5×10^{18} 杂质/厘米³ 至 5×10^{19} 杂质/厘米³ 左右。

124. 权利要求 119 所提出的长期性加热器,其特征是:其中
所述长期性加热件组包括硅半导体材料。

125. 权利要求 124 所提出的长期性加热器,其特征是:其中
所述硅半导体材料掺有磷杂质,浓度为 5×10^{18} 杂质/厘米³ 至 5×10^{19} 杂质/厘米³ 左右。

126. 一种将烟草香味送给吸烟者的吸烟系统,其特征是所述
吸烟系统包括:

一个打火机,所述打火机包括:

一个加热件基座,所述基座预定一个接纳一支可更换烟卷的
腔的一个第一端,这个腔具有一个从第一端到第二端的气道,允许
空气从中通过;

一组长期性电加热件,所述加热件组配置在加热件基座上,每
个加热件都有一个用来贴靠在可更换烟卷上的表面,

一个电源,所述电源用来向长期性加热件组提供电能,和

一个控制装置,所述控制装置用来将电能加到长期性加热件

上,有选择地加热长期性加热件组中的一个加热件;以及

一支可更换烟卷,所述可更换烟卷包括:

一个承载管,所述承载管具有一个第一端部和一个第二端部和具有一个第一表面和一个第二表面,第一表面在第一端部和第二端部之间围成一个用来产生烟草香味的致香腔,第二表面贴靠在电加热装置上,

一个过滤装置,所述过滤装置用来对在送给吸烟者前的大小预定的烟草香味进行过滤,和

烟香物质层,所述烟香物质层配置在承载管的第一表面上,

在所述系统中,当任何一个电加热件被驱动时,烟香物质层中被加热装置加热的相应部分产生一股大小预先确定的烟草香味送给吸烟者。

127. 一种烟草香味送给吸烟者的吸烟系统,其特征是所述吸烟系统包括:

一个打火机,所述打火机包括:

一个电加热装置,所述电加热装置配置在一个长期性腔内,

一个电源,所述电源用来向电加热装置提供电能,和

一个控制装置,所述控制装置用来将电能加到电加热装置上,有选择地加热电加热装置的一组加热件中的至少一个加热件;以及

一支可更换烟卷,所述可更换烟卷包括:

一个承载管,所述承载管具有一个第一端部和一个第二端部和具有一个第一表面和一个第二表面,第一表面在第一端部和第二端部之间围成一个用来产生烟草香味的致香腔,第二表面贴靠在电加热装置上,

一个过滤装置,所述过滤装置用来对在送给吸烟者前的大小预定的烟草香味进行过滤,和

烟香物质层,所述烟香物质层配置在承载管的第一表面上,

在所述吸烟系统中,当任何一个加热件被驱动时,烟香材料层中被该加热件加热的相应部分产生一股大小预先确定的烟草香味送给吸烟者。

128. 权利要求 113 所提出的吸烟系统,其特征是:其中所述电源包括一个电池。

129. 权利要求 128 所提出的吸烟系统,其特征是:其中所述电源包括一个接到电池的充电泵电路,用来提升电池电压。

130. 权利要求 129 所提出的吸烟系统,其特征是:其中所述电池是一次性的。

131. 权利要求 129 所提出的吸烟系统,其特征是:其中所述电池是可再充电的。

132. 权利要求 113 所提出的吸烟系统,其特征是:其中所述控制装置包括一个用来在电加热件组中选择一个电加热件的装置,和一个在吸烟者抽吸吸烟系统时用来提供一个电能脉冲加热

所选中的那个电加热件的装置。

133. 权利要求 132 所提出的吸烟系统,其特征是:其中所述选择装置是手动的。

134. 权利要求 132 所提出的吸烟系统,其特征是:其中所述选择装置是自动的。

135. 权利要求 134 所提出的吸烟系统,其特征是:其中所述自动选择装置电加热件组中的每个加热件。

136. 权利要求 134 或 135 所提出的吸烟系统,其特征是:其中所述控制装置还包括一个顺序指示装置,用来指示电加热件组中还可顺序加热的加热件数,直至加热件组中的所有加热件都已为一只所抽吸的烟驱动了至少一次。

137. 权利要求 136 所提出的吸烟系统,其特征是:其中所述顺序指示装置包括一个液晶显示器。

138. 权利要求 137 所提出的吸烟系统,其特征是:其中所述液晶显示器通过反复通断指示电池电压已降到预定的低电压值以下。

139. 权利要求 137 所提出的吸烟系统,其特征是:其中所述液晶显示器在电池电压降低于预定的低电压值时在在电池电压在降低于预定的低电压值后已被充到预定的高电压值时发出指示。

140. 权利要求 137 所提出的吸烟系统,其特征是:其中所述

液晶显示器在没有可更换烟卷装在打火机内时发出指示。

141. 权利要求 137 所提出的吸烟系统,其特征是:其中所述液晶显示器在没有加热器装在打火机内时发出指示。

142. 权利要求 132 所提出的吸烟系统,其特征是:其中所述脉冲提供装置提供一个宽度预定的脉冲。

143. 权利要求 132 所提出的吸烟系统,其特征是:其中所述脉冲提供装置根据所要求供给所选中的加热件的能量提供一个宽度预定在 0.5 秒至 5 秒左右的脉冲。

144. 权利要求 143 所提出的吸烟系统,其特征是:其中所述脉冲提供装置根据要求供给所选中的加热件的能量提供一个宽度预定在 1 秒至 3 秒左右的脉冲。

145. 权利要求 144 所提出的吸烟系统,其特征是:其中所述脉冲提供装置根据要求供给所选中的加热件的能量提供一个宽度预定在 1 秒至 2 秒左右的脉冲。

146. 权利要求 132 至 145 中任何权利要求所提出的吸烟系统,其特征是:其中所述电能脉冲包括一个具有预定电能的脉冲。

147. 权利要求 146 所提出的吸烟系统,其特征是:其中所述预定电能为 5 焦耳至 40 焦耳左右。

148. 权利要求 147 所提出的吸烟系统,其特征是:其中所述预定电能为 15 焦耳至 25 焦耳左右。

149. 权利要求 132 至 148 中任何权利要求所提出的吸烟系

统,其特征是:其中所述脉冲提供装置包括一个驱动装置,所述脉冲提供装置根据吸烟者对该驱动装置的驱动提供脉冲。

150. 权利要求 149 所提出的吸烟系统,其特征是:其中所述驱动装置包括一个压敏传感器。

151. 权利要求 149 或 150 所提出的吸烟系统,其特征是:其中所述驱动装置循环地接通断开,以节约电源。

152. 权利要求 150 所提出的吸烟系统,其特征是:其中所述驱动装置在小于给定周期的 50% 左右内接通。

153. 权利要求 152 所提出的吸烟系统,其特征是:其中所述驱动装置在小于给定时间周期的 20% 左右内接通。

154. 权利要求 153 所提出的吸烟系统,其特征是:其中所述驱动装置在小于给定时间周期的 5% 左右内接通。

155. 权利要求 113、128 至 154 中任何权利要求所提出的吸烟系统,其特征是:其中所述控制装置包括一个现场可编程逻辑阵列。

156. 权利要求 132 至 155 中任何权利要求所提出的吸烟系统,其特征是:其中这控制装置还包括一个电压检测电路,用来检测电池电压降低于预定的低电压值的时刻和检测电池电压在降低于预定的低电压值后已充电到预定的高电压值的时刻。

157. 权利要求 156 所提出的吸烟系统,其特征是:其中所述预定的低电压值为小于 5 伏左右,而所述预定的高电压值为大于

5 伏左右。

158. 权利要求 157 所提出的吸烟系统,其特征是:其中所述预定的低电压值为 3 伏至 3.5 伏左右,而所述预定的高电压值为 5 伏至 6 伏左右。

159. 权利要求 113、128 至 158 中任何权利要求所提出的吸烟系统,其特征是:其中所述承载管包括一个具有预定电阻率的非织制碳纤维垫层,该预定电阻率与一种特定类型的烟卷相应,从而使打火机可以区别烟卷的一些不同类型。

160. 权利要求 159 所提出的吸烟系统,其特征是:其中所述控制装置包括:

一个选择装置,所述选择装置用来从电加热件组中选出一个加热件;以及

一个脉冲提供装置,所述脉冲提供装置用来在吸烟者抽吸烟系统时提供一个电能脉冲加热所选中的那个电加热件。

161. 权利要求 160 所提出的吸烟系统,其特征是:所述吸烟系统还包括一个测量预定电阻率的装置。

162. 权利要求 161 所提出的吸烟系统,其特征是:在所述吸烟系统中,如果测到一个第一预定电阻率,则提供一个第一电能脉冲加热所选中的电加热件,如果测到一个第二预定电阻率,则提供一个第二电能脉冲加热所选中的电加热件。

传送烟香的电吸烟系统及其制造方法

本发明与由烟卷和打火机构成的吸烟系统及其制造方法有关。

在我们的美国专利No. 5, 060, 671中揭示了一种电吸烟物品, 该专利在此列为参考。该专利所揭示的吸烟物品有一组一次性使用的电加热件。每个电加热件上都装有含诸如烟草或从烟草中提炼出来的物质之类的具有烟草香味的媒质。一次性使用的加热器/香料组合接到诸如电池或电容器那样的提供电能的电源和根据吸烟者抽吸该吸烟物品或按压手动开关驱动加热件的控制电路上。控制电路设计成每次抽吸至少使一个但不是全部加热件启动工作, 使得有一定股数, 每股含一定数量的具有烟草香味的物质(例如含烟草香味的烟雾或散发烟草香味的响应)传送给吸烟者。控制电路也能防止任何一个加热件再次启动, 从而避免了过分加热上面的烟草香料。

使用这样的物品, 加热器在用完剩余的烟草物质后就要扔掉。此外, 加热器与电池之间的电连接必需能经得住不断更换香料组件的反复插拔。

在我们的1991年3月11日提出的、现已由1993年2月2日提出的后续申请No. 08/012, 799所代替的相关未决美国专利No. 07/666, 926中, 揭示了一种电吸烟物品, 它具有一组可重复使用的加热件和一个一次性使用的产生烟草香味的部分。这个一次性使用部分包括一个香料段和一个用包端纸或其它固定结构连接起来

的过滤段。然而, 由于使用了重复使用的加热件, 这种物品工作起来有一些问题, 特别是残留的烟尘会积聚在这种物品的加热件和其它一些长期使用的结构件上。

本发明的目的是使以上提出的问题得到改善。

一种体现本发明的吸烟系统包括烟卷和打火机, 其优点是烟的传送得到改善。一种体现本发明的吸烟系统的优点是打火机的加热件可重复使用, 使一次性使用部分的体积降到最小。

一种体现本发明的系统的优点是使得烟尘在打火机的加热件和其它构件上的积聚大大减少。

一种体现本发明的吸烟物品及其制造方法的优点是制造容易、成本低, 甚至可以用现代技术的大规模生产速度进行生产。

本发明的各实施例还可以具有使烟雾和香味传送给吸烟者得到改善的优点。

按照体现本发明一个方面的优选实施例, 提供了一种在含有加热装置的将烟草香味传送给吸烟者的吸烟系统中使用的烟卷。这种烟卷包括一个承载管, 该承载管具有在继向上相互分开的第一端和第二端, 还具有第一表面和第二表面。第一表面在第一端和第二端之间围成了一个腔, 第二表面包括一个可与加热装置紧贴的区域。具有烟草香味的物质配置在承载管的第一表面上。这种烟草物质在受到加热装置加热时在腔内产生烟草香味传送给吸烟者。承载管和烟草物质可以允许横向气流进入腔内。

按照体现本发明另一个方面的优选实施例, 提供了一种在将烟草香味送给吸烟者的吸烟系统中与可更换烟卷配合使用的打火机。这种打火机包括一个通过它的第一端接纳一支可更换烟卷的加热器。这个

加热器具有至少向可更换烟卷的某一部分提供横向气流的装置。在加热器内装有一组电加热件。每个加热件都有一个可贴靠在烟卷上通过横向气流那部分上的表面。打火机中还装有驱动这组电加热件中一个或几个电加热件的装置，使得在烟卷内可以产生一股大小预定的烟草香味。横向气流在吸烟者抽吸掉在打火机内的烟卷时产生。

按照体现本发明第三方面的优选实施例，提供了一种将烟草香味传递给吸烟者的吸烟系统。这种系统逐个驱动电加热件工作，使得在烟卷的腔内产生一股大小预定的烟草香味。

按照体现本发明第四方面的优选实施例，提供了一种在将烟草香味传递给吸烟者的吸烟系统中使用的加热件。这种加热件包括一个第一端、一个第二端和一组在第一和第二端之间、用来增加加热件电阻的弯曲区。加热件用电阻材料制成，具有大致配置在一个平面内的第一和第二表面。其总长度为L，总重量为W，厚度为T。加热件的有效电长度大于L，而加热件的有效电截面积则小于W和T的乘积。

按照体现本发明第五方面的优选实施例，提供了一种在将烟草香味传递给吸烟者的吸烟系统中使用的集成加热组件的制造方法。

按照这种方法，一片电阻性材料切成一组至少在一端相互连接的加热件。这片材料卷成一个圆筒形状。

下面将结合附图举例说明体现本发明各个方面的一些实施例。在这些附图中：

- 图1为体现本发明的一个吸烟系统的示意性透视图；
- 图2为体现本发明的一个吸烟系统的局部剖开的示意性透视图；
- 图3A为体现本发明的一个加热器的侧面剖视图；
- 图3B为沿图3A的3B-3B可剖取的端视图；

- 图4A为体现本发明的一支烟卷的示意性透视图；
- 图4B为沿图4A的4B-4B所剖取的侧剖视图；
- 图5为体现本发明的一个加热器的示意性组合视图；
- 图6为体现本发明的一个加热组件的透视图；
- 图7为体现本发明的一个加热组件的展开外形图；
- 图8为体现本发明的一个加热件的局部透视图；
- 图9为体现本发明的一个引线组件的透视图；
- 图10A为体现本发明的一个衬套的示意性侧剖视图；
- 图10B为沿图10A的10B-10B所剖取的示意性视图；
- 图10C为沿图10A的10C-10C所剖取的示意性视图；
- 图11A为体现本发明的一个基座的示意性侧剖视图；
- 图11B为沿图11A的11B-11B所剖取的示意性视图；
- 图11C为沿图11C-11C所剖取的示意性视图；
- 图12A为体现本发明的一个衬套基底组合构件的示意性透视图；
- 图12B为沿图12A的12B-12B所剖取的示意性侧剖视图；
- 图12C为沿图12A的12C-12C所剖取的示意性视图；
- 图12D为沿图12A的12D-12D所剖取的示意性视图；
- 图13为本发明一个实施例中的一个环的端视图；
- 图14A为本发明一个实施例中的一个端帽的示意性透视图；
- 图14B为沿图14A的14B-14B可剖取的示意性侧剖视图；
- 图14C为沿图14A的14C-14C所剖取的示意性视图；
- 图14D为沿图14A的14D-14D所剖取的示意性视图；

图15A为体现本发明的一个加热套的示意性侧视图；
图15B为沿图15A的15B-15B所剖取的端视图；
图16和17为一个吸烟系统的一些部分的示意性侧视图，示出了在这个吸烟系统中气流的通路；

图18为示出体现本发明的电路配置的电原理图；
图19为体现本发明的另一个吸烟系统的示意性侧剖视图；
图20为体现本发明的另一个加热器的示意性侧剖视图；
图21为制造图19吸烟系统的一次性烟卷的组成部分的设备的示意性透视图；

图22为体现本发明的吸烟系统的一个周边抽吸实施例的示意性剖视图；

图23为示出体现本发明的另一种电路配置的电原理图；以及
图24为图23中控制电路的一个定时网络的电原理图。

图1和2示出了本发明的一种包括一支烟卷23和一个可反复使用的打火机25的吸烟系统21。烟卷可以插入打火机25前端29的孔口27和从孔口27取下。吸烟系统21在使用方式上非常象平常的烟卷。烟卷23在吸了一次或几次后扔掉，而打火机则在吸了好些烟卷后才扔。

具有机壳31的打火机25有前部33和后部35。在打火机25的后部35中装有为加热烟卷23的加热件供电的电源37。后部35最好通过诸如螺钉或簧扣之类的装置可方便地打开和合上，以利于更换电源。在前部33中装有与后部35内电源37电连接的加热件和电路装置。前部33通过诸如燕尾榫接合或插座式配合可方便地插到后部35上。机壳31用硬的耐热材料制成，如金属基底材料，

更值得推荐的是聚合物基底材料。机壳31做成可舒适地握在吸烟者手中的形状，总尺寸为10.7厘米×3.8厘米×1.5厘米。

一定大小的电源37为加热烟卷23的加热件提供足够的功率。电源37最好是可更换和可充电的，可以含有一个电容或一个电池之类的器件。在所介绍的优选实施例中，电源是一个开路电压大约为4.8伏至5.6伏的可更换充电电池（实际上是用四个镍镉电池串联而成的）。然而，电源37的特性要根据吸烟系同21的其它器件，特别是加热件的情况加以选定。美国专利No.5,144,962介绍了几种可用于本发明的吸烟系统的电源，例如可充电电池式电源和用电池充电的快速放电电容式电容。因此该专利在此列参考专利。

在打火机的前部33装有一个加热烟卷23、使烟卷夹在打火机25上的圆筒形的加热器39和一个将一定能从电源37传送给加热器中各加热件（未在图1和2中示出）的控制电路41。在所介绍的这个优选实施例中，加热器39包括8个沿径向分开的加热件43，如图3A所示。这些加热件在电路41的控制下逐个得到电源37的供电，对围着烟卷23外周的8个区域进行加热，以便产生8股烟草香味。虽然加热件43的数目可以不是8个，但最好是8个，因为在一支常规的烟卷上标称有8股，并且8个加热件适合用二进制器件进行电控制。

电路41由一个抽烟驱动转感器45（见图2）启动工作。这个传感器对在吸烟者吸烟卷23时所发生的压力改变或气流改变敏感。抽吸驱动传感器45安装在打火机25的前部33，通过一个穿过加热

器的衬套49和基座50的通道47以及,如果需要的话,一根吸烟传感管(未示出)与加热器39内靠近烟卷23的空间相通。在美国专利No.5,060,671中介绍了一种抽吸驱动传感器45,很适合用在这个吸烟系统21,该专利在此列为参考。这种传感器为伊里诺斯州付里普特的好耐威尔公司微开关部(Microswitch division of Honeywell, Inc., Freeport, Ill.)所制造的163PC01D35型硅传感器。当吸烟者抽吸烟卷23时所引起的压力改变使该传感器启动加热件43中的一个适当加热件工作。那些利用热线测风原理的气流传感器也已成功地证明可用于根据对气流变化的检测来启动一个适当的加热件43。

打火机25的外表面上装有一个指示器51,最好装在前部33上,用来指示插入打火机中的烟卷23还剩几股烟没吸。指示器51包括一个7段液晶显示器。在这个优选实施例中,当光传感器53(见图2)检测到它所发出的光束从一支新插入的烟卷23前端反射时,指示器51就显示出数字“8”。光传感器53安装在加热器39的衬套49和基座50中的开口55内,如图3A所示。光传感器53向电路41提供信号,而电路41将信号加到指示器51上。指示器51显示数字“8”表示每支烟卷23上有8股烟可吸,也就是说,这些加热件43中还没有一个曾启动加热这支新的烟卷。烟卷23全部吸完后,指示器51显示数字“0”。当烟卷23从打火机25上取下时,光传感器53检测不到烟卷23,指示器51关掉。光传感器23调整成不是一直发出光束的状态,以减小不必要的电源37的损耗。适用于吸烟系统21的优选光传感器51是OPR5005型光传感器,由奥普特克技

术公司(OPTEK Technology, Inc., 1215 West Crosby Road, Carrollton, Texas 75006)制造。

上述光传感器53也可以用其它形式的来代替。例如可以安装一个机械开关(未示出)来检测是否有烟卷23,可以安装一个复位按钮(未示出),在一支新的烟卷插入打火机25时使电路41复位,例如使指示器51显示数字“8”,等等。适用于本发明吸烟系统21的电源、电路、抽吸传感器和指示器在列为参考的美国专利No.5,060,671中有介绍。在衬套49和加热器基座50中的通道47和开口55在吸烟期间最好是气密的。

图4A和4B详细地示出了一支吸烟系统21所用的优选烟卷23,虽然这烟卷也可以是其它所要求的形式,只要能在被加热件43加热时产生烟草香味传送给吸烟者。烟卷23包括一个烟草卷57,由承载含烟草的烟香物质61的承载管或送烟管59构成。烟草卷57一端包在一个圆柱形的后气流过滤器63上,而另一端包在一个圆筒形的第一自由气流过滤器65上。第一自由气流过滤器65是一个管状过滤器,中央有一个纵向通道67,因此对抽吸阻力很小,气流自由。

需要的话,在烟草卷57上卷一层烟卷纸69。可以用作烟卷纸69的纸包括低定量(单位重量)纸,最好是带有烟草香料涂层的纸或含烟草的纸,以增强散发烟草香味响应的烟草香味。在烟卷纸69上可以涂上浓缩提取液或加以稀释的浓缩提取液。烟卷纸69最好是定量低厚度薄的纸,但要有足够的拉伸强度,以便于机器处理加工。含烟草的纸最好具有下述特性:

定量在20—25克/米²之间(相对湿度为60%),最小透气率为0—25柯莱斯特(CORESTA 定义为在压强差为1.0千帕斯卡下一分钟内通过一平方厘米物质(如纸张)的以立方厘米为单位的空气量),拉伸强度为对于27毫米(1英寸)宽大于等于2000克,厚度为1.3—1.5密耳,碳酸钙含量小于等于5%,柠檬酸盐为0%。用来制造烟卷纸69的材料最好包括大于等于75%的含烟草薄片(非雪茄型、液或液气固化的混合填料和洁净茎)。可以加一些亚麻纤维,但量以能得到满足要求的拉伸强度为限。烟卷纸69也可以是定量为15—20克/米²的普通亚麻纤维纸或带有提取物涂层的这种纸。可以加一些柠檬果胶型粘合剂,其量不大于1%。也可以加一些甘油,其量应以能得到普通烟卷纸那样的刚度为限。

烟卷23还包括一个圆柱形的过滤嘴71和一个圆筒形的第二自由气流过滤器73。过滤嘴71最好是一个普通的阻流型过滤器。包端纸75将过滤嘴71和第二自由气流过滤器73紧裹在一起。包端纸75伸过第二自由气流过滤器73的顶端,粘在烟卷纸69上,将第一自由气流过滤器65的顶端紧接到第二自由气流过滤器73的顶端。象第一自由气流过滤器65那样,第二自由气流过滤器73中央也开有一个纵向通道77。后气流过滤器63和第一自由气流过滤器65与烟草卷57围成了一个烟卷23内的腔79。

最好第二自由气流过滤器73的纵向通道77的内径大于第一自由气流过滤器65的纵向通道67的内径。纵向通道的内径最好在1至4毫米之间,而纵向通道77的内径最好在2至6毫米之间。业已发现,通道67和77内径不同有利于在加热具有烟香物质而产生的

烟雾与吸烟期间从烟卷23外吸入的空气之间形成所希望的混合和混流,使散发烟草香味的响应得到改善,并且过滤器71的端部可以更多地暴露在混合烟雾之中。加热烟香物质而产生的散发烟草香味的响应在腔79内主要是汽相的,而在通道77内由于混合作用而转化为可见烟雾。第一自由气流过滤器65除了采用上述带有一个纵向通道67的结构外,也可以采用其它能使气相的烟草香味与引入的空气产生所希望的混合的结构。例如,第一自由气流过滤器可以做成一个具有大量小孔的过滤器形式,也就是说第一自由气流过滤器可以呈蜂窝状或开有一系列孔的金属板状。

空气最好绝大部分是横向(径向)通过烟草卷57和烟卷纸69而不是纵向通过后气流过滤器63吸入烟卷23内。然而,如以下所要说明的那样,在吸烟卷上的第一股烟期间希望允许气流通过后气流过滤器进入,这样可以降低对抽吸的阻力。可以理解,纵向将空气吸入烟卷23会造成不能使由于围烟草卷57径向配置的加热件43加热烟草卷57而产生的烟雾有效地从腔79排出。现在希望的是,所产生的烟草香味几乎完全取决于烟草卷57的结构成分和加热件43的能量。因此,除了第一股烟外,在吸烟期间纵向通过后气流过滤器63的那部分气流越小越好。此外,后气流过滤器63可以在烟香物质61得到加热后使向后流出腔79的烟雾流为最小,以减少从烟卷向后流出的烟雾损坏打火机25器件的可能性。

承载烟香物质61的承载管或送烟管59将加热件43与烟香物质61隔开,将加热件所产生的热传导给烟香物质61,以及使吸过的烟卷不致散开。所推荐的承载管59包括一个热性能稳定的非织制

碳纤维垫层构成的那些承载管。这些承载管在同一受让人1992年9月11日提出的相关未决美国专利申请No. 07/943, 747中有详细的讨论。该专利在此列为参考。这些垫层最好厚度大约在0.05毫米至0.11毫米之间，由非织制碳纤维组成，其定量大约在6克/米²至12克/米²之间，而纤维直径大约在7微米至30微米之间。纤维的长度应保证垫层经得住加工期间所受到的拉伸应力。最好，垫层应含有适用于电吸烟物品（即具有主观能接受性质）的粘合剂。

其它的承载管59包括低质量的网状金属筛或多孔金属箔。例如，可以使用质量大约为5克/米²至15克/米²、线径大约为0.038毫米（1.5密耳）至0.076毫米（3.0密耳）的金属筛。另一个实施例是用一片厚为0.0064毫米（约0.25密耳）的金属箔（如铝箔）来构成承载管，上面冲有一系列直径约为0.3毫米至0.5毫米的孔，使金属箔的质量相应减小30%至50%。最好，金属箔上的孔交错或不连续排列排列（即不排成直线），以减小离开烟香物质61的侧向热传导。

这类金属筛和金属箔能以不同方式结合入烟卷23中。例如：
(1)将具有烟草香味的浆液涂在一条带上在干前将筛或箔叠在湿的浆液上，(2)用适当的粘结剂将筛或箔粘到具有烟草香味的基片或垫层上。由于使用金属承载管会导致加热件43本身及各加热件之间的电短路，这种金属承载管通常不直接与加热件接触。因此在使用金属承载管的场合，要用适当的粘合剂在金属承载管外粘上诸如烟卷纸69那样的低定量纸，以使金属承载管59与电加热件43

绝缘。

现在所推荐的烟草卷57是采用造纸工艺过程制造的。在这种工艺过程中，首先用水冲洗烟草条。可溶物在以后的上涂层工序中使用。剩下的（所提取的）烟草纤维用来构成基垫。将碳纤维分散在水中，加入藻酸钠。也可以加入任何其它水解胶体来代替藻酸钠，只要这种水解胶体不干扰散发烟草香味的效应，可溶于水，以及具有适当的分子量以增加烟草卷57的强度。将这分散物与所提取的烟草纤维的浆液和可选用的香料混合。将所得到的混合物湿敷分一个长网上，通过传统造纸机的其余部分，就形成一个基垫。最好用一个配置在一个滚筒亦即杨基干燥器后的逆转辊涂器将冲洗烟草条冲下的可溶物涂在基垫的一侧。烟草的可溶物与烟草微粒之比最好在1:1至20:1之间。浆液也可以浇到或挤到基垫上。或者，上涂层工序脱机进行。在上涂层期间或以后，加上烟卷工业中常用的香料。加入果胶或其它水解胶体，量在0.1%至2.0%之间，以改善浆液的可涂性。

无论采用哪种承载管59，配置在这种承载管内表面上的烟香物质61要能附着到承载管的表面上，在受到加热放出烟草香味。这些物质包括呈片状的、泡沫状的、凝胶状的，也可以是经干燥的浆液或经干燥的喷涂浆液。这些物质虽然不一定、但最好含有烟草或从烟草中提取的物质，这在以上引用的美国专利申请No. 07/943, 747中有比较详细的讨论。

最好，在处理期间烟草卷57中加入诸如甘油或丙二醇那样的湿润剂，其量为烟草卷重量的0.5%至10%。湿润剂由于起着烟

雾母体的作用，有利于形成可见烟雾。当吸烟者喷出含有烟草香味和湿润剂的烟雾时，湿润剂在大气中凝聚，而凝聚的湿润剂就形成了普通烟卷的烟雾。

由于本发明的烟香物质61配置在承载管59的表面，因此可以特意改变发出的烟味的特性，使得各股烟味类型都不相同。例如，邻近第一个加热件43的烟香物质61可以含有第一种香料，而邻近第二个加热件的烟香物质61含有量和类型都不同的第二种香料。因此，通过将非一致的烟香物质配置在承载管表面，可以使吸烟者有选择地吸到不同的烟味。例如，吸烟者可以在将烟卷插入打火机25时将一次性使用的烟卷23相对长期使用的加热件按需定位，这样，一个特定的加热件就能对非一致烟香材料的一个预定部分进行加热。

此外，按照本发明，可以通过向加热件43提供可控能量有选择地改变烟草香味。例如，如果提供给第一上加热件43的能量（如20焦耳）大于提供给第二个加热件43的能量（如1.5焦耳），那么第一个加热件所达到的温度一般就要高于第二个加热件所达到的温度。因此，第一个加热件一般产生比第二个加热件大一些的烟草香味。这样，通过改变传送给各股的能量就能有选择地控制烟草香味的大小。

烟卷23最好直径不变，象普通烟卷一样，大致为7.5毫米至8.5毫米，使吸烟者对吸烟系统21的“口感”与普通烟卷一样。在这个优选实施例中，烟卷23的总长度为58毫米，因此可以用普通的包装机来包装这种烟卷。过滤嘴71加上第二自由气流过滤器

73的长度为30毫米。包端纸75伸出第二自由气流过滤器73顶端5毫米，包在烟草卷57上。烟草卷57的长度为28毫米。烟草卷57的两端分别支承在长度为7毫米的后气流过滤器63和长度为7毫米的第一气流过滤器63上。由烟草卷57、后气流过滤器63和第一自由气流过滤器65围成的腔79的长度为14毫米。

当烟卷23插入打火机25前端29的孔口27内时，烟卷23就邻接或几乎邻接加热器39中衬套49的底内面81，与和抽烟驱动传感器45相通的通道47以及安装光传感器53的开口55相邻，如图3A所示。在这个位置上，烟卷23的腔79紧贴加热件43，而烟卷的第二自由气流过滤器73和过滤器71部分全都留在打火机25外，各加热件43都有一部分径向内偏，以利将烟卷23相对打火机25保持在适当位置，使得加热件可以直接或通过烟卷纸69将热传给烟草卷57。因此，烟卷23最好是能挤压的，以便使加热件43可以压进烟卷的侧面。

通过烟卷23的气流有几种方式。例如，在图4A和4B所示的烟卷23的实施例中，烟卷纸69和烟草卷57都是充分透气的，以便得到所要求的抽吸阻力，使得在吸烟者抽吸烟卷时空气横向（径向）通过烟卷纸和烟草卷流入腔79。如前面所提到的那样，透气的后气流过滤器69可以用来使空气纵向流入腔79。

必要的话，可以在一个或几个邻近腔79的区域上开一系列穿透烟卷纸69和烟草卷57的气孔（未示出），以利于横向气流流入腔79。已经发现，这些气孔可以改善散发烟草香味的响应和烟雾的形成。穿透烟草卷57的气孔的密度大约为每1至2平方毫米1个，

每个气孔的直径在0.4毫米至0.7毫米之间，相应的柯莱斯特 (CORESTA) 气孔率在100至500之间。烟卷纸69的透气率最好在100至1000柯莱斯特之间。当然，为了得到所希望的诸如抽吸阻力那样的吸烟特性，也可以用不同于以上所述的气孔密度和相关的气孔直径。

也可以通过穿透烟卷纸69的烟草卷57两者的气孔（未示出）来改善横向气流进入腔79的情况。在加工这种具有这类气孔的烟卷23时，可以先将烟卷纸69和烟草卷57贴在一起再打孔，也可以分别打孔后再贴在一起，使得各气孔叠合对准。

图3A和3B示出了加热器39的一个优选实施例。图5示出了一个经修改的加热器39A的实施例的分解剖视图，这个加热器39A具有一个组合衬套和基座的构件49A。加热器39A的构件49A代替了图3A所示的加热器39的衬套49和基座50。无论是图3A—3B或图5所示的加热器都具有提供容纳烟卷23的空间和提供加热烟卷23的加热件43的通常功能。

由图3A和3B可见，加热器39配置在打火机25的孔口27内。烟卷23从后气流过滤器63开始插入打火机25的孔口27，进到加热器39的大体呈柱状的空间内。加热器39包括：一个具有接纳烟卷的开口端的环形盖帽83，一个可选用的筒形加热件保护套85，一个筒形气道套87，一个包括一些加热件43的加热组件89，一个用作加热组件的各加热件的公共引线的导电销或公共引线组件91，以及衬套49。衬套49的底内面81将烟卷23挡住在加热器39内适当位置上，使得加热件43紧贴烟卷内的腔79。在图5所示的加热器39A

中，构件49A的底内面81A将烟卷23挡住在加热器39A内适当位置上。

整个加热器39基本上配置在内部，通过与打火机25前部33的机壳31紧密配合紧固就位。盖帽83的前缘93配置在打火机25的前端29，或者稍稍伸出，最好有一个内倒角或倒圆部分，以利于引导烟卷23插入加热器39。加热组件89的各加热件43和销组件91的各销95都在相应部位由环99通过摩擦配合紧固在衬套49的外表面97周围。各加热件43的尾端101以及两个销95的尾端103分别焊到卡住在基座50上的相应的销104上，这些销104通过基座50的各孔107伸出基座50的外底面105（见图3B），接到电路41和电源37上。销104应该十分紧密地卡在基座50上，使得空气不致通过孔107流入。销104可以插入相应的插座（未示出），使加热件39在打火机25内得到支持。从插座引出的导线或印刷电路引线接到各种电路元件上。另外两个销95提供了附加支持，使销组件91的强度有所加强。衬套49和基座50内的通道47通到抽吸驱动传感器45和检测打火机25中是否插有烟卷23的光传感器53。

类似，在图5所示的加热器39A中，加热组件89的各加热件43的销组件91的各销95都在相应部位由环99通过摩擦配合紧固在构件49A的外表面97A周围。各加热件43的尾端101以及两个销95的尾端103伸出构件49A的外底面105A，以使接到电路41和电源37上。

构件49A有一个凸缘109，上面至少开了两个槽或孔107A，两个销95的尾端103通过这两个孔107A穿过外底面105A。另外两个销95用来提高销组件91的强度。加热件43的尾端101弯成符合凸

缘109的形状,沿凸缘的外侧111伸出外底面105A。构件49A内的通道47通到抽吸驱动传感器45和检测打火机25中是否插有烟卷23的光传感器53。

图3A、5和6中所示的加热组件89最好是用一片具有高机械强度的耐高温超级合金材料经激光切割而成的单片。这片材料通过冲或激光切割形成至少图7所示的加热组件89的概略外形片115。

在外形片115中,各加热件43相互在尾端101由切割外形片115的尾部117连在一起,在前端119由形成加热组件89前部121那部分连在一起。两个侧部123在尾部117和前部121之间。尾部117和侧部123虽然最后要切去,但有利于加工期间对外形片115进行处理。

在形成了外形片115后,每个加热件43都有一个以后要贴在烟草卷57上的宽部125和一个要与电路41连接的窄部127。需要的话,每个加热件43的窄部127在靠近尾端101处有凸起部129,以便于与销104焊接或插入插座(未示出)与电路41电连接。概略外形片115再加以处理,最好还是用激光切割,在宽部125形成如图6和8所示的蛇形“轨迹”131。当然,需要的话,在形成外形片115的同时就可以切割出轨迹131。

割好的片最好加以电抛光,使各加热件43的边缘圆滑平整。加热件43的边缘圆滑使烟卷23可方便地插入打火机25,不会受到阻碍。割好的片卷在一个型架(未示出),形成筒形。切去后部117和侧部123,将前部121的两个边缘133焊在一起,就形成了如图6所示的一个整体的加热组件89。

加热组件89也可以用其它合用的方法制造。例如,一种方法是首先将一片材料初加工成一个筒(未示出),再加以切割,形成如图6所示的一组独立的加热件。也可以将一些离散的加热件43通过点焊之类接到一个起着象前部121那样作为各加热件的公共电极和机械支持作用的公共环或带(未示出)上。此外,可以将加热组件89的前部121焊或接到一个内径大体等于烟卷23直径的定径环(未示出)上。这一定径环有利于筒形加热组件保持所要求的形状和增加强度。

图9所示的销组件91可以用与以上所述的制造加热组件89相类似的其中一个方法制造。象加热组件89一样,各个销95和形成销组件91前部135的带形部也是从一片平的导电材料上割下后卷起焊成一个筒形。销组件91的内径做成大体等于加热组件89的外径。加热组件89的前部121安装在销组件91的前部135内,用点焊将这两部分焊在一起,使得四个销95分别配置在各对相邻加热件43之间的开口空间内。如图3B所示,四个销95(在本优选实施例中只有两个真正电连接到穿过基座50的销104上)都径向配置在离8个加热件43中相邻的那两个 22.5° 角的位置上,接到伸出基座的销104上。

本发明的打火机25的各种实施例都设计成能在标准的使用条件下将烟草香味有效地传送给吸烟者。具体地说,希望8股烟将5至13毫米,最好是7至10毫米的烟雾传送给吸烟者,每股烟持续2秒,35毫升。已经发现,为了达到这个目的,加热件43应该在将热传给烟卷23情况下能达到大约 200°C 至 900°C 。此外,加热件43

应该消耗大约5至40焦耳的能量，最好是大约10至25焦耳，更值得推荐的是大约15焦耳左右。如果加热件43要求比较低的能量，测加热件43应更弯向烟卷23，以改善热传导关系。

具有所要求特性的加热件43的有效表面积大约为3平方毫米至25平方毫米，电阻在大约0.5欧至3.0欧。更值得推荐的是，加热件43的电阻在大约0.8欧至2.1欧之间。当然，加热件电阻还取决于用来提供加热器43必需的电能的具体电源。例如，以上例举的加热件电阻适合于电能是由四个串接的镍镉电池（开路总电压为4.8伏至5.8伏）供给的各实施例。或者，如果用六个或八个这样串接的电池，那么加热件43的电阻应该相应为3欧至5欧或5欧至7欧。

制造加热件43的材料应加以选择，保证能可靠地重复开关至少1800次而不发生故障。加热器39最好是可从包括电源37和电路41的打火机25上单独拆离处置的，打火机25最好能在3600次以上的开关后再处置掉。加热件材料还要根据抗氧化性和不易反应性加以选择，以保证不被氧化和不致在可能遇到的温度下与烟卷23发生反应。需要的话，可以将加热件43用诸如合适的陶瓷材料那样的惰性导热材料封装，进一步避免氧化和反应。

根据这些准则，电加热装置的材料包括掺杂半导体（如硅）、碳、不锈钢、钛、金属陶瓷材料以及诸如含镍、铬和铁的合金之类的金属合金。掺以量为 5×10^{19} 杂质/厘米³至 5×10^{20} 杂质/厘米³磷杂质的硅半导体材料的电阻率相应为大约 1×10^{-2} 欧厘米至 1×10^{-3} 欧厘米。这种材料在列作参考的共同受让人的相关

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来决美国专利申请No.07/943, 505中有所说明。合适的金属陶瓷材料包括131碳化硅铝和碳化硅钛。诸如镍的铝化物和铁的铝化物那样的抗氧化金属化合物也是合适的材料。

值得推荐的是，用具有高机械强度和抗高温表面退化的耐热合金来制造电加热件43。最好，用具有高强度和在高达熔点百分之八十左右温度下保持表面稳定的材料来制造加热件43。这样一些合金包括通常称为超级合金的那些合金，一般以镍、铁或钴为基础。最好，制造加热件43的超级合金含铝，以进一步改善加热件的性能（如抗氧化性）。一种材料是海纳斯214合金，可从海纳斯国际公司（Haynes International, Inc. of Kokomo, Indiana）得到。这种高温材料含有重量为75%左右的镍、16%左右的铬、4.5%左右的铝和3%左右的铁。

如上所述，加热组件39的各个加热件43包括一个由一组相互连接的弯曲（大体呈S形）区构成的蛇形部131，以增加每个加热件的有效电阻。加热件43的蛇形部131增加了电阻而并不增加加热件的总长度或减小加热件的截面宽度。具有电阻大约为0.5欧至3欧、蛇形部131长度适合安装在图3A所示加热器39和图5所示加热器39A的加热件43最好有N个相互连接的S形区，其中N大约为3至12，最好是大约6至10。

如果图8所示的加热件蛇形部131首先是切割如图7所示的宽部125的形状，使得宽部的宽度为W1、长度为L1和厚度为T，则从宽部的一端125'到相对端125''的电阻为

$$R = \frac{\rho \cdot L1}{W1 \cdot T}$$

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其中 ρ 为所使用的材料的电阻率。在形成蛇形部131后，由于加热件43的有效电长度增加和横截面积减小，因此蛇形部的电阻就增加了。例如，在加热件43上形成了蛇形部131后，电流就沿路径P通过加热件。与初始电长度 L_1 相比，路径P的有效电长度大约为9或10乘以 W_1 （对于有5个完整的S形转折的蛇形区而言）。此外，横截面积从 $W_1 \cdot T$ 减小到 $W_2 \cdot T$ 。按照本发明，由于电阻正比于电长度和反比于截面积，因此电长度的增加和截面积的减小都会使加热件43的总电阻增大。

因此，在加热件43中形成蛇形部131使得可以用较小体积的导电材料在给定的加热表面（例如为了平方毫米至25平方毫米）上提供预定的电阻。本发明的这个特征至少有以下三个优点。

第一，对于一定的电阻而言，用矩形片来构成加热件43的话，其长度较长。因此采用蛇形部131可以用较低的成本来制造较紧凑的加热器39和打火机25。

第二，由于在静止空气内将一个加热件43加热到给定工作温度所需的能量并随着这个加热件的质量的增加而增加，因此蛇形加热件的能量利用率较高，可以用比较小的体积给出所要求的电阻。例如，如果加热件43的体积减小一倍，则质量也减小一倍。这样，由于在静止空气内将一个加热件43加热到给定工作温度所需的能量大致与该加热件的质量和热容量成正比，因此体积减小一倍也就是所需能量减小一倍。这使加热件43具有较高的能量利用率。

蛇形加热件43体积较小的第三个优点与加热件的响应时间有

关。响应时间定义为一个给定的加热件43对一个给定的能量输入作出响应使它的温度从第一温度改变到较高的第二温度所需的时间。由于一个加热件43的响应时间一般与其体积成正比，因此可以预料一个体积较小的加热件，其响应时间也较短。这样，蛇形加热件43除了紧凑和能量利用率较高外，加热到工作温度也较快。本发明的这个特点提供了一个更为有效的加热件43。

因此，通过在加热件43上形成一组来回曲折（如蛇形图案），就能增加加热件的电阻，而不需要增加加热件的长度或减小加热件的截面积。当然，也可采用不同于图8所示的加热件43的图案，应用在这种结构中所体现的原理来提供一个紧凑、有效的加热件。

可以，用任何合适的方法，例如用激光（最好是 CO_2 激光），在加热件43上切割出蛇形部131。由于蛇形加热件43的几何尺寸很小（例如，图8中的沟宽B大致为0.1毫米至0.25毫米数量级），对于切割形成蛇形部131来说激光切割要比其它加工法更为可取。因为激光能量适合集中在小范围内，因此激光能量有利于通用、快速、精确和自动化加工。此外，与其它切割方法（如放电切割）相比，激光加工既减少了在被切割材料上产生的感应应力，也减少了材料受热影响的程度（即被氧化材料的量）。其它合用的方法有放电切割、精密冲压、化学腐蚀和化学蚀刻等。也可以用常规的压花方法来形成蛇形部131。然而，可以理解，由于模具烧损，这种方法至少对于蛇形图案来说没有多少吸引力。

除了用激光来切割出蛇形加热件43外，也可用激光（最好是钕铝石榴石（YAG）激光）将打火机的各器件有效地连接在一起。

例如，加热组件89和销组件91最好用CO₂或YAG激光点焊在一起。此外，加热件43的尾端101或凸起部129最好也激光焊接到基座50的接线销104或适当的电路器件或插座上。当然，也可以用各种常规连接方法来将打火机的各个器件连接在一起。

按照本发明，大大降低了在加热件43中产生热感应应力损伤的可能性。如图6所示，焊到销104或其它电路或器件上的尾端部101（或凸起部129）和产生热的蛇形部131形成一个单件加热件43，因此就不用将分开的蛇形部和端部焊在一起。业已发现，这样的焊接会导致在加热件加热期间产生有害的形变。端部101或凸起部129的纵向中心线最好与蛇形部131的中心线对准。也已发现，中心线不对准在加热件加热期间也会产生形变。此外，蛇形部131的两个相对端131'和131''最好以对称方式（即每个点在相同的方向上）会合加热件43的非蛇形部。相对端131'和131''的对称性会防止蛇形部131的这两端在加热件加热期间向两个相反的方向扭转而损害蛇形部。在蛇形部131的两端、处于加热件43的非蛇形部和端部之间的相应过渡区137'和137''倒成斜角，如图6所示。可以理解，倒成斜角的过渡区137' 137''也减小了热感应应力。

加热件43和加热器39还有一些可以避免由于加热和反复加热所造成的问题的特点。例如，可以预料，加热件43在加热期间会伸长。由于加热件43固定在位置固定的与加热组件89的前部连接的销组件91的前端135和接近加热件尾端101的环99之间，加热件的伸长会导致使加热件或者向内弯向烟卷23（这是所希望的），

或者向外弯离烟卷23（这是不希望的）。向外弯曲会在加热件43和烟卷23之间留出一个热隙。这造成了对烟草卷57的加热效率不高，并且也不均匀，因为在加热件表面与烟卷之间的面际接触的程度发生了改变。

为了避免向外歪曲，加热组件89的各个加热件43都做成向内弯曲的形状，如图3A所示。向内弯曲有利于保证加热件43和烟卷23紧贴和良好的热接触。加热件43的内弯形状可以用许多方法来实现。例如，将如图6所示的筒形加热器放到一个具有所要求的内弯形状 of 型架（未示出）成形。最好，在加热组件89做成筒形前将加热件43冲压成向内弯曲的形状。加热件43向内弯曲的形状使得加热件在加热期间由于伸长而更加向内弯曲。这种弯曲在整个蛇形部131的长度范围内应相应平缓。倒角的过渡区137'和137''可以弯得比更加细微的蛇形部131厉害一些。这样就能避免热应力集中在加热件43的比较容易损坏的部位。

需要的话，可以围着各加热件43的蛇形部131加一个环（未示出）。这个环起着散热器作用。当加热件43的蛇形部131由于加热而伸长时，蛇形部131就被迫使向内朝烟卷23弯曲。

除上述加热组件89外，图3A所示的加热器39还包括衬套49和加热器基座50。如图10A—10C所示，衬套49有一个圆柱形的外表面97，销91和加热件43就由环99通过摩擦配合固定在这个外表面上。衬套49还包括一个可让烟卷进入衬套的圆柱形内壁141和一个底壁139。底壁139的底内面81用来挡住烟卷23不致更加深入打火机25，使得烟卷23正确地相对加热件43定位。在底壁139

上加工了一个构成与抽吸驱动传感器45相通的通道47的组成部分47'。组成部分47'最好是一个与衬套49的中心平行、穿透底壁139的孔。在底壁139上还加工了一个构成配置光传感器53的开口55的组成部分55'。一个首股气孔143从衬套49的外表面97一直延伸到开口组成部分55'。首股气孔143由于提供了一个从烟卷周围区域至后气流过滤器63邻近区域的附加气流通道,从而有利于在第一次抽吸烟卷23期间提供适当的抽吸阻力。因为烟草卷57和烟卷纸69在还没有一个加热件43曾加热过烟卷的一个区域前会阻碍气流进入烟卷23,因此首股气孔143通过烟卷的后气流过滤器63为加热器39的这个区域提供了气流。后气流过滤器63允许足够的气流进入烟卷23,从而使抽吸阻力低于不采用这种结构时所遇到的抽吸阻力。然而,后气流过滤器63虽然仍要保证在第一股烟期间可以流入上述气流,但应尽量“紧密”,使得在抽吸了烟卷23后残留在腔79内的烟雾不致通过后气流过滤器进入打火机25。在吸了烟卷23呈一条开在基座的底内表面157上的槽,这条槽在装上了衬套49后就成为气密的。最好,组成部分47"是由开在底壁151上的两个相互交接的纵向和径向孔构成的。开口55的组成部分55"开在底壁151上。衬套49上的组成部分47'和55'分别与基座50上的组成部分47"和55"对准,形成通道47和开口55。

图12A—12D详细地示出了在图5所示加热器39A实施例中的构件49A。构件49A有一个圆柱形外表面97A,各销95和加热件43由环99紧固在这个外表面97A上。构件49A还包括一个可允许烟卷插入构件的圆柱形内壁141A和一个底壁139A。底壁139A的内表面

81A用来挡住烟卷23,使烟卷23相对加热件43正确定位。在构件49A上还可以加工一个首股气孔(未示出)。与抽吸驱动传感器45连通的通道47A开在底壁139A上。通道47A是一个穿透底壁139A、与构件49A中心线平行的孔。如上所述,各加热件43的尾端101和至少两个销95的尾端伸过构件49A的底外表面105A,与电路41和电源37连接。构件49A上有一个凸缘109,上面至少开了两个槽或孔107A,使得两个销95的尾端103可以通过,伸出在底外表面105A之外。加热件43的尾端弯成与凸缘109相符的形状,沿凸缘外缘111伸过底外表面105A。气道套87A与凸缘109的外缘111配合进一步将加热件43的尾端101紧固在适当位置上。

除了特别提到以外,为了参照方便起见,以下对吸烟系统21的讨论主要是针对图3A—3B所示加热器39的各零件。然而,可以理解这些讨论也可适用于图5所示加热器39A的实施例以及在这里没有具体指明和讨论的其它实施例。如上所述,加热器能包括其它一些能完成各种诸如提供一个靠近加热烟卷的加热件的空间那样的加热器功能的器件。

图13示出了将加热件43和销95围着图3A所示的衬套49的外表面97加以紧固的环99的端视图。环99的内径应是以保证围住各加热件43,并且用摩擦配合将这些加热件43紧固在圆柱形的外表面97上。围着环99的内周边所开的相互隔90°角的纵向槽159用来容纳较厚的各销95,这样,环99就能围住这些销95,将它们紧固在外表面97上。

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气道套87的第一端161接到基座50上,第二端163接到盖帽83上。气道套87的第一端161上有一个外脊165,用来卡在基座50的内壁155上的内槽167内。类似,气道套87的第二端163上有一个外脊171,用来卡在盖帽83的内缘175上的内槽173内。图5所示加热器39A的实施例中的气道套87A与图3中所示的气道套87的实施例不同。气道套87A的第一端161A上有一个内槽165A,用来卡在构件49A的凸缘109的外缘111上的外脊167A上。各加热件43的靠近尾端101的部分处在构件49A和气道套87A的各接合部之间。正如以下要结合图17加以进一步讨论的那样,如果要求增大气流,则可以开一个或几个径向孔穿过加热器39的一些诸如气道套87那样的部分,最好开在沿气道套长度的一些气流通顺的点上。

图3A所示加热器39的盖帽83和图5所示加热器39A的盖帽83A一切都相同,只是盖帽83的内壁177比盖帽83A的内壁177A长一些。盖帽83的内壁177的内径最好不大于烟卷23的外径;以稍小一些为好,使得烟卷在插入打火机25时受到挤压,由压配合可靠地保持在适当位置上。盖帽39的内壁117长一些是可取的,这增加了对烟卷23的支持。为了说明起见,图14A—14D示出了盖帽83A的结构。

盖帽83A上开有一组纵向孔或通道179A,从倒圆或倒角的前端93A至背面181A穿过盖帽83A,用来使空气可以流入容纳烟卷23的加热器39A内的烟卷和气道套87之间的空间,使得横向(即径向向内)气流通过加热件43的蛇形部131附近的烟草卷57。如图3A所示,在加热器39的盖帽83的这个优选实施例中,孔或通道

179在靠近背面181处做得比靠近前端93处大,以便得到一个所要求的抽烟阻力。在盖帽的另一个实施例中,这些纵向孔用开在盖帽内壁的纵向槽(未示出)代替。由图14A—14D可见,在背面181A上开了一个圆周槽183A,用来容纳和支承图15A—15B所示的可选用的防护性加热器套85。加热器套85是一个管形构件,具有第一端185和第二端187,这两端都可纳入槽183A内。圆周槽183A开在半径超出孔或通道179A的圆周上,以便在吸烟者抽吸烟卷23时将空气引入加热器39。

图3A所示盖帽83可以通过模压或机械加工制成。最好通过模压将盖帽制成一个单件,诸如图5中所示的盖帽83A。如果采用机械加工的方法,则盖帽83最好做成两件,一个外件83'和一个内件83",如图3A所示。这两件安装在一起就形成了一个盖帽83。在将内件83"安装入外件83'前,在内件83"的外表面上加工一个圆周切口。这个切口在内件和外件安装在一起时形成了槽183。用机械加工的两件合成盖帽83避免了必需对一个单件进行机械加工来形成槽183。

吸烟者可以在吸了一些烟(例如30至60支烟卷23)后取下加热器套85扔掉,再换上一个新的加热器套。加热器套85防止气道套87的内壁169受到在加热件43和气道套之间的区域内产生残留烟雾的作用。有了加热器套85,这些烟雾就作用在加热器套85上了。

加热器套85用耐热的纸或塑料之类的材料制成,由吸烟者在吸了一些烟卷23后加以更换。因此,与具有一个接到如下面将要

说明的烟草香料组件的烟雾阻挡管的“管中管”结构相反，烟雾阻挡管要随吸完的香料组合一起扔掉，而本吸烟系统21的加热器套85则是适合再使用的。因此，简化了烟卷23的制造，减少了吸完每支烟卷后要废弃的材料量。

图16简略地示出了当吸烟者抽吸过滤嘴71时在加热器39和烟卷23内形成的优选气流图。由于在过滤嘴71处的抽吸，空气通过纵向孔或通道179被吸入加热器39内气道套或加热器套（在该视图中未标号）之间，越过与烟卷23接触的加热件（未示出），穿过透气的烟卷纸69和烟草卷57（或穿过上面的透气孔）后进入烟卷的腔79内。空气从腔79流入第一自由气流过滤器65的纵向通道67和第二自由气流过滤器73的纵向通道77，通过过滤嘴71至吸烟者。通道179的数量和大小选择成使传送给吸烟者的总物质微粒（TPM）为最佳。在本优选实施例中，在盖帽83上开了6或8个通道179。

如图17所示，需要的话，提供一些其它气道来代替或辅助通道179，使空气进入加热器39内部和烟卷23的腔79。例如，可以在加热器39上任何有利位置（通常是在气道套上）开一个或几个径向通道189。可以在加热器39上开几个通过基座或基座和衬套（图中未示出）的纵向通道191。此外，盖帽83上的通道179可以是如上所述的孔或开在盖帽83的内壁177上的纵向槽。如上所述，需要的话，在烟卷上可以加一个在吸烟者吸烟卷时允许纵向空气流入腔79的后气流过滤器63。

需要的话，打火机25可以包括一个选用的锐化管（未示出），

安装在加热器39内，用来刺穿插入打火机的烟卷的后气流过滤器63。这个管的顶端处在腔79内，因此当吸烟者抽吸烟卷23时可使直接气流进入腔79内。锐化管在引导端部开有一个或几个气孔，这些气孔最好开在管的侧壁上，而不是管的引导端上，以便在有利于使气流在腔内形成漩涡的方向上得到高速气流。这种涡流改善了流入的空气与烟卷23内产生的烟雾和蒸汽的混合。

图18简略示出了吸烟系统21的电控制电路41。电路41包括：是一个专用集成电路（ASIC）的逻辑电路195，检测吸烟者是否抽吸烟卷23的抽吸驱动传感器45，检测烟卷是否插入打火机25的光传感器53，指示烟卷上还剩的股数的液晶指示器51，电源37，以及定时网络197。逻辑电路195是任何一个可以完成在此所述功能的常规电路。现场可编程门阵列，例如可从阿克特尔公司（Actel Corporation, Sunnyvale, California）得到的ACTEL A1010A FPGA PL44C，能通过编程执行数字逻辑功能，而模拟功能则由其它器件执行。然而，只需要一个专用集成电路既可以完成模拟功能也可以完成数字功能。与本发明的控制电路41和逻辑电路195类似的控制电路和逻辑电路的特点例如在列作参考的美国专利No. 5, 060, 671中已有说明。

在这个优选实施例中，8个独立的加热件43（图18中未示出）通过相应的场效应晶体管（FET）加热件开关201-208接至电源37的正端和地。在逻辑电路195的控制下，分别通过端点211-218使加热件开关201-208逐个导通。逻辑电路195为各加热件开关201-208提供启动和撤销信号，使相应的加热件启动工作和停止。

工作。

抽吸驱动传感器45将一个指示吸烟者抽吸活动(即在持续一段时间内有连续气压降或气流)的信号加到逻辑电路195。逻辑电路195具有去脉动措施,对较短时的气压波动和较长期抽吸烟卷进行区别,以免对来自抽吸驱动传感器45的信号偶然波动作出响应而启动加热件。抽吸驱动传感器45可以包括一个压阻式压力传感器或一个光栅式传感器,用来驱动一个运算放大器,而运算放大器的输出则作为一个逻辑信号加到逻辑电路195。适用于这种吸烟系统的抽吸驱动传感器有耐威尔公司微开关部(Microswitch division of Honeywell, Inc., Freeport, Ill.)制造的163PC01D35型硅传感器,芦卡斯-诺氟(Lucas-Nova, Fremont, California)的NPH-5-02.5G NOVA型传感器,以及山赛公司(Sen Sym Incorporated, Sunnyvale, California)的SLP 0040型传感器。

检测烟卷插入的光传感器53将一个指示烟卷23已插入打火机25中正确位置(即通过反射光束检测到烟卷距安装在加热器39的衬套49和基座50内的光传感器在几毫米之内)的信号加到逻辑电路195。一种适用于这种吸烟系统的光传感器是奥普特克技术公司(OPTIK Technology, Inc., 1215 West Crosby Road, Carrollton, Texas 75006)制造的OPR5005型光传感器。

为了节约能量,抽吸驱动传感器45和光传感器53最好以低工作比(例如大约从2%至10%)循环地接通和断开。例如,抽吸驱动传感器45每10毫秒工作1毫秒。如果抽吸驱动传感器45在四

个相继的脉冲中(即在40毫秒时间内)都检测到指示抽吸烟卷的气压降或气流,则通过引线端221向逻辑电路195发出一个信号。然后,逻辑电路195就通过引线端211-218中适当的一个引线端输出一个信号,使场效应晶体管加热件开关201-208中相应的一个开关接通。

类似,光传感器53在每10毫秒内工作1毫秒。如果光传感器53检测到四个相继的反射脉冲,指示在打火机25内有烟卷,则光传感器53通过引线端223向逻辑电路195发送一个信号。然后,逻辑电路195就通过引线端225向抽吸驱动传感器45发出一个信号,使抽吸驱动传感器接通。逻辑电路195还通过引线端227向指示器51发送一个信号,使指示器51接通。上述调制技术减少了抽吸驱动传感器45和光传感器53所需的平均电流,从而延长了电源37的寿命。

定时网络197最好是一个恒定焦耳能量定时器,用来在一个已被某一个场效应晶体管加热件开关接通启动的加热件工作了一段所要求的时间后通过引线端229向逻辑电路195发出一个截断信号。按照本发明,定时网络197在一段时间后向逻辑电路195发出一个截断信号,这段时间是在加热器加热期间逐渐下降的电源电压的函数。定时网络197还可以防止在电池放电后继续启动一个加热件43。其它一些诸如以下要加以说明的定时网络的电路配置也可使用。

在工作期间,当打火机25内插入一支烟卷23时,光传感器53就检测到烟卷存在。于是,光传感器通过引线端223向逻辑电路

195发送一个信号。逻辑电路195确定电源37是充了电或者还是在低电压状态。如果在烟卷23插入打火机25后，逻辑电路195检测到电源37的电压不足，则指示器51闪烁，而打火机也不再工作，直至电源重新充电或换上新的电源。在加热件43启动工作期间，电源37的电压也受到监视，如果电源电压下降到预定值以下，则中断加热件43工作。

如果电源37充了电，电压足够，则逻辑电路195通过引线端25向检测传感器45发送一个信号，使之确定是否吸烟者正在抽吸烟卷23。同时，逻辑电路195通过引线端227向指示器51发送一个信号，这样液晶显示器就显示数字“8”，表示有8股烟可吸。

当逻辑电路195通过引线端221从抽吸驱动传感器45接收到一个表示检测到持续的气压降或气流的信号时，逻辑电路195在吸烟期间关闭光传感器53，以便节省功率。逻辑电路195通过引线端231向定时网络197发送一个信号，启动恒定焦耳能量计时器。逻辑电路195还通过一个不计数装置确定8个加热件中的哪一个加热件应该得到加热，从而通过引线端211—218中一个相应的引线端发出一个信号，使场效应管加热件开关201—208中的一个相应开关接通。这个相应的开关在计时器计时期间一直保持接通。

当定时网络197通过引线端229向逻辑电路195发送一个指示计时器已经停止计时的信号时，那个接通的场效应管加热件开关就被断开，从而不再有能量加到相应的加热件上。逻辑电路195也进行下计数，并通过引线端227向指示器51发送一个信号，这样指示器将显示所剩的少了一股（即吸了第一股烟后就显示“7”）。

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当吸烟者再次抽吸烟卷23时，逻辑电路195将使另一个预定的场效应管加热件开关接通，从而将能量加到相应的加热件上。整个过程将重复进行，直至指示器51显示数字“0”，这表示烟卷23已被吸完。当烟卷23从打火机上取下时，光传感器53指示已没有烟卷，于是逻辑电路195复位。

其它一些诸如以下将要说明的器件可以用在控制电路41中，代替或辅助上述器件。例如，需要的话，可以增加各种暂定器件。一种暂定器件是定时电路（未示出），用来防止过分频繁地接续抽烟，以便电源37来得及恢复。另一个暂定器件是一个在插入加热器39的烟卷是未经许可的产品时暂停加热件43工作的装置。例如，烟卷23可以带有识别标记，在对加热件43供电前，打火机25必需识别出这些标记。

图19示出了本发明吸烟系统222的另一个实施例。吸烟系统222包括一支一次性使用的烟卷224和一个具有一个接纳烟卷的孔口228的可重复使用的打火机226。吸烟系统222是一个“中央抽吸”系统，气流主要通过烟卷224和打火机226的中央。打火机226在远离孔口228（未示出）的那一端上有一个电源和控制电路（未示出）。象吸烟系统21那样，吸烟系统222最好装有诸如抽吸驱动传感器和指示器（未示出）之类的器件。

打火机226由一个外形类似普通烟卷那样的机壳232覆盖。机壳232最好做成管状，可以用耐热的塑料或铝制成，也可以用螺旋缠绕的双层重磅纸制成。在机壳232上开有一些气孔233，以便在吸烟期间允许外界空气被吸入打火机226。需要的话，在烟卷

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224上或打火机226的其它一些点上开一些空气通道(未示出),以便得到需要的气流。

烟卷224与烟卷23类似。烟卷224包括一个由一个承载烟香物质(最好含有烟草)的承载管或送烟管259构成的烟草卷257。烟草卷257一端围住一个圆柱形的后气流过滤器263,另一端围住一个圆柱形的第一自由气流过滤器265,从而得到了支承。第一自由气流过滤器265可以有一个纵向通道(未示出)。

烟卷224还有一个圆柱形的过嘴271。过滤嘴271最好是一个普通抽吸阻力型过滤器。烟卷224可以包括一个圆柱形的第二自由气流过滤器(未示出),该过滤器有利于将汽相的烟草香味与空气混合,这与以上所讨论的第二自由气流过滤器73类似。后气流过滤器263和第一自由气流过滤器265与烟草卷257一起在烟卷224内围成一个腔279。第一自由气流过滤器265、后气流过滤器263和过滤嘴271可以用适合普通大规模组装机械的方法安装在一起。

与烟卷23不同,烟卷224还包括一个环状的烟雾阻挡管273,围着烟草卷257相隔一定距离配置。烟雾阻挡管273大大减少了由于加热具有烟草香味的物质261而形成的烟雾凝聚在机壳232的内壁上。烟雾阻挡管273用一个套环275围着第一自由气流过滤器265安装到烟卷224上。套环275和烟雾阻挡管273的硬度应足以防止烟卷224被挤扁和保持烟雾阻挡管和烟草卷257的对中,使得在烟雾阻挡管与烟草卷之间的间隙大体均匀。烟卷纸或包端纸269将过滤嘴271紧固在邻接第一自由气流过滤器265、套环275和烟雾

阻挡管273的一端的位置上。

打火机226包括一个具有一组(最好是8个)加热烟卷224的加热件243的加热器239。加热件243最好是直线型的,从打火机226内靠近孔口228处延伸到靠近可以容纳后气流过滤器263的后气流过滤器腔245处。各加热件243一端接成公共端,最好是靠近后气流过滤器腔245这端,而在靠近孔口228那端倒角,以便插入烟卷224而不会损坏加热件243。加热件243被容纳在烟草卷257和烟雾阻挡管273之间所形成的间隙内。

图20简略地示出了加热器239的结构。加热器239包括一个加热件基座249,一个加热件支架251和一组加热件支臂253,所有这些构件都是用热性能稳定的绝缘材料制成。各加热件243分别安装在相应支臂253上。加热件243的两端243'和243"分别与导电指255A和255B电接触。

各加热件243的端部243'都电连接在一起,形成加热件系统的“公共端”。一个公共端291接到一块导电板293上,而导电板293则与分别接到各加热件243的端部243'的公共导电指255A连接。导电板293上开有一个或几个在抽吸烟卷期间允许空气流入邻接烟卷224后气流过滤器263的区域的空气通道。

加热件紧圈297容纳一个围着公共端291的邻接导电板293安装的颈块299。颈块299上开有一个或几个允许空气流入通道295的通道301。各导电销303穿过加热件紧圈297,将相应的导电指255B接到电路241上。导电指255B沿加热件支臂253配置,分别与各加热件243的端部243"电连接。

导电指 255B 的端部 255B' 最好加以弯曲, 以有利于在加热件紧圈 297 和颈块 299 之间形成“按扣配合”连接, 使端部 255B' 与销 303 接触。按扣配合连接有利于打火机 226 上取下加热件 243, 予以更换或修理。销 303 和公共端 291 插入相应的插口 (未示出), 将各加热件 243 与使加热逐个工作的电路 241 连接起来。

图 21 简略地示出了用来制造烟卷 224 的包括烟草卷 257、第一自由气流过滤器 265 和后气流过滤器 263 的组成部分 224' 的设备 321 的实施例。用来制造承载管 259 的材料 259' 由计量辊 (未示出) 从供料轴 323 上拉出。在这个实施例中所示的承载管材料带 259' 包括一系列相互隔开的在工段 325 所加的烟香物质 261 的区域, 工段 325 也可以处在其它合适位置, 诸如在将材料带 259' 卷在供料轴 323 的工位以前。然后, 材料带 259' 通过一个涂粘合剂的装置, 该装置包括一个在承载管材料带 259' 上涂上一个个粘合剂区 261A 的涂粘合剂工段 327。或者, 烟香物质 261 可以连续地加到承载管材料带 259' 上, 而粘合剂区 261A 则涂在烟香物质 261 上面的预定位置上。

加过滤器工段 329 处在涂粘合剂工段 327 的下游。加过滤器工段 329 有一个转盘装置 331, 交替地将一个过滤器 333 或一个过滤器 335 加到承载管材料带 259' 上的粘合剂区 261A。装置 331 的转速与承载管材料带 259' 的速度同步。

卷包工段 337 处在加工过滤器工段 329 的下游。卷包工段 337 将承载管材料带 259' 卷包在过滤器 333 和 335 上, 形成一根连续棒。形成的棒在切断工段 339 切断。切断工段 339 有一个切断装置,

将棒在各过滤器 333 和 335 的中间切断, 使得切成两段的过滤器 333 分别形成两支烟卷 224 的组成部分 224' 上的相应第一自由气流过滤器 265, 而切成两段的过滤器 335 分别形成两支烟卷 224 的组成部分 224' 上的相应后气流过滤器 263。需要的话, 在切断后, 对后气流过滤器 263 进行加工, 形成便于将加热件 243 围住组成部分 224' 的倒角端。在切断后, 每个组成部分 224' 在装阻挡管工段 (未示出) 插在一个烟雾阻挡管 273 内, 用套环 275 固定。阻挡管 273 的直径大于连续棒的直径, 而长度至少与切下的组成部分 224' 一样。在辅助工段 (未示出), 将一个圆柱形的过滤嘴 271 接到第一自由气流过滤器 265 和烟雾阻挡管 273 上, 再裹上卷包材料。

图 22 简略地示出了作为又一个实施例的吸烟系统 421。吸烟系统 421 是一种“周边抽吸”型吸烟系统。在这种系统中, 打火机 425 的加热件 443 配置在游烟卷 423 的环形部形成的腔 427 内。

烟卷 423 包括一个具有烟香物质 461 的烟草卷 457、烟香物质 461 配置在承载管 459 的与腔 427 相背的表面上。烟卷 423 还包括烟雾阻挡管 473、柱塞 475、环形自由气流过滤器 465、环形后气流过滤器 463 以及过滤嘴 471。自由气流过滤器 465、后气流过滤器 463、烟草卷 457 和烟雾阻挡管 473 围成了一个腔 481。当加热件 443 加热烟香物质 461 时, 在腔 481 内就产生烟草香味。烟卷 423 上最好裹上烟卷纸或包端纸 469。加热器 439 中装有一个柱塞 477。柱塞 477 与柱塞 475 配合, 大大减少了经过吸烟系统 421 的加热件区的烟雾。柱塞 477 上开有一些让控制加热件 443 的导体 479 通过

的孔。

图23示出了另一种电控制系统541的原理图。控制系统541应具有以下几个功能。控制系统541可对通常是8个的加热件43定序,每次抽吸驱动传感器45启动,就选用下一个加热件43。控制系统541可将电流输到选中的加热件内,其时间应足够长,以保证普通一股烟能产生充分的散发烟草香味的响应,但也不能太长,否则就要烧坏具有烟草香味的物质61。控制系统541可对指示器51加以控制,使它指示:(1)烟卷23剩余多少(即还剩几股没吸);(2)电源37的电压是否超出范围;(3)打火机25中是否没装烟卷;以及(4)打火机25中是否装入了诸如可用按扣配合装人的加热器。

控制系统541还控制电源37传送给每个加热件43的总能量。由于电源37提供的电压对于各股来说可能并不相同,从而在相等的时间内提供给各加热件43的能量也不同,因此最好能为每一股传送恒定的能量。为了传送恒定的能量,控制电路541监视电源37在一个加热件43工作时的加载电压,继续向这个加热件供电,直至供出所需焦耳数的能量。

如图23所示,控制系统541包括逻辑电路570、BCD解码器580、电压检测器590、定时网络591、抽吸驱动传感器45、指示器51和充电泵电路593。逻辑电路570可以是任何能完成在此所讨论的功能的普通电路,如经编程执行这类功能的一个现场可编程门阵列(如阿克特尔公司的ACTEL A1010A FPGA PL44C)。最好,逻辑电路570工作在低时钟频率(如33千赫),以便节约能量。

各加热件43A—43H通过相应的场效应晶体管(FET) 595A—

595H接到电源37的正极和地。在BCD译码器580(最好是标准的4至16线译码器CD4514B)控制下通过引线端581—588使场效应晶体管595A—595H中的一个相应的场效应管导通。BCD译码器580通过引线端580A从逻辑电路570接收两个类型的信号:(1)需要启动工作的那个加热件43A—43H的BCD码;和(2)启动该加热件工作的接通和断开信号。

BCD译码器580通过引线端580B接到充电泵电路593的接线端593A,该电路提供用来驱动各场效应晶体管595A—595H的极电压。充电泵电路593包括一个接至电源37的二极管594和一个接至逻辑电路570的电容器595。逻辑电路570包括一个接到引线端572的普通开关网络(未单独示出),该网络可以使充电泵电路593的引线端593B处的电压增高到电源37的电压的两倍左右。二极管594使这个电压得以保持,不致反加到电源37上。因此,在解码器580的引线端580B上就有经倍增的电压,用来增强对场效应晶体管595A—595H的驱动,从而提高了电路541的效率。分别与场效应晶体管595A—595H的栅极串接的电阻596A—596H用来增加各栅极的充电时间,以便减小所产生的高频谐波,因为这些高频谐波会在控制系统541中产生噪声。

抽吸驱动传感器45向逻辑电路570输出一个指示吸烟者抽吸活动(即一个持续的约为1英寸水的压降)的信号。因此,抽吸驱动传感器45可以包括一个驱动运算放大器的压阻式压敏传感器,而运算放大器的输出则作为逻辑信号加到逻辑电路570。例如,压敏传感器可以是芦卡斯诺氟(Lucas Nova)的NPH—5—002,5G

NOVA型传感器,也可以是山赛(Sen Sym)公司的SLP004D型传感器。

为了节约能量,抽吸驱动传感器45以小工作比进行工作(例如工作比为2%至10%左右)。例如,抽吸驱动传感器45在每16毫秒中只工作0.5毫秒。这种调制技术减小了抽吸驱动传感器45所需的时间平均电流,因此延长了电源37的寿命。

定时网络591用来在一个加热件启动工作了一段预定时间(取决于传送给该加热件的能量)后向逻辑电路570发送一个切断信号。按照本发明,每个加热件43A—43H的工作时间应保证在这段时间内加热件所得到的能量恒定(例如为5至40焦耳左右,最好是15至25焦耳左右),因而与电源37的加载电压无关。因此,引线端591A向定时网络591提供每个加热件43的接通时间和电源37的加载电压的信息,假设加热件电阻是已知的和恒定的(即1.2欧)。引线端591B向逻辑电路570的引线端578发出一个指示已传送了恒定能量的切断信号。

定时网络591的一个优选实施例示于图24。定时网络591的引线端591从逻辑电路570接收一个在加热件见件A—43H开始工作时刻开始的从大约零伏上升到加载电源电压的信号。这个信号通过阻容网络601(由电阻603—606、电容607和二极管608组成)滤波后驱动过压检测器602。过压检测器602最好是马克西姆公司(Maxim Corporation, Sunnyvale, California)的ICL7665A过/欠压检测器。按照本发明,阻容网络601选择成使得定时网络591的引线端591B在预定的恒定能量传送给加热件的时刻从高电

平状态变为低电平状态。当然,也可以使用其它的定时网络电路结构。

需要的话,控制电路541可以对传送恒定能量的时间加上最长时间的限制。例如,如果电源37的电压很低,以致要用2秒多的时间来传送20焦耳的能量,那么逻辑电路570就会在加热器接通2秒后,即使还没有传送出20焦耳的能量,将一个自动切断信号加到引线端571上。

在本发明的另一个实施例中,定时网络591在一段预定的、与能量传送无关的时间后向逻辑电路570发送一个切断信号。因此,这种定时网络591在例如大约0.5秒至5秒的一段固定不变的时间后发出一个切断信号。

电压检测器590用来监视电源37的电压,向逻辑电路170发送一个信号,当电源37的电压低于第一预定电压(如3.2伏)时该信号指示必需对电源充电,而当电源37的电压高于第二预定电压(如5.5伏)时则该信号指示电源在电压低于第一预定电压后已充足了电。电压检测器590最好是用马克西姆公司的ICL7665A过/欠压检测器。

如上所述,逻辑电路570引线端571对BCD解码器580加以控制。逻辑电路570还控制用来向用户指示还有几股可吸的指示器51。对于一个8股吸烟系统来说,指示器最好是一个单数字七段液晶显示器(LCD)。因此,对于一支新插入的具有8股烟香物质的烟卷,指示器51将显示“8”,而对于一支剩下一股的烟卷,指示器51则显示“1”。在吸了最后一股烟后,指示器51就显示“0”。

此外,指示器51在没有烟卷或加热器装在打火机中或没有按扣式加热件243装在加热器239中时显示“0”。并且,为了指示电源电压超出范围,即已降到再充电电平以下(例如3.2伏),或者在电压降到再充电电平以下而还没有充满电,指示器51以2赫的频率反复通断。例如,如果在吸了第一股烟后电源电压立即降到3.2伏以下,则指示器51每秒显示两次数字“7”。

逻辑电路570通过引线端597A和598A分别测量高电阻597和598(如为1兆欧)两端电压来确定加热器或加热组件是否已装入打火机。电阻597和598都有一段固定地接到相应的场效应管595G和595H的漏极,而另一端接地。当没有加热组件装入打火机时,图23中标为43G和43H的两个加热件就没有接到相应的场效应管595G和595H的漏极。因此,电源37也没有加到场效应晶体管595G和595H的漏极。结果是,由逻辑电路570通过引线端597A和598H分别监视的电阻597和598两端都没有电压。因此,当没有加热器装入打火机时,逻辑电路570在引线端597A和598A上检测到两个“0”。

在加热器装入了电打火机的情况下,电源37通过加热件43G和43H分别接到电阻597和598上,在电阻597和598两端都产生了一个电压。因此,逻辑电路570在引线端597A和598A上通常就检测到两个“1”。逻辑电路570所以要监视两个电阻(即电阻597和598)是因为:如果场效应晶体管595G和595H中有一个导通而使相应的加热件工作,那么相应的电阻597或598就基本上被短路。因此,如果只用一个电阻的话,就可能时现即使装入了加热器也

会错误地指示尚未装入的情况。然而,如果用两个电阻,则例如当场效应晶体管595G导通时,电阻597两端的电压接近为0,但电阻598两端的电压为逻辑“1”,而当场效应晶体管595H导通时,电阻598两端的电压接近为0,但电阻597两端的电压为逻辑“1”。因此,使用两个电阻,由逻辑电路570对分别从电阻597和598上取得的两个信号进行逻辑或运算,就能确定是否有加热器装在打火机内。

为了确定是否有烟卷装在打火机内,逻辑电路570的辅助引线端599每当在打火机内烟卷时就收到一个信号。引线端599上的信号由一个由于有烟卷而被机械或电启动工作的普通开关产生。如果烟卷有以上讨论过的本发明的碳纤维垫层,则引线端599上的信号可以通过将一个电探针直接与碳垫层接触、对通过碳垫层的漏电流加以监视来产生。由于碳垫层并不十分绝缘,因此如果一个有一端如图23所示那样接到电源37的加热件与本发明的碳垫层接触,那么无论是否有场效应晶体管595A—595H启动导通,都有一些电流漏入碳层。按照本发明,这个漏电流用一个直接与碳垫层接触的电探针加以监视,以便检测是否存在烟卷。

除了用通过碳垫层的电传导来确定在电打火机内是否装有烟卷外,需要的话,这种电传导还可用来确定所装人的烟卷的特定类型(例如是X型还是Y型烟卷)。按照本发明的这个特点,逻辑电路570用两个相隔一定距离与碳垫层接触的辅助引线端(未示出)来确定碳垫层的电阻率。由于对于一种特定的烟卷来说,其碳垫层的电阻率处于一定的范围以内(即在制造时,不同类型烟

卷的碳垫层含有不同种类和数量的碳纤维和(或)粘合剂),因此就可以通过测量电阻率来确定插入电打火机的烟卷的类型。这样,逻辑电路570便利用这个信息提供预定的电能供给。

例如,第一种类型或牌号的烟卷是用一种具有第一预定电阻率的碳垫层,而第二种类型或牌号的烟卷则用另一种具有第二预定电阻率的碳垫层。因此,如果逻辑电路570能实时确定所插入烟卷的碳垫层电阻率,则就能有效地控制供给打火机加热件的电能。

按照本发明的以上特点,电能供给情况是根据所确定的打火机中烟卷的具体类型或牌号而改变的。例如,在逻辑电路570确定插入烟卷的电阻率后,根据测得的电阻率逻辑电路570决定提供15焦耳还是20焦耳的能量。此外,逻辑电路570还包括在确定所插入的烟卷不适合这个打火机时阻止提供任何能量的电路。

回到图23,在吸烟者吸第一口烟以前,指示器51显示例如数字“8”,表明有8股烟可吸。因此,逻辑电路570将第一加热件(如加热件43A)的地址置于引线端51,使得BCD解码器580在吸烟者吸烟时通过引线端580选择这个加热器进行加热。当吸烟者抽烟时,抽吸驱动传感器45通过引线端575向逻辑电路570发送一个高电平信号,指示打火机内的气压已经下降,例如下降至少1英寸水的压强。此时,逻辑电路570就通过引线端571发出一个信号,向BCD解码器580指示第一加热件的场效应晶体管595A应该加以导通。然后,在BCD译码器580的引线端580B上的电压就由BCD译码器580接到第一场效应晶体管595A的栅极,从而使加热件43A

接通。

在第一加热件43A开始工作的同时,定时网络591随时对已供给加热件的总能量加以监视,在总能量已达到预定值(如20焦耳)时刻通过引线端578向逻辑电路570发出一个逻辑信号。然后,逻辑电路570就通过引线端向BCD译码器580发出一个断开信号,使译码器580断开加热件43A。

此后,在等待吸烟者吸第二股烟时,逻辑电路570通过引线端571向BCD译码器580发送第二加热件(如43B)的地址,使得第二场效应晶体管595在吸烟者吸下一股烟时被导通。此外,逻辑电路570向指示器51发送一个显示数字“7”的信号,向吸烟者指示还有7股烟可吸。

需要的话,逻辑电路570还可以包括阻止吸烟者在一定时间间隔内吸下一股烟的定时电路,以便电源得到恢复。例如,逻辑电路570可以包括一个禁止逻辑电路570在向BCD译码器580发出断开信号后的6秒暂停时间内通过引线端571向BCD译码器580发出接通信号的电路(未单独示出)。如果需要下吸烟者指示打火机正处于这样的暂定状态,指示器51可以某一频率,如千赫,反复通断(即以与用来指示电源电压超出范围的频率不同的频率来指示)。

无论打火机是否装有上述暂停抽吸装置或暂停指示装置,当吸烟者第二次抽吸烟卷时(在有暂停抽吸装置的情况下,需在预定的暂停时间以后),控制电路541就重复以上用来使第一加热件的各步操作,使第二加热器工作。

以上循环一直重复到最后一个加热器工作结束。此时,逻辑

电路570向指示器51发出一个使显示消隐的信号，并且禁止任何加热器再启动工作，直至在打火机中插入了一支新的一次性使用烟卷。

虽然图23的控制电路541将逻辑电路570、BCD译码器580、电压检测器590和定时网络591都示为独立、离散的电路，但这些电路的功能显然可以完全纳入到一个单独的集成网络中（如由一个单片集成电路来完成）。

需要的话，本发明的一支一次性使用烟卷可以具有向吸烟者指示这支烟卷先前已插入过打火机后来又取下的措施。例如，在一个实施例中，一支尚未用过的烟卷上带有一个可取下的“撕条”或其它必须先从烟卷上取下才能将烟卷插入打火机的标记。这样，一支以前已经用过的烟卷就不再带有撕条之类的标记。或者，一支未吸过的烟卷具有一个机械可变的区域，烟卷插入打火机会使这个区域有划痕、撕裂、压扁或其它机械变化。这样，吸烟者就能通过观察机械可变区来确定这支烟卷是否以前插入过打火机。

此外，如果需要的话，一支一次性使用烟卷还可以具有向吸烟者指示这支烟卷曾经被加热产生过散发烟草香味的响应的措施。例如，烟卷可以有一个热敏指示区，该区域的颜色改变向吸烟者指示这支烟卷已经吸过。或者，在热敏指示区可以有一个可熔条，它的熔化、断开或其它外形变化向吸烟者指示这支烟卷已经吸过。当然，也可以用其它的热敏措施指示烟卷已经吸过。此外，显然可以采用许多其它电或机械措施来完成相同目的，即向吸烟者指

示烟卷已经吸过。

虽然本发明已结合优选实施例作了说明，但可以理解，在这些实施例中可以作出种种改变，而并不偏离如以下权利要求所提出的本发明的专利保护范围。

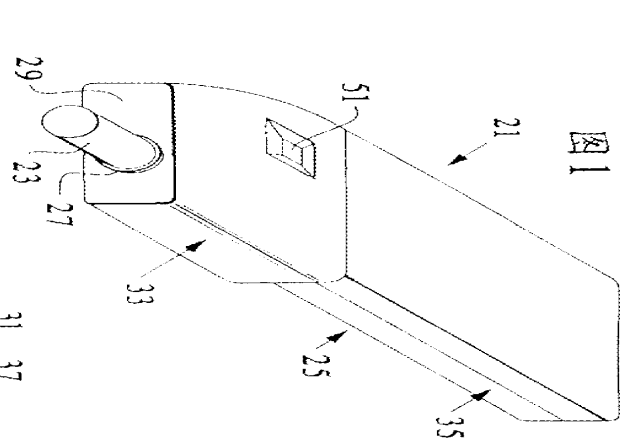


图1

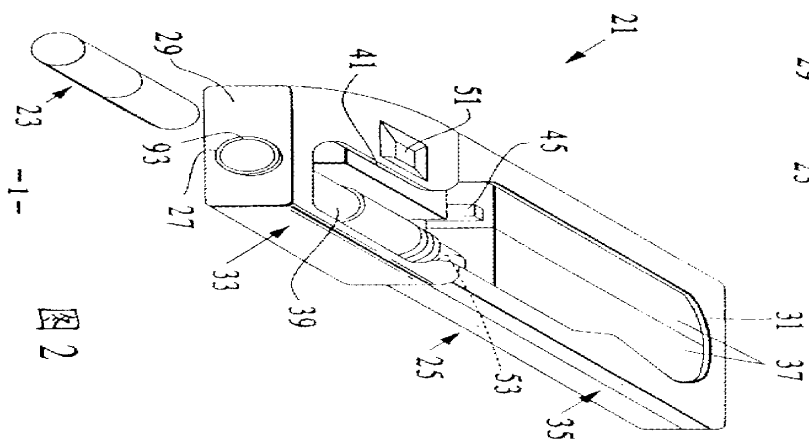


图2

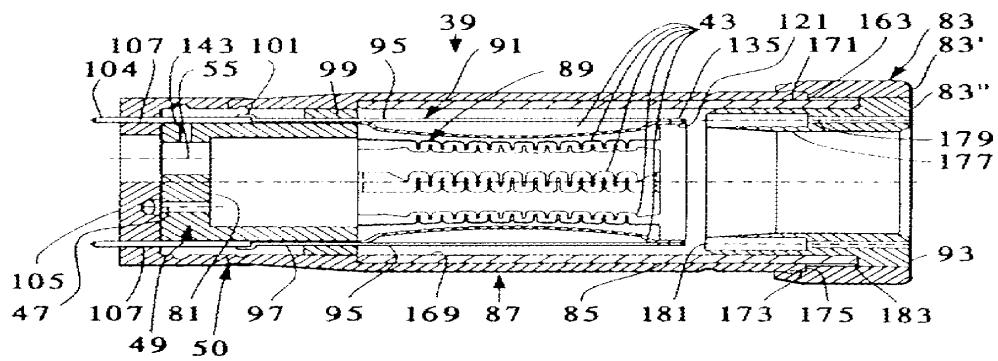


图3A

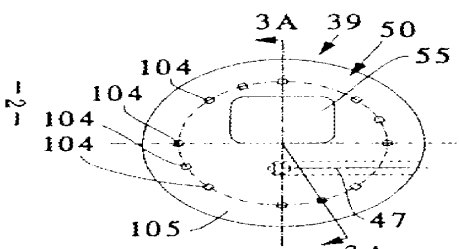


图3B

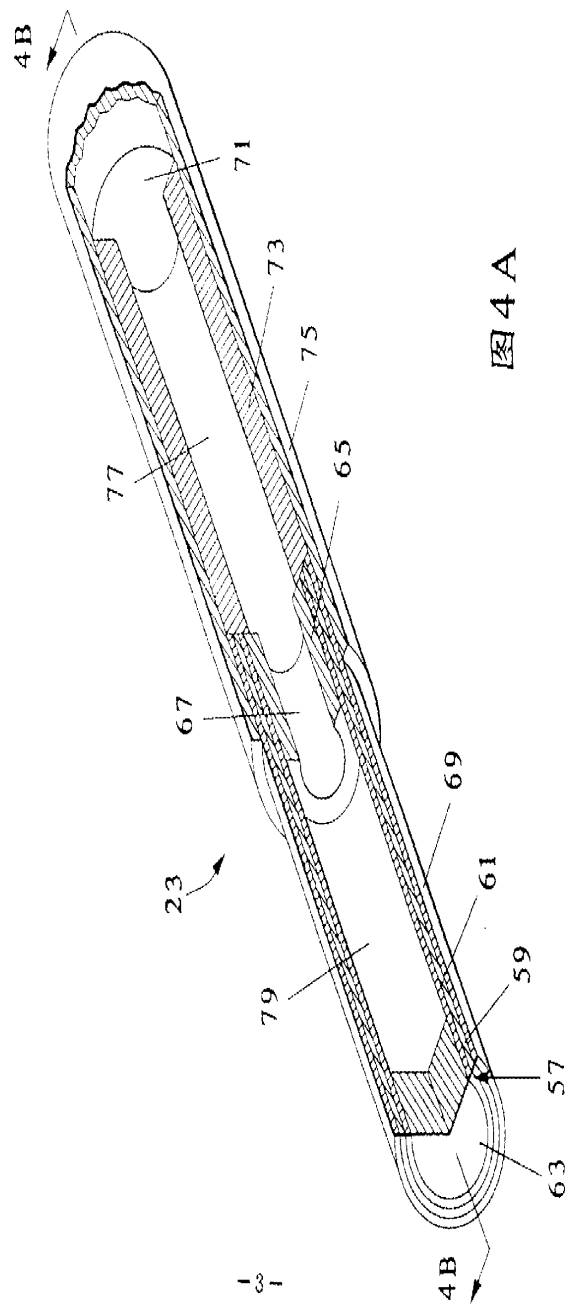


图 4 A

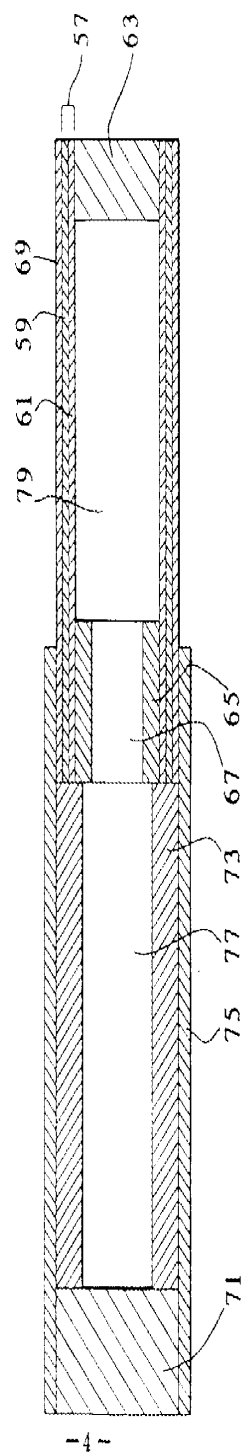


图 4 B

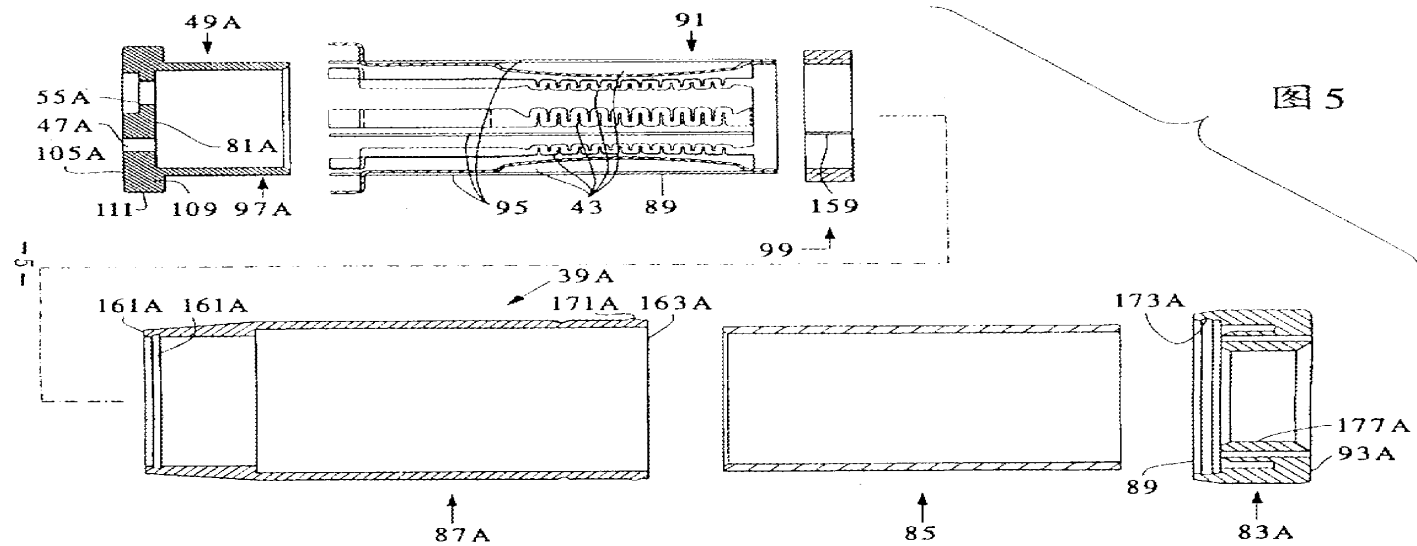


图5

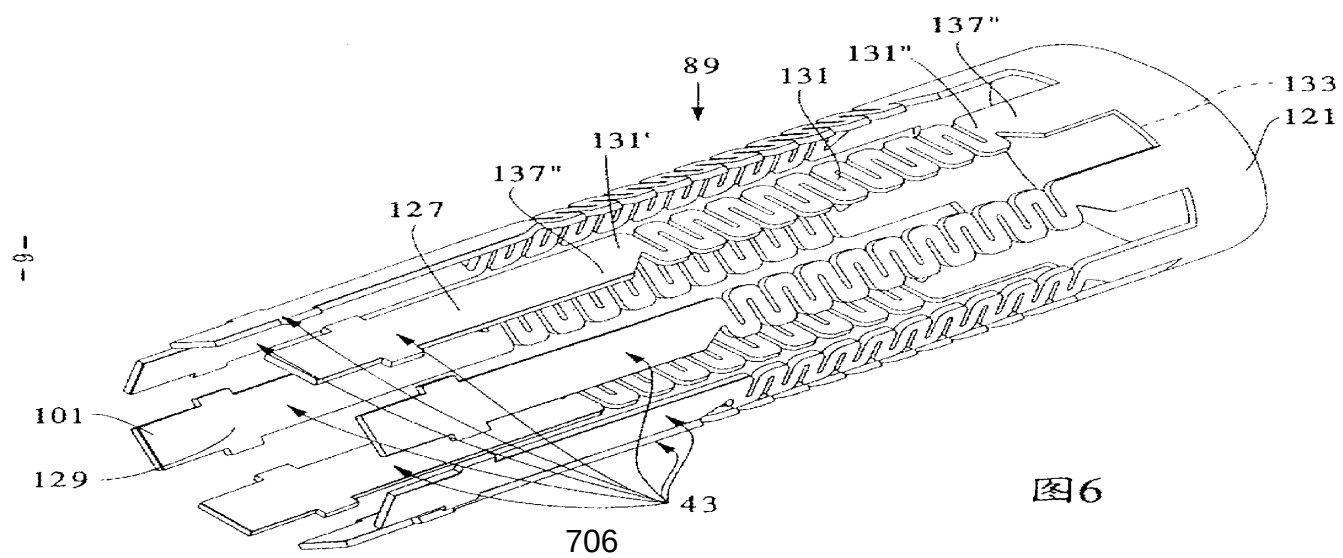
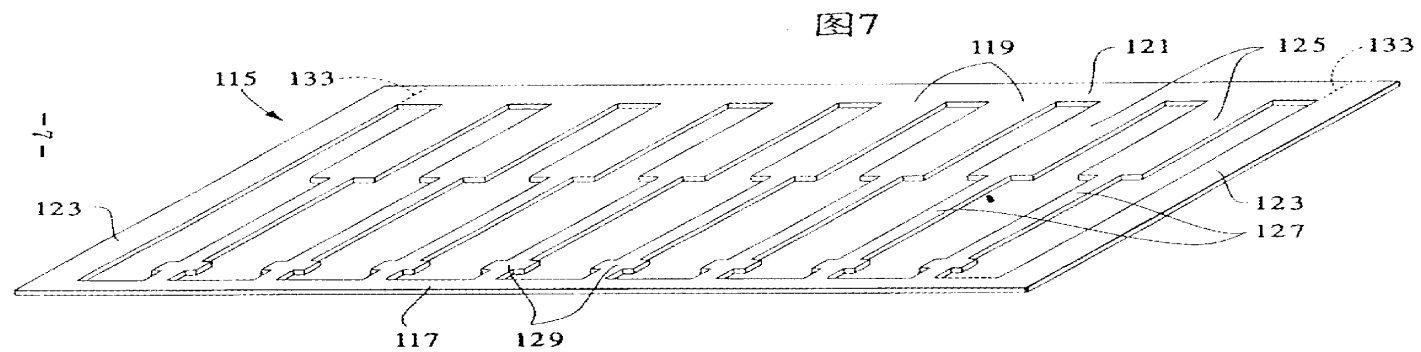
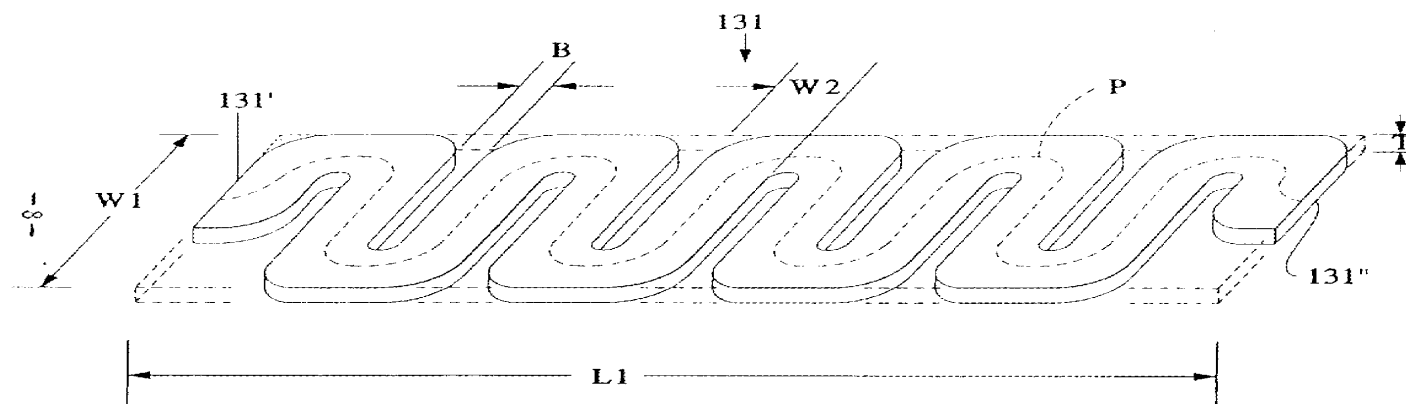


图6



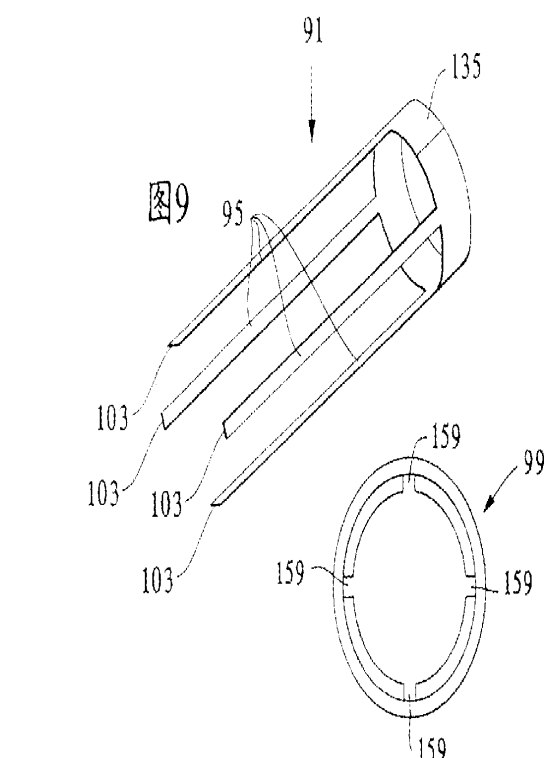


图13

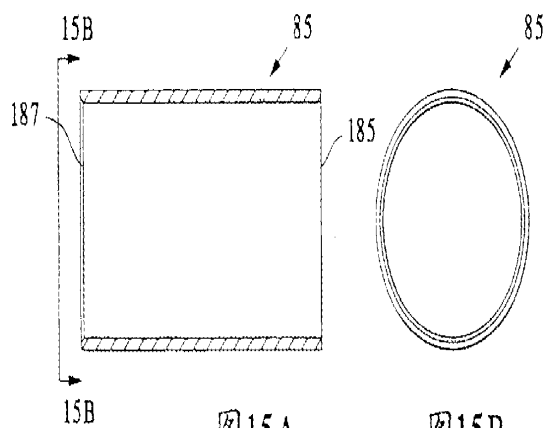


图15A
-9-

图15B

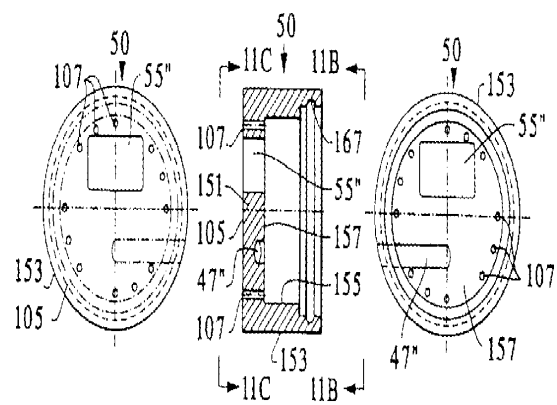


图11C

图11A

图11B

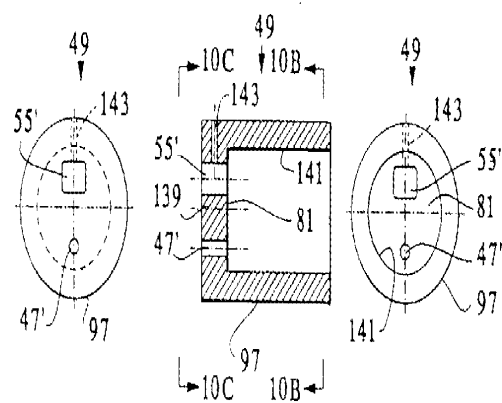
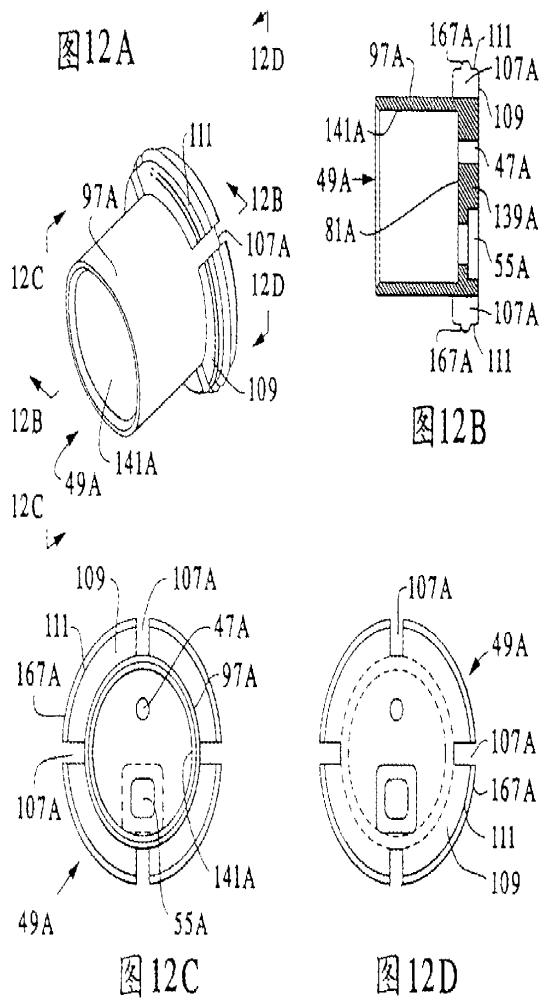


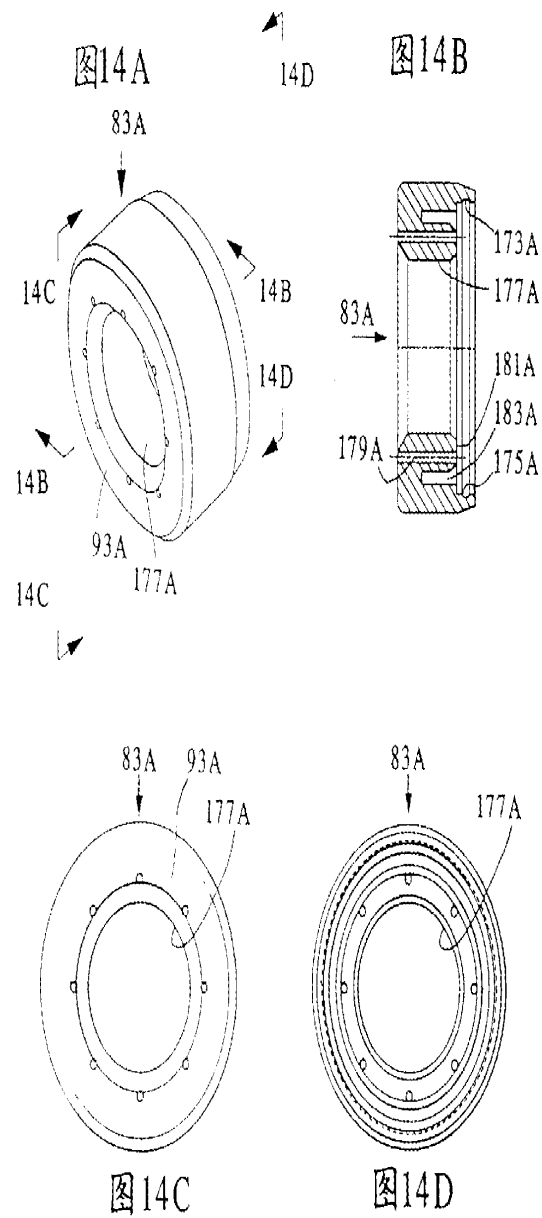
图10C

图10A

图10B



-11-



-12-

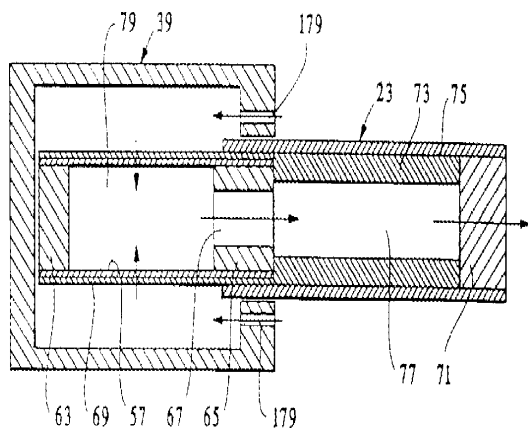


图16

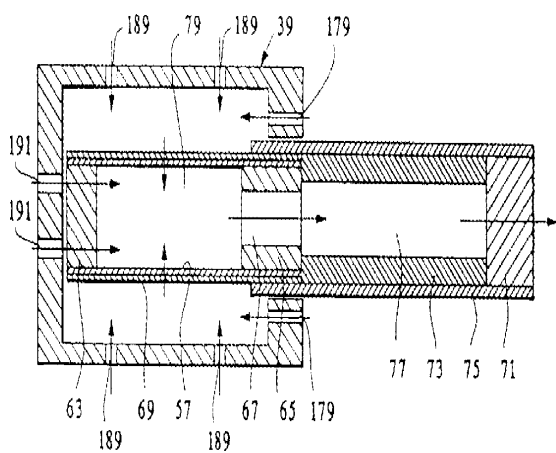


图17

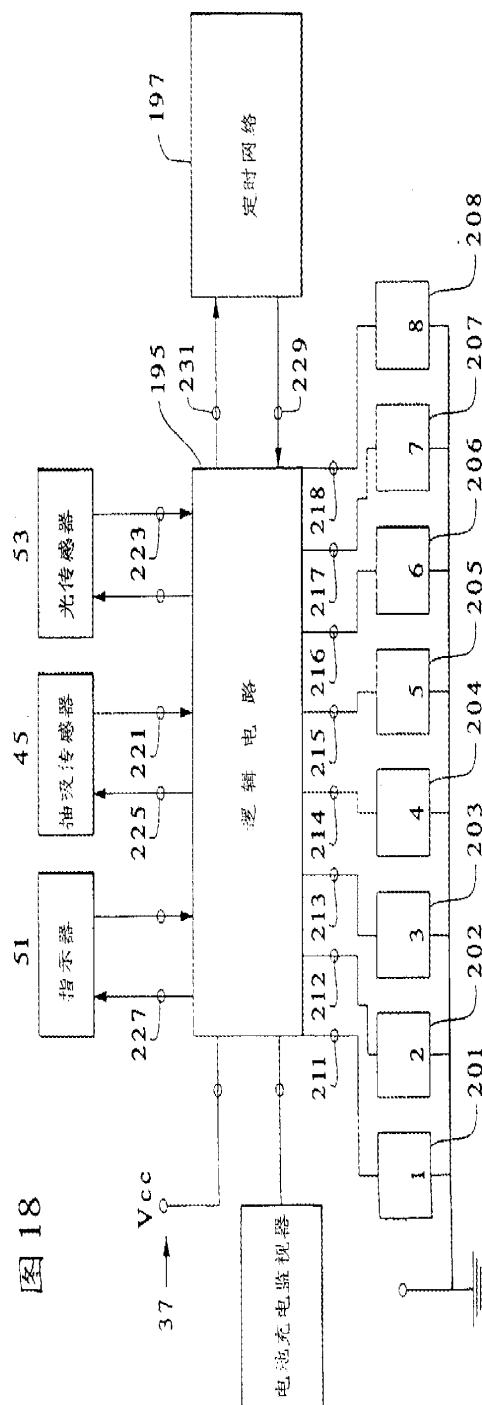


图18

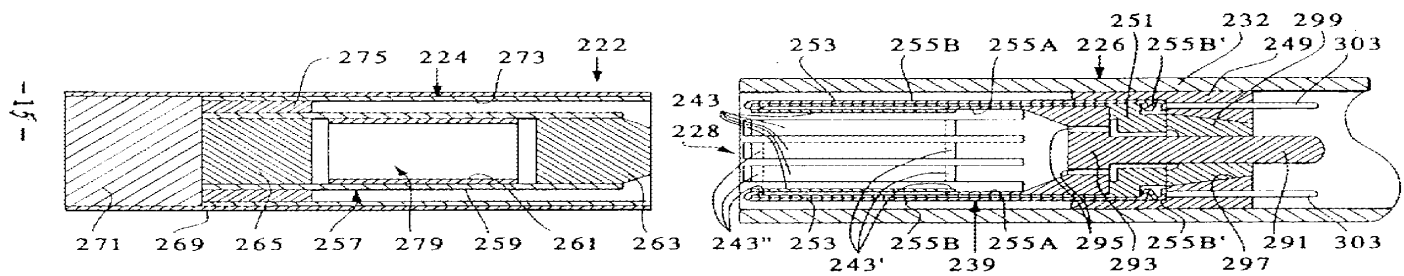


图19

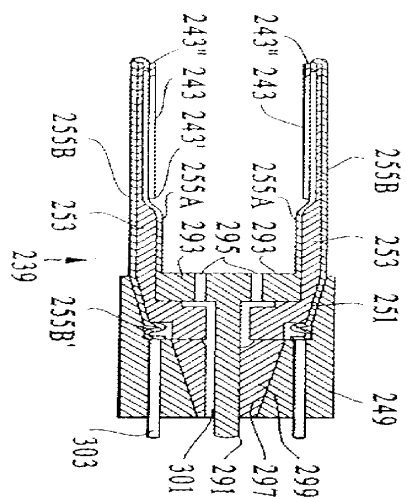


图20

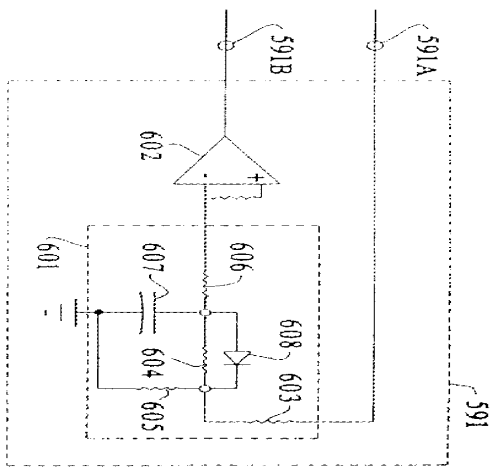


图24

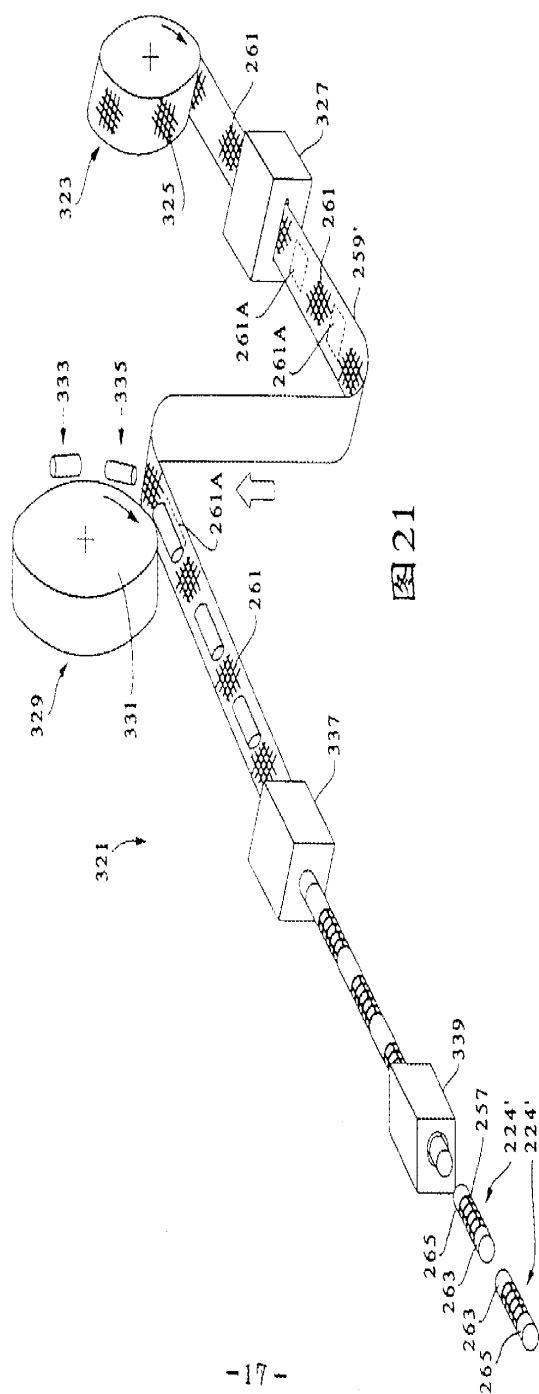


图 21

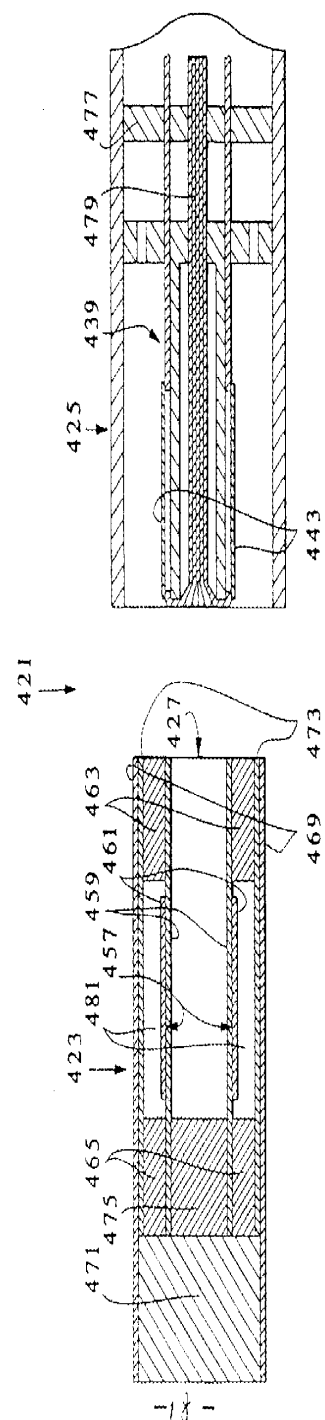


图 22

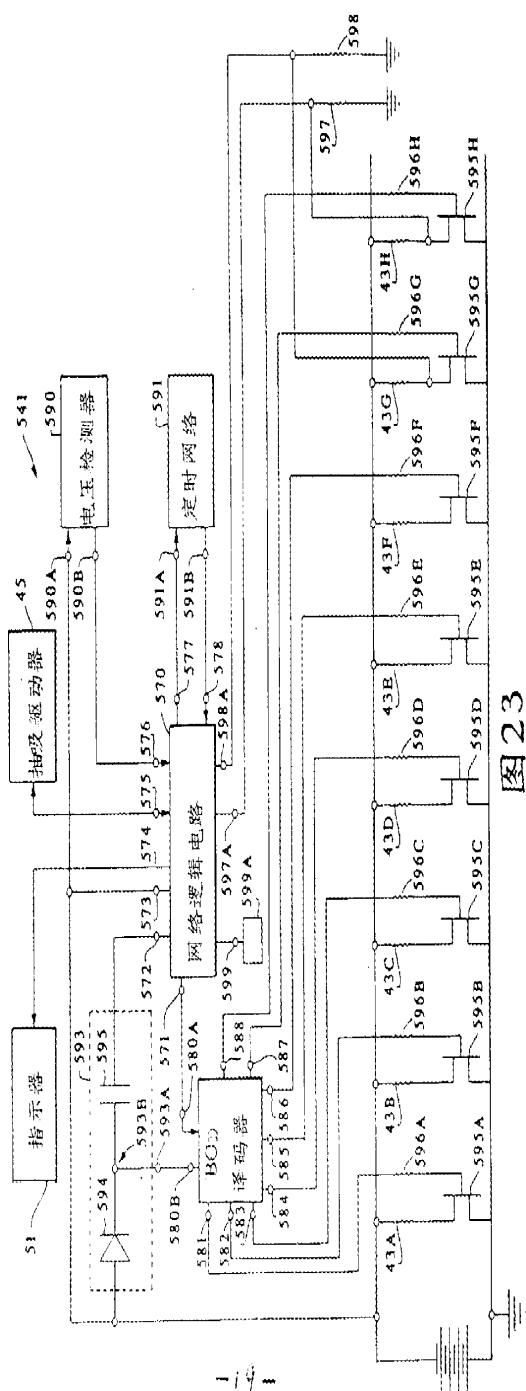


图 23

Patent/Publication: CN1122213A

Bibliography

DWPI Title

Electrical smoking system for delivering flavours to smoker heats tobacco flavour material in cavity electrically into vapour delivering it to smoker helped by transverse through air flow

English Title

Electric smoking system for delivering flavors and methods for making same

Assignee/Applicant

Standardized: PHILIP MORRIS PROD

Original: PHILIP MORRIS PROD INC, US

Inventor

COLLINS A L, COUNTS M E, DAS A,

Publication Date (Kind Code)

1996-05-15 (A)

Application Number / Date

CN1994102530A / 1994-02-25

Priority Number / Date / Country

CN1994102530A / 1994-02-25 / CN

Abstract

Abstract

In the smoking system of the present invention, the cigarette containing fragrant tobacco material is heated by the electrical heating elements inside lighter to release tobacco fragrance and other components in the form of steam or mist to the smoker. The cigarette and lighter can provide various airflow forms and make airflow into cogarette laterally. The said airflow forms can improve the supply of mist and fragrance to smoker and decrease the agglutination of steam and mist in heating element area.

(51) Int.Cl. ⁷	識別記号	F I	テーマコード* (参考)
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1/34		1/34	3 E 0 6 7

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 株式会社中央研究所内
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 弁理士 秋元 輝雄

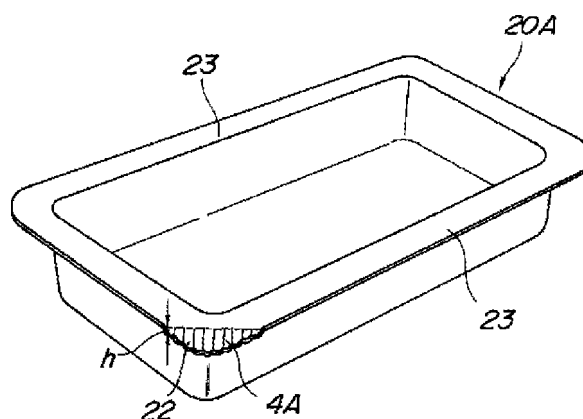
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(54) 【発明の名称】 包装材

(57) 【要約】

【課題】 蓋を熱融着する際に、蓋は包装材のシール部には熱融着されるが、隅の三角形開け口には蓋が熱融着されないのを蓋を手で開封し易い包装材を提供すること。

【解決手段】 物品を入れた後、蓋を熱融着して密封包装する包装材であって、少なくとも1つの隅部に蓋が熱融着されていない三角形開け口を設け、この開け口の表面に凹凸を設けた包装材を用いる。前記開け口の表面にリブ状凹凸を設けることが好ましく、前記リブ状凹凸のリブの方向が前記開け口の蓋を開封する方向とほぼ平行であるリブ状凹凸を設けることがさらに好ましい。



【特許請求の範囲】

【請求項1】 物品を入れた後、蓋を熱融着して密封包装する包装材であって、少なくとも1つの隅部に蓋が熱融着され難い三角形形状開け口を設け、この開け口の表面に凹凸を設けたことを特徴とする包装材。

【請求項2】 前記開け口の表面にリブ状凹凸を設けたことを特徴とする請求項1に記載の包装材。

【請求項3】 前記リブ状凹凸のリブの方向が前記開け口に対応する蓋を開封する方向とほぼ平行に設けたことを特徴とする請求項2に記載の包装材。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、包装材に関するものであり、さらに詳しくはカレールーなどの食品やその他の物品を密封包装した包装材の蓋を手で開封し易くした包装材に関するものである。

【0002】

【従来の技術】従来、ポリカーボネートなどの熱可塑性樹脂を真空成形あるいは圧空成形した浅い皿状の包装材にカレールーなどの食品を充填した後、ヒートシーラント層、アルミニウム箔、プラスチックフィルムなどをラミネートした多層フィルムからなる蓋を熱融着して密封包装して、箱詰めするなどして商品とすることが行われている。

【0003】図5の(A)～(F)は包装材を成形し、食品を充填し、蓋を熱融着するなどして商品を製造する工程を示す説明図である。まず、(A)工程でポリカーボネートなどの熱可塑性樹脂30をベルトコンベア31で真空成形機32へ供給して真空成形して複数の浅い皿状の包装材20を多数一体的に成形する。(A)工程で一体的に成形された包装材20はベルトコンベア31で(B)工程に送られて各包装材20に食品(カレールー27、28)が充填される。食品を充填した後、(C)工程に送られて多層フィルムからなる蓋21が熱融着され密封包装される。次いで(D)工程に送られて個々の包装材20に切り放される。次いで(E)工程に送られて個々の包装材20のエッジがトリミングされて丸められて、安全性、美観などが向上される。次いで(F)工程に送られて箱詰めしてシュリンクパックするなどして出荷される。

【0004】図6に示すように、このようにして製造された従来の包装材20の隅部には、蓋21が熱融着されないようにシール部23の面より少しの距離hだけ下方に位置して三角形形状開け口22がシール部23と一体に設けてある。このようにすることにより上記(C)工程で蓋21を熱融着する際に、蓋21は包装材20のシール部23には熱融着されるが、三角形形状開け口22には対応する蓋21が熱融着され難いようになっている。

【0005】

【発明が解決しようとする課題】しかし、実際には図7

に示すように従来の包装材20の隅部の三角形形状開け口22に対応する蓋21が熱融着されてしまう場合があり、三角形形状開け口22に対応する蓋21が熱融着されてしまうと、両手の指で蓋21と三角形形状開け口22を持って開封するのが困難になる問題があった。本発明の目的は、カレールーなどの食品やその他の物品を密封包装した包装材の蓋を手で開封し易くした包装材を提供することである。

【0006】

【課題を解決するための手段】本発明者は、上記問題に鑑み鋭意研究した結果、三角形形状開け口22の表面に凹凸を設けることにより、蓋21が熱融着されなくなることを見だし、本発明を成すに至った。

【0007】本発明の請求項1は、物品を入れた後、蓋を熱融着して密封包装する包装材であって、少なくとも1つの隅部に蓋が熱融着され難い三角形形状開け口を設け、この開け口の表面に凹凸を設けたことを特徴とする包装材に関するものである。

【0008】本発明の請求項2は、請求項1に記載の包装材において、前記開け口の表面にリブ状凹凸を設けたことを特徴とする。

【0009】本発明の請求項3は、請求項2に記載の包装材において、前記リブ状凹凸のリブの方向が前記開け口に対応する蓋を開封する方向とほぼ平行に設けたことを特徴とする。

【0010】

【発明の実施の形態】以下、本発明の実施の形態を図1～図4に基づいて詳細に説明する。図1は、本発明の包装材の一実施形態の要部を示す斜視図であり、図2は、本発明の他の包装材の三角形形状開け口を説明する説明図であり、図3は、本発明の他の包装材の三角形形状開け口を説明する説明図であり、図4は、本発明の他の包装材にカレールーを密封包装した状態を説明する斜視図である。なお、これらの図において前記図5～7の符号と同一符号で示した部分は、従来技術の項で説明したものと同様の機能を持つ部分であり、本発明の理解を妨げない範囲で説明は省略した。

【0011】図1において、本発明の包装材20Aの隅部には、蓋21が熱融着され難いようにシール部23の面より少しの距離hだけ下方に位置して三角形形状開け口22がシール部23と一体に設けてあり、この開け口22の表面には複数のリブ状凹凸4Aが設けられている。そして前記リブ状凹凸4Aの各リブの方向は開け口22に対応する蓋を開封する方向とほぼ平行に設けてある。上記のように複数のリブ状凹凸4Aを設けたことにより対応する蓋21との接触面積が少なくなるなどの理由により、上記(C)工程で蓋21を熱融着する際に、蓋21は包装材20Aのシール部23には熱融着されるが、三角形形状開け口22には蓋22が熱融着されない。したがって蓋21を手で開封し易い。またリブ状凹凸4Aの

各リブの方向は開け口 2 2 に対応する蓋 2 1 を開封する方向とほぼ平行に設けてあるので、各リブは開け口 2 2 の剛性を向上するように作用し、それにより一層蓋 2 1 を開封し易くなる。

【0012】図 2 において、本発明の包装材 2 0 B の隅部には、蓋 2 1 が熱融着され難いようにシール部 2 3 の面より少しの距離 h だけ下方に位置して三角形開け口 2 2 がシール部 2 3 と一体に設けてあり、この開け口 2 2 の表面には複数のリブ状凹凸 4 B が開け口 2 2 に対応する蓋 2 1 を開封する方向とほぼ直角に設けられている。上記のように複数のリブ状凹凸 4 B を設けたことにより対応する蓋 2 1 との接触面積が少なくなるなどの理由により、上記 (C) 工程で蓋 2 1 を熱融着する際に、蓋 2 1 は包装材 2 0 B のシール部 2 3 には熱融着されるが、三角形開け口 2 2 には蓋 2 1 が熱融着されない。したがって蓋 2 1 を手で開封し易い。

【0013】図 3 において、本発明の包装材 2 0 C の隅部には、蓋 2 1 が熱融着され難いようにシール部 2 3 の面より少しの距離 h だけ下方に位置して三角形開け口 2 2 がシール部 2 3 と一体に設けてあり、この開け口 2 2 の表面には複数の凸部 4 C が設けられている。上記のように複数の凸部 4 C を設けたことにより対応する蓋 2 1 との接触面積が少なくなるなどの理由により、上記 (C) 工程で蓋 2 1 を熱融着する際に、蓋 2 1 は包装材 2 0 C のシール部 2 3 には熱融着されるが、三角形開け口 2 2 には蓋 2 1 が熱融着されない。したがって蓋 2 1 を手で開封し易い。

【0014】図 4 において、本発明の包装材 2 0 D は中央部に隔壁 2 4 を設けて、物品 (カレールー) を収容する箇所を 2 5、2 6 と 2 つ設けた以外は図 1 に示した包装材 2 0 A と同様になっている。2 7、2 8 は密封包装されたカレールーを示す。複数のリブ状凹凸 4 A を設けたことにより対応する蓋 2 1 との接触面積が少なくなるなどの理由により、上記 (C) 工程で蓋 2 1 を熱融着する際に、蓋 2 1 は包装材 2 0 D のシール部 2 3 には熱融着されるが、三角形開け口 2 2 には蓋 2 1 が熱融着されない。したがって蓋 2 1 を手で開封し易い。またリブ状凹凸 4 A の各リブの方向は開け口 2 2 に対応する蓋 2 1 を開封する方向とほぼ平行に設けてあるので、各リブは開け口 2 2 の剛性を向上するように作用し、それにより一層蓋 2 1 を開封し易くなる。

【0015】なお、本発明は上記実施例に限定されるものではないので、特許請求の範囲に記載の趣旨から逸脱しない範囲で各種の変形実施が可能である。例えば、本発明の包装材に密封包装する物品は特に限定されず、食

品でも食品以外の密封包装が必要なものであれば適用することができる。上記実施例では浅い皿状の包装材を示したが、形状はこれに特に限定されず、正四角、三角、楕円、丸などの形状でもさしつかえない。

【0016】

【発明の効果】少なくとも 1 つの隅部に蓋が熱融着され難い三角形開け口を設け、この開け口の表面に凹凸を設けた本発明の包装材は、蓋を熱融着する際に、蓋は包装材のシール部には熱融着されるが、三角形開け口には蓋が熱融着されないで蓋を手で開封し易い。

【0017】前記開け口の表面にリブ状凹凸を設けた本発明の包装材は、蓋を熱融着する際に、蓋は包装材のシール部には熱融着されるが、三角形開け口には蓋が熱融着されないで蓋を手でより開封し易い。

【0018】前記リブ状凹凸のリブの方向が前記開け口の蓋を開封する方向とほぼ平行であるリブ状凹凸を設けた本発明の包装材は、蓋を熱融着する際に、蓋は包装材のシール部には熱融着されるが、三角形開け口には蓋が熱融着されないで蓋を手でより開封し易いとともに、三角形開け口の剛性が向上するので蓋を手でさらに開封し易くなる。

【図面の簡単な説明】

【図 1】 本発明の包装材の一実施形態の要部を示す斜視図である。

【図 2】 本発明の他の包装材の三角形開け口を説明する説明図である。

【図 3】 本発明の他の包装材の三角形開け口を説明する説明図である。

【図 4】 本発明の他の包装材にカレールーを密封包装した状態を説明する斜視図である。

【図 5】 (A) は、真空成形工程を示し、(B) は食品の充填工程を示し、(C) は、蓋を熱融着して密封包装する工程を示し、(D) は包装材の切り放し工程を示し、(E) はエッジのトリミング工程を示し、(F) は箱詰め工程を示す。

【図 6】 従来の包装材の要部を示す斜視図である。

【図 7】 従来の包装材の三角形開け口に対応する蓋が熱融着した状態を示す説明図である。

【符号の説明】

4 A、4 B、4 C 凹凸

2 0、2 0 A、2 0 B、2 0 C、2 0 D 包装材

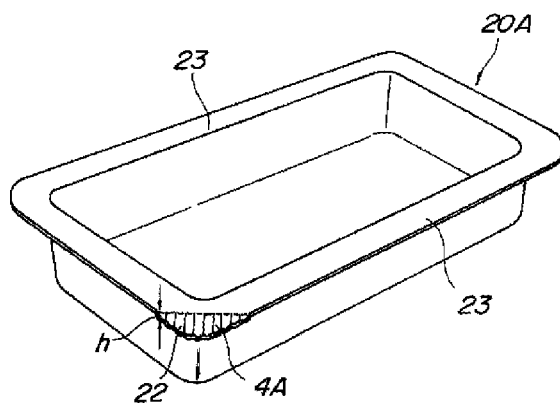
2 1 蓋

2 2 開け口

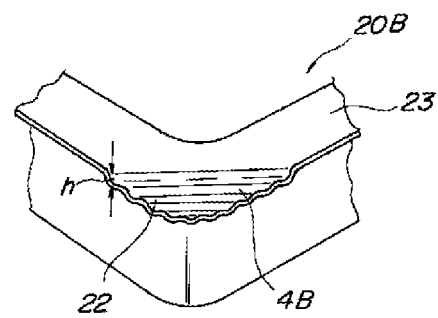
2 3 シール部

2 7、2 8 物品 (カレールー)

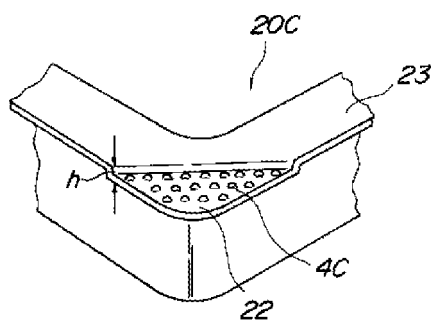
【図1】



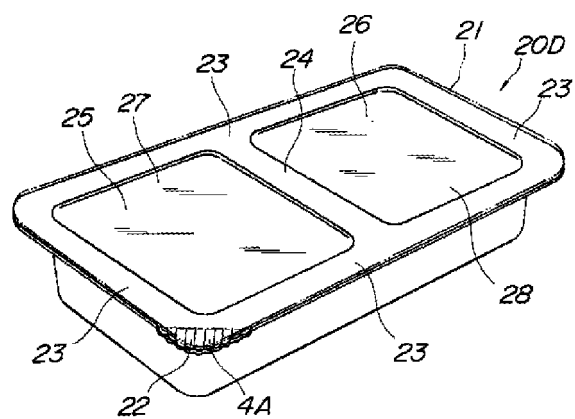
【図2】



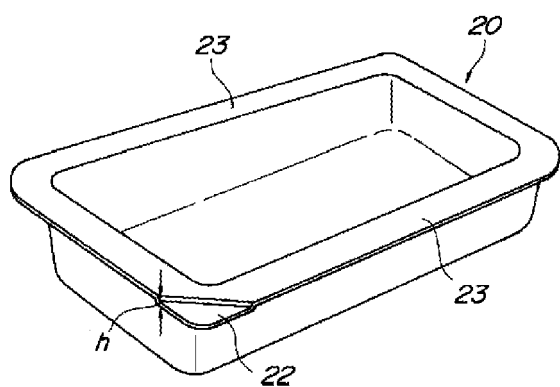
【図3】



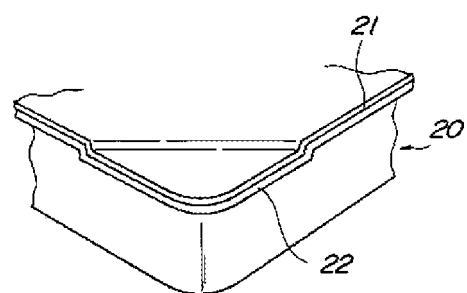
【図4】



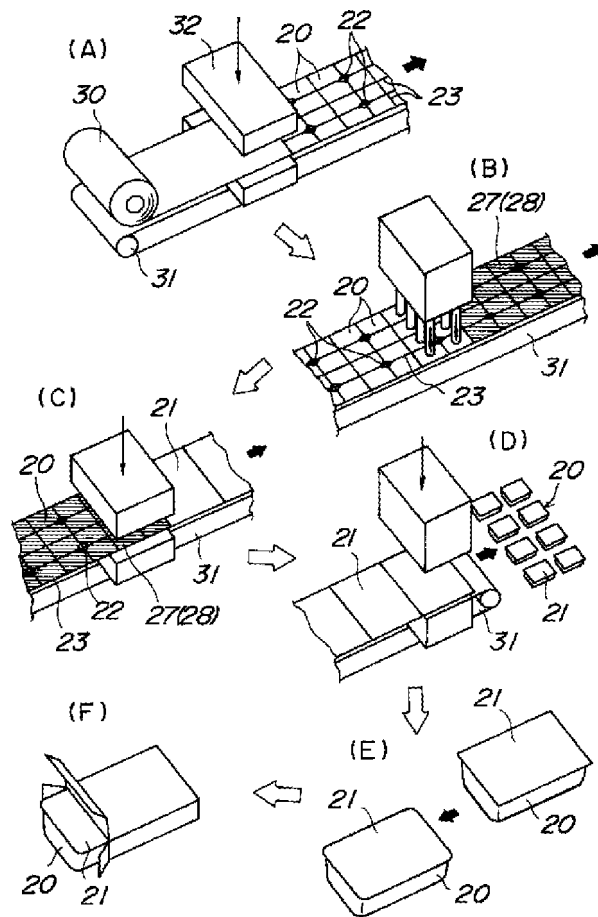
【図6】



【図7】



【図5】



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CA24 EA09 EA11 EA32 EB11
FA01 FC01 GD07 GD08

Patent/Publication: JP2000203639A

Bibliography

DWPI Title

Packing material for foodstuff, has triangular uneven portion in surface of opening which is not thermobonded with corresponding triangular portion of lid

Original Title

PACKAGING MATERIAL

Assignee/Applicant

Standardized: S & B FOODS INC

Original: S & B FOODS INC

Inventor

SAITO YOSHINORI, HIKICHI AKIO,

Publication Date (Kind Code)

2000-07-25 (A)

Application Number / Date

JP19998513A / 1999-01-14

Priority Number / Date / Country

JP19998513A / 1999-01-14 / JP

Abstract

Abstract

PROBLEM TO BE SOLVED: To provide a packaging material wherein when a lid is fused, the lid is fused to a seal part of the packaging material, but the lid is not fused to a triangular opening part provided at a corner of the seal part, and hence the lid can be easily opened by hand.

SOLUTION: In the packaging material, which is tightly packaged after receiving an article by fusing a lid, a triangular opening part 22 is provided in at least one of the corners of the packaging material, to which the lid is not fused, and a packaging material 20A is used wherein rib-shaped irregularities 4A are preferably formed on the surface of the part 22. The rib-shaped irregularities are preferably provided nearly in parallel to an unsealing direction of the lid of the part 22.

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(51) Int.Cl. ⁷	識別記号	F I	テームコード*(参考)
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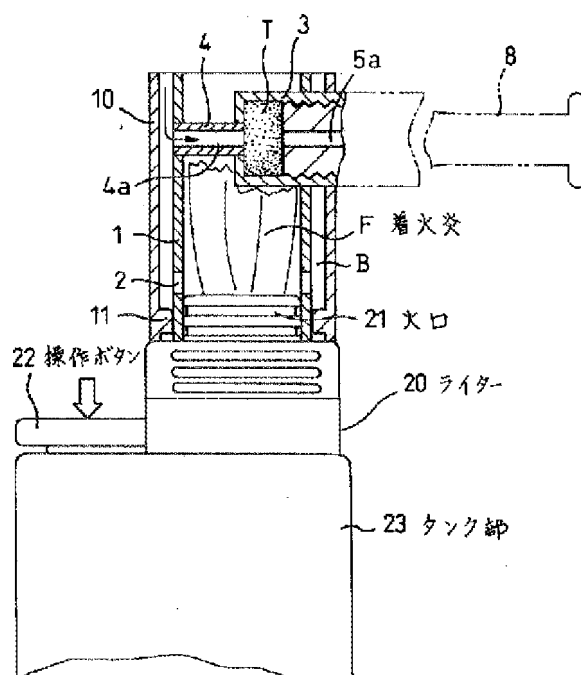
弁理士 村山 光威

(54) 【発明の名称】 喫煙用具

(57) 【要約】

【課題】 シガレットライターを用い、かつ比較的簡単な構成により、喫煙時の煙の発生を抑制することができる喫煙用具を提供する。

【解決手段】 ライター20を操作して着火させ、着火炎Fにより加熱筒体1内の収納筒体3を加熱し、収納筒体3内部のタバコTを熱して蒸し焼き状態にする。この状態で喫煙者が吸口部材8を口に当てて吸引すると、外部からの空気が通気部材4の通気路4aを通過して収納筒体3内へ入るため、収納筒体3内部の気体状(多少の煙の発生を伴う)になっているタバコ成分を空気と共に吸うことができる。このとき、収納筒体3部分からはタバコの煙は発生しない。



【特許請求の範囲】

【請求項1】 内部にタバコを収納し、かつ一部に外部と連通する通気部が設けられた耐熱性部材からなる収納部と、この収納部に連通する通道が設けられた吸口部とを備え、前記収納部をシガレットライターの炎によって外部から加熱し、収納されている前記タバコを熱することによってタバコの成分を、前記通道を通して前記吸口部から吸引するように構成したことを特徴とする喫煙用具。

【請求項2】 内部にタバコを収納し、かつ一部に外部と連通する通気部が設けられた耐熱性部材からなる収納部と、この収納部を上部に保持し、かつ下部開口に前記収納部を外部から加熱するためのシガレットライターの火口部分が設置される加熱筒体と、この加熱筒体の外周を覆う耐熱性部材からなる断熱カバー体と、前記収納部に連通する通道を有する吸口部とを備え、前記収納部をシガレットライターの炎によって外部から加熱し、収納された前記タバコを熱することによってタバコの成分を、前記通道を通して前記吸口部から吸引するように構成したことを特徴とする喫煙用具。

【請求項3】 前記収納部を、前記加熱筒体の内部空間部に一部が突出するように、前記加熱筒体の側壁部に設けたことを特徴とする請求項2記載の喫煙用具。

【請求項4】 前記収納部を、前記加熱筒体の内部空間部の略中央に設けたことを特徴とする請求項2記載の喫煙用具。

【請求項5】 前記収納部と前記吸口部との間に、吸口部の前記通道に連通する通道が設けられた金属部材からなる放熱用筒体と、前記通道に連通する通道が設けられた耐熱性部材からなる断熱筒体とを連結して設置したことを特徴とする請求項1または2記載の喫煙用具。

【請求項6】 前記断熱筒体あるいは吸口部の少なくともいずれか一方における前記通道の内部にタール類などを吸着するためのフィルターを設けたことを特徴とする請求項5記載の喫煙用具。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、タバコを吸うための喫煙用具に係り、特に喫煙時の煙の発生をなくすようにした喫煙用具に関するものである。

【0002】

【従来の技術】近年の嫌煙権の問題における中心となる課題は、喫煙時に発生するタバコの煙がタバコを吸わない者に対しても影響を与えることであり、この問題に対応するため、各所において喫煙場所を限定したり、あるいは室内では喫煙を許さないような状況にするようになってきている。

【0003】そして、近年ではタバコに付設されるフィルターなどに工夫をして煙の発生を少なくしたり、タバコの煙が外部に広まらないように煙を吸引する装置、あ

るいはタバコの煙が発生し難くした喫煙用の器具が開発されている。

【0004】例えば、喫煙用の器具にあつては、タバコを燃焼させずに燃焼煙を発生させない程度に加熱して、その状態において発生したタバコ成分を吸うようにした喫煙用の器具がある。

【0005】

【発明が解決しようとする課題】従来の喫煙時の煙を抑制するようにした喫煙用の器具では、タバコを燃焼しない程度に加熱するための手段として、タバコに直接触させたニクロム線ヒータを用いたものが知られているが、ヒータを加熱するための電源として商用電源を用いたり、あるいは携帯時においても使用可能にするために充電電池を内蔵するようにしている。

【0006】このため、前記従来の喫煙用の器具は、各種電気部品を使用すること等から全体として大型になり、またコストが高くなるという問題があった。

【0007】本発明の目的は、前記従来の問題を解決し、シガレットライターを用い、かつ比較的簡単な構成により、喫煙時の煙の発生を抑制することができる喫煙用具を提供することにある。

【0008】

【課題を解決するための手段】前記目的を達成するため、本発明の喫煙用具は、内部にタバコを収納し、かつ一部に外部と連通する通気部が設けられた耐熱性部材からなる収納部と、この収納部に連通する通道が設けられた吸口部とを備え、前記収納部をシガレットライターの炎によって外部から加熱し、収納されている前記タバコを熱することによってタバコの成分を、前記通道を通して前記吸口部から吸引するように構成したものであり、この構成によって、シガレットライターを使用して、収納部内のタバコを外部から加熱し、内部のタバコを、いわゆる蒸し焼き状態にして、タバコの成分を吸口部から吸うことができるために、吸口部から多少の煙が発生することはあっても、タバコの燃焼煙が発生することはない。

【0009】また本発明は、内部にタバコを収納し、かつ一部に外部と連通する通気部が設けられた耐熱性部材からなる収納部と、この収納部を上部に保持し、かつ下部開口に前記収納部を外部から加熱するためのシガレットライターの火口部分が設置される加熱筒体と、この加熱筒体の外周を覆う耐熱性部材からなる断熱カバー体と、前記収納部に連通する通道を有する吸口部とを備え、前記収納部をシガレットライターの炎によって外部から加熱し、収納された前記タバコを熱することによってタバコの成分を、前記通道を通して前記吸口部から吸引するように構成したものであり、この構成によって、前記発明と同様な作用効果を得ることができ、かつシガレットライターを使用しても、断熱カバー体を用いるなど、安全で簡潔な構成にすることができる。

【0010】また本発明は、前記収納部を、前記加熱筒体の内部空間部に一部が突出するように、前記加熱筒体の側壁部に設けた構成を採用することができる。

【0011】また本発明は、前記収納部を、前記加熱筒体の内部空間部の略中央に設けた構成を採用することができる。

【0012】また本発明は、前記収納部と前記吸口部との間に、吸口部の前記通道に連通する通道が設けられた金属部材からなる放熱用筒体と、前記通道に連通する通道が設けられた耐熱性部材からなる断熱筒体とを連結したものであり、この構成によって、吸口部から安全に、かつ冷えた気体状態でタバコの成分を吸うことができる。

【0013】また本発明は、前記断熱筒体あるいは吸口部の少なくともいずれか一方における前記通道の内部にタール類などを吸着するためのフィルターを設けたものであり、この構成によって、フィルターを適宜選択することにより、喫煙者の好みに合った味にすることができる。

【0014】

【発明の実施の形態】以下、本発明の実施の形態を図面に基づいて説明する。

【0015】図1は本発明の第1実施形態を説明するための喫煙用具全体の断面図、図2は第1実施形態における要部の底面図、図3は第1実施形態における各部材の形状などを示す分解斜視図であり、1は、上下が開口した円筒状の耐熱材料の金属からなり、下部全周に細かな通気窓2が複数個形成された加熱筒体、3は、内部にタバコ（タバコの形態としては、刻みタバコ状態のもの、あるいは本例のようにタバコ粉を錠剤状に成形したものなど）Tが収納され、加熱筒体1の上部開口近傍における側壁に横方向に延出するように設けられた耐熱材料の金属からなる収納筒体、4は、収納筒体3に一方の開口部が固定され、他方の開口部が加熱筒体1の側壁に固定されて、外部から空気を収納筒体3内へ導入する通気路4aが設けられている耐熱材料の金属からなる管状の通気部材である。

【0016】5は、収納筒体3の外部開口3a側に一端部が螺合し、外周部に多数の放熱用のフィン6が刻設された放熱用筒体、7は、放熱用筒体5に横方向に貫通するように設けられた通道5aと連通する通道7aが設けられ、一端部が放熱用筒体5に嵌合する耐熱性プラスチックなどからなる断熱筒体、8は、断熱筒体7の通道7aと連通する通道8aが設けられ、一端部が断熱筒体7に螺合するプラスチック製の吸口部材、9は、本例では断熱筒体7および吸口部材8の通道7a、8a内部に配設されて、通道7a、8aを通過するタバコTの煙成分からタール類を吸着するフィルターである。

【0017】10は、耐熱性プラスチックからなる筒状の断熱カバーであって、下部開口10a近傍の内壁に複

数の突起11が形成されており、内部空間に加熱筒体1が入り、突起11において断熱カバー10の内側壁が加熱筒体1の外側壁に嵌合することによって、外部に通じる隙間Bが断熱カバー10と加熱筒体1との間に形成される。断熱カバー10の上部側には、放熱用筒体5の下側部分を覆う収納溝部12aが形成された突出部12が一体に形成されている。

【0018】断熱カバー10は、喫煙時に加熱状態になる加熱筒体1と放熱用筒体5とに、喫煙者の手などが触れないようにする安全カバーとして機能する。

【0019】次に、前記構成の第1実施形態の使用方法を説明する。

【0020】まず、収納筒体3の外部開口3aから放熱用筒体5を取り外し、外部開口3aから内部にタバコTを入れ、その後、収納筒体3の外部開口3aに放熱用筒体5を螺合することにより、既に連結している断熱筒体7および吸口部材8を図1に示す状態にセットする。そして、本例ではシガレットライター20として、いわゆるターボライター（火力の強いライターが効果的である）を用い、図4に示すように、そのライター20の火口21を加熱筒体1の下部開口における内周部に嵌合させる。

【0021】この状態で喫煙が可能になり、ライター20の操作ボタン（ライターおよび操作ボタンの形状などは本例のものに限定されない）22を押圧して着火すると、着火炎Fが加熱筒体1の内部空間に広がって収納筒体3を加熱する。この加熱によって、収納筒体3内部のタバコTは熱せられて、蒸し焼き状態になる。

【0022】そして、喫煙者が吸口部材8を口に当てて吸引すると、通気部材4の通気路4aを通過して外部からの空気が収納筒体3内へ入るため、収納筒体3内部において気体状（多少の煙の発生を伴う）になっているタバコ成分が空気と共に吸口部材8方向へと吸い寄せられるため、通道5a、7a、8a、およびフィルター9を通してタバコ成分を吸うことができる（本発明では、この状態を喫煙という）。このタバコ成分はタバコTが加熱（約200℃）されていれば発生する。

【0023】したがって、一度着火させて前記のように収納筒体3を過熱させた後、操作ボタン22を離して消火させても成分発生温度であれば喫煙は可能である。そして、喫煙者は、タバコ成分がなくなるように感じられたら、再びライター20の操作ボタン22を押圧して着火させて、収納筒体3を加熱させタバコ成分を発生させることにより、再び喫煙することができる。この動作を繰り返すことによって、全タバコ成分を吸うことができる。

【0024】前記加熱喫煙動作中、喫煙者は、図4に示すライター20のタンク部23を手で持ち、吸口部材8からタバコ成分を吸うことになるが、本喫煙用具がライター20の着火炎の熱を利用するものであって、一部に

において加熱状態にある喫煙用具を手で持って喫煙することになり、さらに喫煙後にも各部においてかなりの残留熱が存在するために、喫煙者が触れることによって火傷などの恐れがあるが、第1実施形態では、断熱カバー10が、喫煙時に加熱状態になる加熱筒体1と放熱用筒体5とを覆い、かつ隙間Bが空気断熱層として断熱カバー10と加熱筒体1間に形成される断熱構造になっているため、喫煙用具を構成する部材における加熱部分に喫煙者が触れずに保護される。

【0025】さらに加熱筒体1には、下部開口近傍の全周に複数の細かな通気窓2を形成しており、加熱筒体1における熱が、喫煙者の手に近く、かつライター20の火口22が嵌合する部位である加熱筒体1の下部に伝達することを抑制するようにしている。また収納筒体3には放熱用のフィン6が刻設された放熱用筒体5を連結することによって、喫煙後のこの部位の冷却を早めるようにしている。

【0026】なお、放熱用筒体5としては、フィン6を形成させずに金属製の中空柱体の外周にスプリングを巻回するようにして、空気と接触する表面積を広くするようにして冷却効果を得ることも考えられる。

【0027】図5は本発明の第2実施形態を説明するための喫煙用具全体の断面図であり、基本的には前記第1実施形態の構成と同様であるので、図1～図4にて説明した部材に対応する部材には同一符号を付して詳しい説明は省略する。第2実施形態の喫煙用具が第1実施形態のものとは異なる点は収納筒体3の加熱筒体1に対する設置構成である。

【0028】すなわち、第2実施形態では、加熱筒体1における内部空間における上部の略中央に底面側が閉鎖された収納筒体3を配設し、この収納筒体3の周壁に一方の開口部が固定され、かつ他方の開口部が加熱筒体1の側壁に固定されて、外部から空気を収納筒体3内へ導入する通気路4aが設けられている耐熱材料の金属からなる管状の複数の通気部材4によって、収納筒体3を加熱筒体1内部に保持するようにしている。さらに、収納筒体3の上部開口には、中空管体30が連結され、収納筒体3内部と放熱用筒体5の通道5aとを連通する開閉蓋体31が螺合している。

【0029】この第2実施形態では、収納筒体3底面の直下にライター20の火口22が配設されるため、着火炎Fが収納筒体3に効率的に当たることになるので、収納されているタバコTに対して熱エネルギーが無駄なく加わる。

【0030】中空管体30、放熱用筒体5、断熱筒体7および吸口部材8部分を1つの操作レバーとして回すことによって、開閉蓋体31を収納筒体3から取り外すこ

とができ、この取り外し状態で使用済みのタバコを取り去り、新規のタバコTを収納筒体3内に詰めることができる。

【0031】第2実施形態におけるその他の使用方法是前記第1実施形態と同様である。

【0032】

【発明の効果】以上説明したように、本発明の喫煙用具によれば、シガレットライターを使用して、収納部内のタバコを外部から加熱し、内部のタバコを、いわゆる蒸し焼き状態にして、タバコの成分を吸口部から吸うことができるために、吸口部から多少の煙が発生することはない。しかも、安全で簡潔な構成にすることができる。

【図面の簡単な説明】

【図1】本発明の第1実施形態を説明するための喫煙用具全体の断面図

【図2】第1実施形態における要部の底面図

【図3】第1実施形態における各部材の形状などを示す分解斜視図

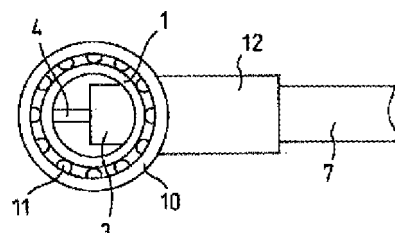
【図4】第1実施形態の使用方法を説明するための一部を断面して示す説明図

【図5】本発明の第2実施形態を説明するための喫煙用具全体の断面図

【符号の説明】

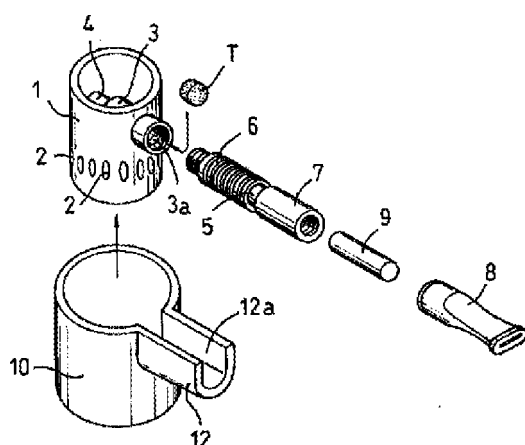
- 1 加熱筒体
- 2 通気窓
- 3 収納筒体
- 4 通気部材
- 4a 通気路
- 5 放熱用筒体
- 5a, 7a, 8a 通道
- 7 断熱筒体
- 8 吸口部材
- 9 フィルター
- 10 断熱カバー
- 11 突起
- 12 突起部
- 12a 収納溝部
- T タバコ
- 20 ライター
- 21 火口
- 22 操作ボタン
- 23 タンク部
- F 着火炎
- 30 中空管体
- 31 開閉蓋

【图 1】

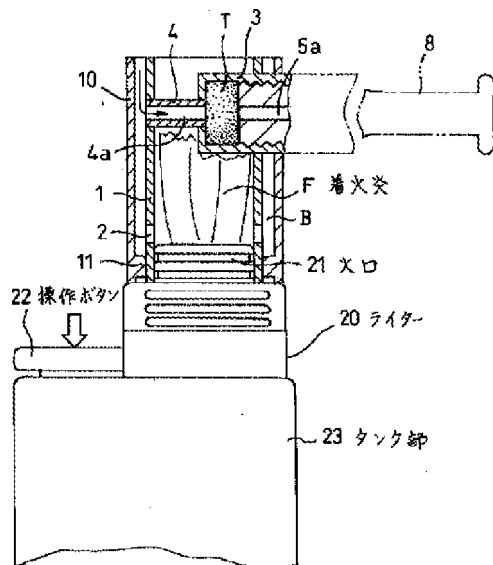


【图 2】

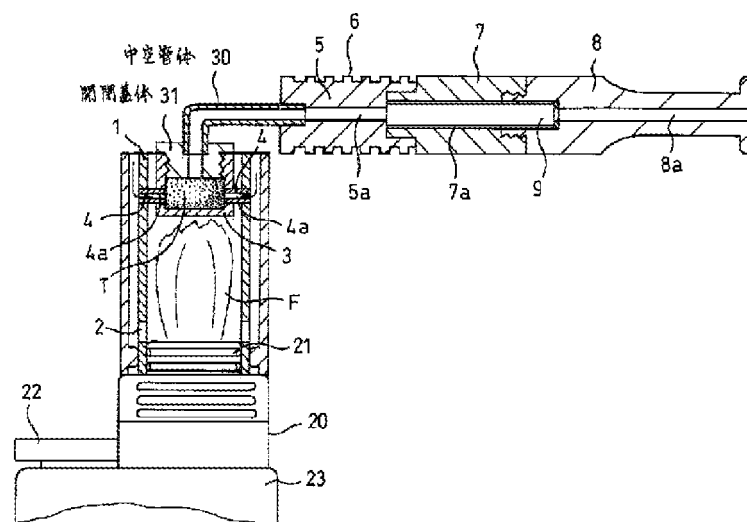
【図 3】



【图 4】



【図5】



Patent/Publication: JP2000236865A

Bibliography

DWPI Title

Smoking tool for cigarette lighter, has suction piece which inhales external air from cigarette storage cylinder to stop formation of combustion smoke in storage cylinder

Original Title

INSTRUMENT FOR SMOKING

English Title

INSTRUMENT FOR SMOKING

Assignee/Applicant

Standardized: **SEIKO KOGYO KK**

Original: SEIKO KOGYO KK

Inventor

SUZUKI NARIAKI,

Publication Date (Kind Code)

2000-09-05 (A)

Application Number / Date

JP199943495A / 1999-02-22

Priority Number / Date / Country

JP199943495A / 1999-02-22 / JP

Abstract

Abstract

PROBLEM TO BE SOLVED: To provide a smoking instrument which uses a cigarette lighter, has a relatively simple structure, and can inhibit the generation of smoke on smoking.

SOLUTION: A lighter 20 is operated to ignite, and the ignited flame F heats a receiving cylinder 3 in a heating cylinder 1 to heat a cigarette T in the receiving cylinder 3 in a baking state. When a smoker sucks a mouthpiece 8 from his mouth in the baking state, air is charged from the outside into the receiving cylinder 3 through the aeration path 4a of an aeration member, whereby gaseous tobacco ingredients (slightly containing generated smoke) can be sucked together with air. Therein, the smoke of the tobacco is not generated from the portion of the receiving cylinder 3.

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(51) Int.Cl.⁷

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2/40

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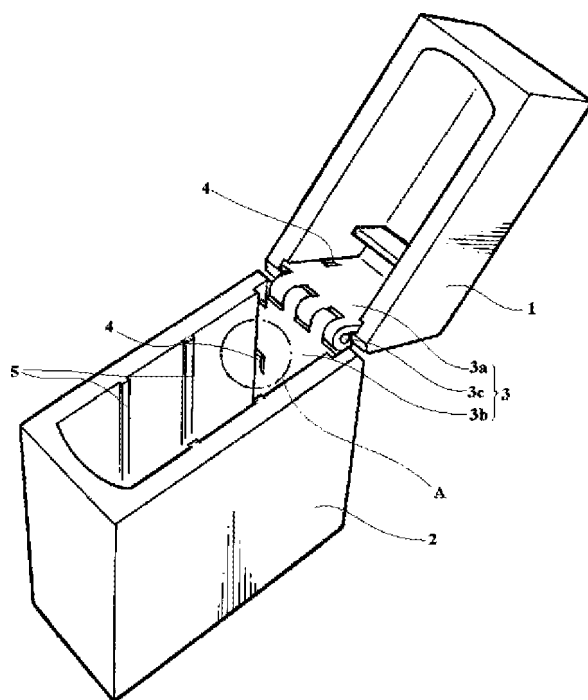
Fターム(参考) 3K095 AA02 AB06 KA01

(54) 【発明の名称】 ライターケース

(57) 【要約】

【課題】 この発明は、燃料タンク及び点火部を一体としたライター本体を収納し、携帯することを目的としたライターケースであって、プラスチック等の樹脂材料の如き金属製の蝶番部材の溶接による固着が不可能なライターケース材料に、特に有益な蝶番部材の固着手段を提供することを目的とする。

【解決手段】 上記課題を解決するためにこの発明が採った手段は、上ケースと下ケースとからなり、下ケース内に燃料タンク及び点火部を一体にしたライター本体を収納するライターケースにおいて、金属製で両側縁の一部を切り曲げて形成した拔止突起を有する上側板状部材及び下側板状部材をヒンジにより回動自在に連結した蝶番を、上ケースと下ケース内にそれぞれ形成した蝶番挿入溝に挿入し、拔止突起を溝内壁に係入して抜け止めを図りつつ上ケースと下ケースを回動自在に連結させたことを特徴とする。



【特許請求の範囲】

【請求項1】 上ケースと下ケースとからなり、下ケース内に燃料タンク及び点火部を一体にしたライター本体を収納するライターケースにおいて、金属製で両側縁の一部を切り曲げて形成した拔止突起を有する上側板状部材及び下側板状部材をヒンジにより回動自在に連結した蝶番を、上ケースと下ケース内にそれぞれ形成した蝶番挿入溝に挿入し、拔止突起を溝内壁に係入して抜け止めを図りつつ、上ケースと下ケースを回動自在に連結させたことを特徴とするライターケース。

【請求項2】 上ケース及び下ケースの挿入溝側の上端面を傾斜面とし、該傾斜面の中央部に蝶番ヒンジ部を受け入れるためのヒンジ受入部を設けたことを特徴とする請求項1記載のライターケース。

【発明の詳細な説明】

【0001】

【発明の属する分野】 この発明は、燃料タンク及び点火部を一体としたライター本体を収納し、携帯することを目的としたライターケースに関する。

【0002】

【従来の技術】 従来、燃料オイル充填式の携帯用ライターは、燃料タンク及び点火部が一体になった本体を、金属製の上下2つに分割されたケースに収納した状態である。しかしながら金属製のケースを用いることにより耐久性は確保されるが、ケース表面もしくはケース自体に所望のデザインを施したり、複雑な表面形状としたりすることは容易ではなかった。

【0003】 又、仮にプラスチック等の非金属製材料、特にライターケースにおいては耐熱性を求められるためにポリカーボネートを使用することになるが、この場合蝶番をケース内に溶接することは不可能である。そのため蝶番を接着剤でケース内に固定する必要があるが、接着剤を使用した場合、接着部分が劣化しやすくクラック発生の原因となり耐久性に問題があった。

【0004】

【発明が解決しようとする課題】 この発明は、燃料タンク及び点火部を一体としたライター本体を収納し、携帯することを目的としたライターケースであって、プラスチック等の樹脂材料の如き金属製の蝶番部材の溶接による固着が不可能なライターケース材料に、特に有益な蝶番部材の固着手段を提供することを目的とする。

【0005】

【課題を解決するための手段】 上記課題を解決するためにこの発明が採った手段は、上ケースと下ケースとからなり、下ケース内に燃料タンク及び点火部を一体にしたライター本体を収納するライターケースにおいて、金属製で両側縁の一部を切り曲げて形成した拔止突起を有する上側板状部材及び下側板状部材をヒンジにより回動自在に連結した蝶番を、上ケースと下ケース内にそれぞれ形成した蝶番挿入溝に挿入し、拔止突起を溝内壁に係入

して抜け止めを図りつつ上ケースと下ケースを回動自在に連結させたことを特徴とする。

【0006】 又、上ケース及び下ケースの案内溝側の上端部を傾斜面とし、該傾斜面の中央部に蝶番ヒンジ部を受け入れるためのヒンジ受入部を設けたことを特徴とする。

【0007】

【発明の実施の形態】 この発明の好ましい実施の形態を、図面を参照しつつ以下に詳細に説明する。図1から6を参照して、(1)は上ケース、(2)は下ケースでありプラスチック等の樹脂材料を一方を閉止した断面長方形の筒状に形成されている。下ケース(2)の内壁面には、ケース内部にライター本体を収納した際にライター本体のガタツキの防止及び固定を行うことを目的とした突条(5)が対向する内壁面にそれぞれ2本形成されており、同内壁面一端側には蝶番(3)を受け入れるための挿入溝(6)が形成されている。又、下ケース(2)の開放端部一端には上下ケースを回動させた際の相互干渉を防ぐための傾斜面(8)が設けられるとともに傾斜面中央部には蝶番(3)のヒンジ部を受け入れるためのヒンジ受入部(7)が形成されている。尚、下ケース(2)と同様に上ケース(1)にも傾斜面(11)及びヒンジ受入部(10)は形成されているが、上ケース(1)内にはライター本体を固定する必要はないので、突条は形成されていない。この発明は、プラスチック等の樹脂材料やゴム、木等の金属製蝶番部材を溶接することが不可能なライターケース材料に特に効果的である。しかしながら、金属等の溶接可能なライターケース材料に溶接によらない固着を可能としている。溶接によることなく固着することによって、ライターケースの表面に溶接痕が形成されることがなく、ライターケースを美しく仕上げる事が可能となる。

【0008】 (3)は上ケース(1)と下ケース(2)を接続するための蝶番であり、上側板状部材(3a)と下側板状部材(3b)及び上下板状部材を連結するためのピン(3c)から構成されている。上側板状部材(3a)先方はライター本体(12)上面に有する蓋係合突起を受け入れられるよう、コ字状に折り曲げられている。コ字状部の根本付近両側には拔止突起(4)が、上側板状部材(3a)の一部を切り曲げるにより作出されている。下側板状部材(3b)両側縁の中央付近にも上側板状部材(3a)と同様に下側板状部材(3b)の一部を切り曲げて作出した拔止突起(4)が形成されている。又、下側板状部材(3b)の先端付近は拔止突起(4)の突出方向とは逆の方向に湾曲させてある。尚、上側板状部材(3a)と下側板状部材(3b)は連結用のピン(3c)で回動自在に連結されている。

【0009】 次に上ケース(1)と下ケース(2)を蝶番(3)で接続する方法について順を追って説明する。図8は上ケース(1)と下ケース(2)を蝶番(3)で接続する際の各々の関係を示したものである。上ケース(1)内に設けられた案内溝(9)の幅は上側板状部材(3a)の厚みより

も若干余裕のある寸法に、又、深さについては対向する挿入溝(9)の最深部から最深部までの距離が上側板状部材(3a)の幅と略同一になる寸法に形成されている。上側板状部材(3a)を上ケース(1)内に固定するには挿入溝(9)に沿って上側板状部材(3a)を押し込む。上側板状部材(3a)には前記のとおり拔止突起(4)がヒンジ部に向かって形成されているため、挿入溝(9)の幅方向に対して付勢力が働き幅方向のガタツキが防止されると共に、返しの役割を果たして上側板状部材(3a)は確実に且容易に固定される。尚、上側板状部材(3a)のコ字状部については前記のとおり幅が狭められているため、上ケース(1)の内壁に干渉することなく収まる。

【0010】下ケース(2)に形成された挿入溝(6)に関しても上ケース(1)と同様に、対向する溝の最深部から最深部までの距離が下側板状部材(3b)の幅と略同一になる寸法に形成されている。又、挿入溝(6)の幅についても上ケース(1)と同様に下側板状部材(3b)の厚みよりも若干余裕のある寸法に形成されている。下ケース(2)内に下側板状部材(3b)を固定する際にも上ケースの場合と同様に挿入溝(6)に沿って下側板状部材(3b)を押し込む。この際、下側板状部材(3b)の先端付近の湾曲及び拔止突起(4)の作用によりガタツキが防止されると共に、拔止突起(4)による返しの作用によって、下ケース(2)内に確実に且容易に固定される。上ケース(1)と下ケース(2)の開放端部には蝶番(3)のヒンジ部を受け入れるためのヒンジ受入部(7)(10)が設けられており、又、ヒンジ受入部(7)(10)の周囲部には傾斜面(8)(11)が形成され、蝶番(3)により上ケース(1)を回動させても、蝶番及び上下ケース同士が干渉しないようにしてある。

【0011】

【発明の効果】この発明によれば、燃料タンク及び点火部を一体としたライター本体を収納し、携帯することを目的としたライターケースをプラスチック等の樹脂材料

で形成することが可能となるため、ケースの表面にデザインを施したり、ケース自体を所望の形状に作成することが容易に出来るものである。

【図面の簡単な説明】

【図1】この発明にかかる上ケースと下ケースを蝶番で連結した状態を示す斜視図

【図2】上ケースの正面図

【図3】下ケースの正面図

【図4】図3 B-B線に沿った断面図

【図5】図3 C-C線に沿った断面図

【図6】下ケースヒンジ受入部を示す斜視図

【図7】蝶番のヒンジ部の周辺を示す斜視図

【図8】上ケースと下ケース及び蝶番の関係を示す図

【図9】図1 A部分の拡大斜視図

【図10】図9 D-D線に沿った断面図

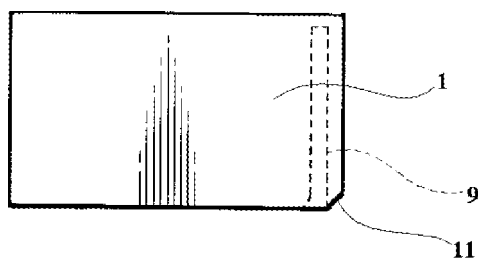
【図11】上ケースを閉じた使用状態を示す正面図

【図12】上ケースを回動させた使用状態を示す正面図

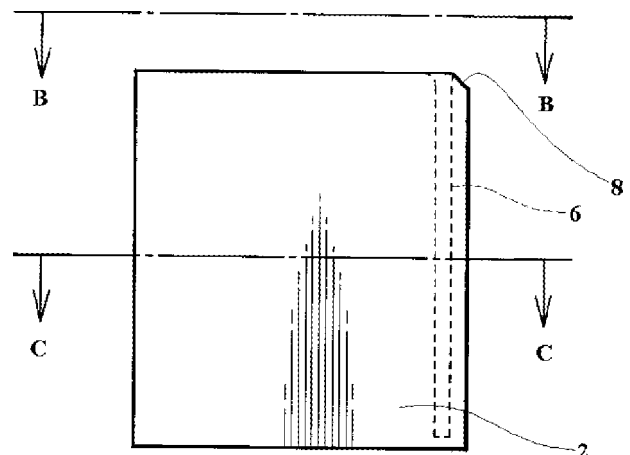
【符号の説明】

- (1) 上ケース
- (2) 下ケース
- (3a) 上側板状部材
- (3b) 下側板状部材
- (3c) ピン
- (4) 拔止突起
- (5) 突条
- (6) 挿入溝
- (7) ヒンジ受入部
- (8) 傾斜面
- (9) 挿入溝
- (10) ヒンジ受入部
- (11) 傾斜面
- (12) ライター本体

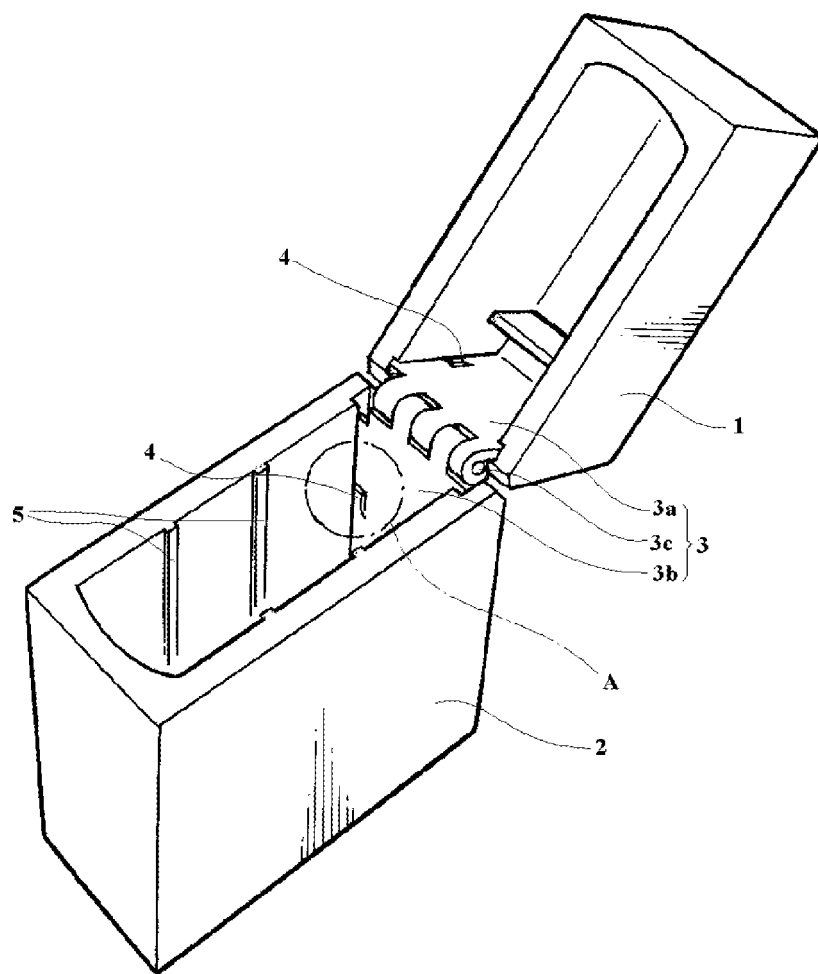
【図2】



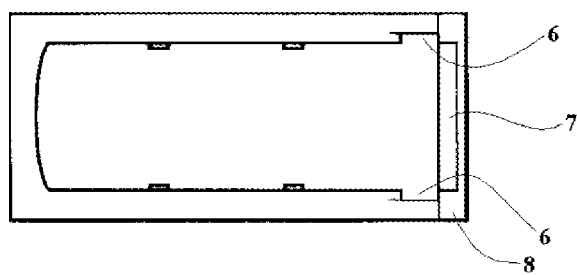
【図3】



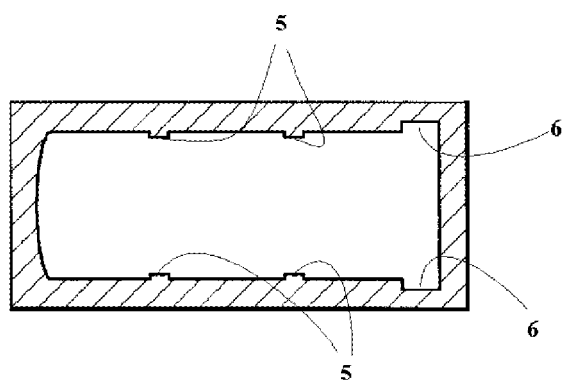
【図1】



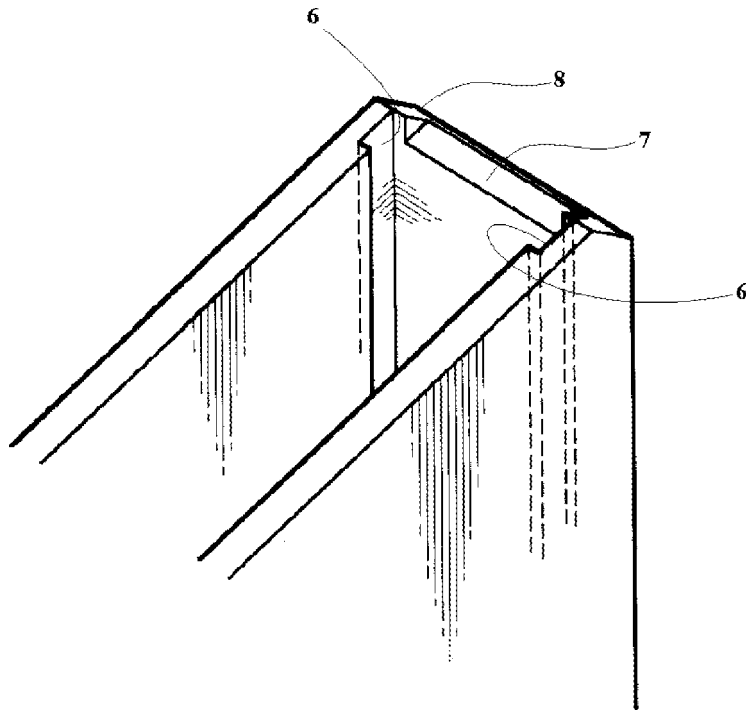
【図4】



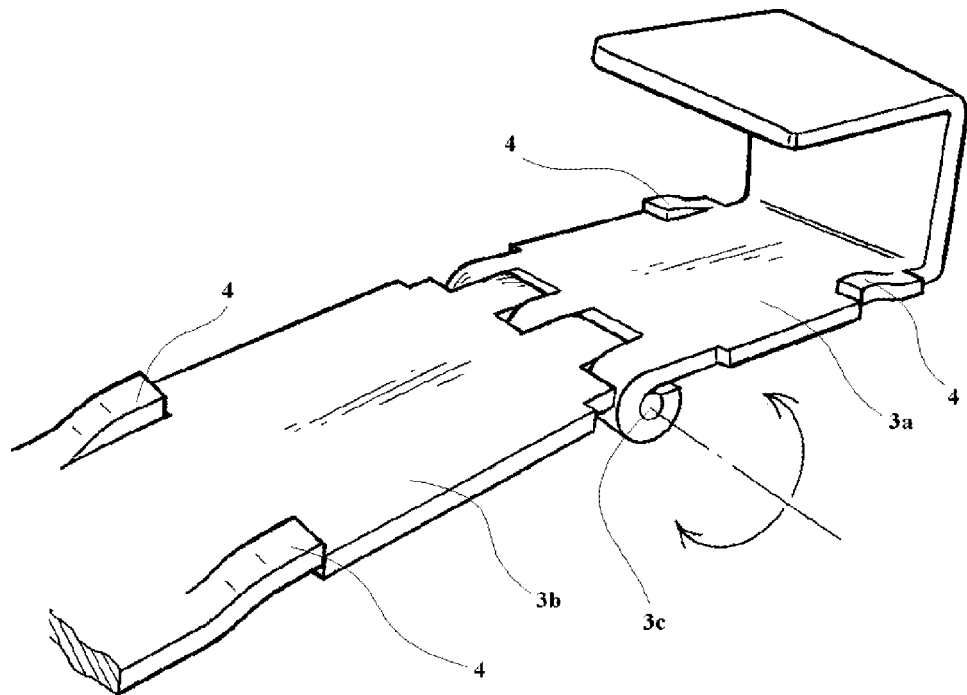
【図5】

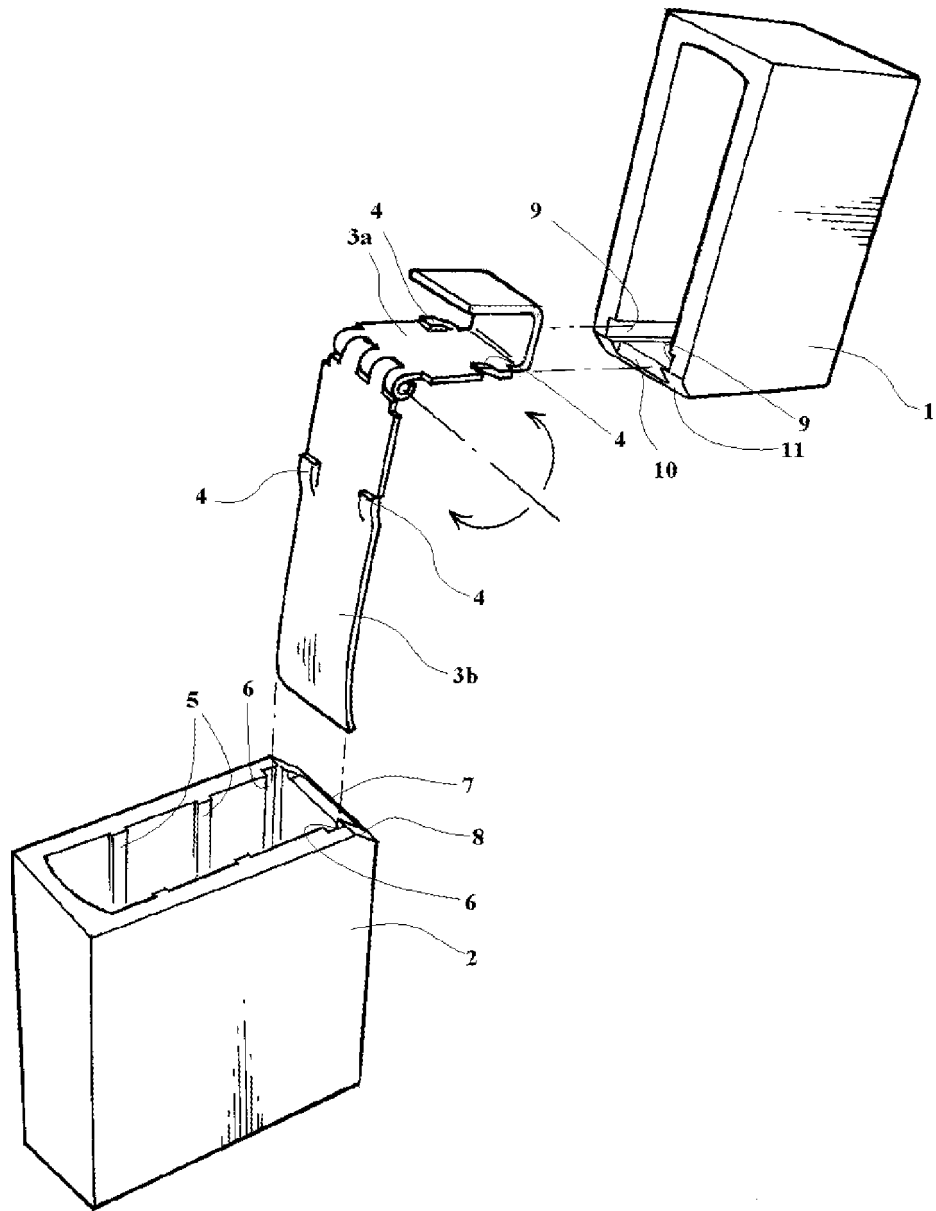


【図6】

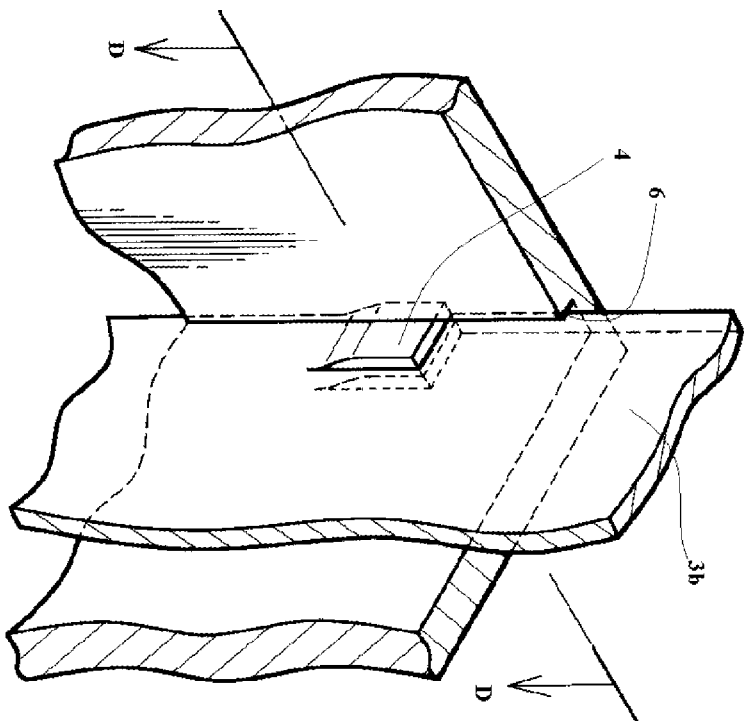


【図7】

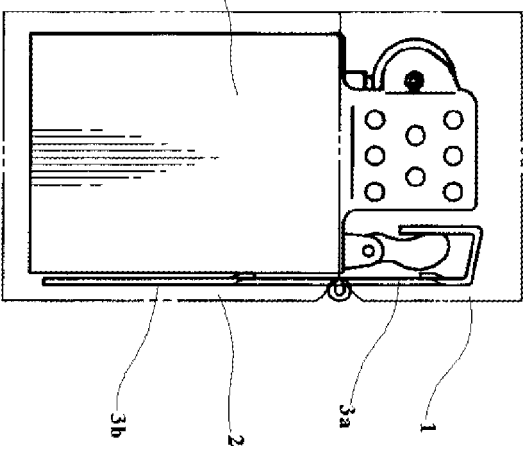




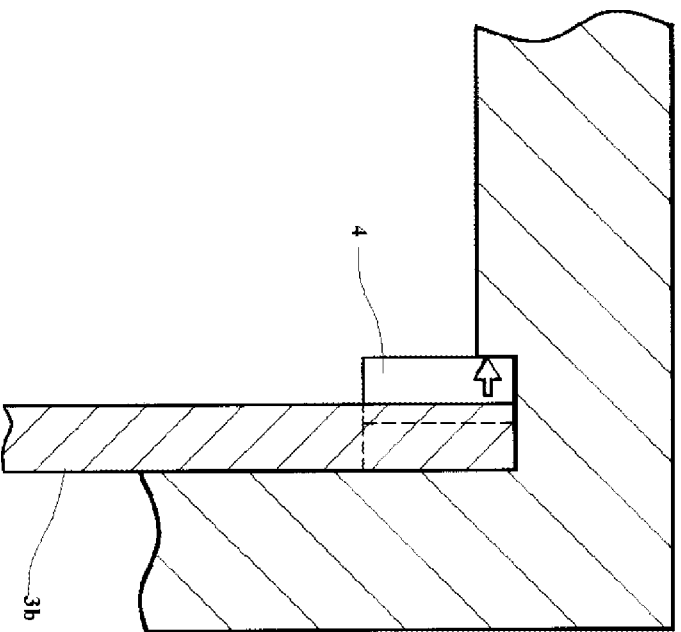
【図 9】



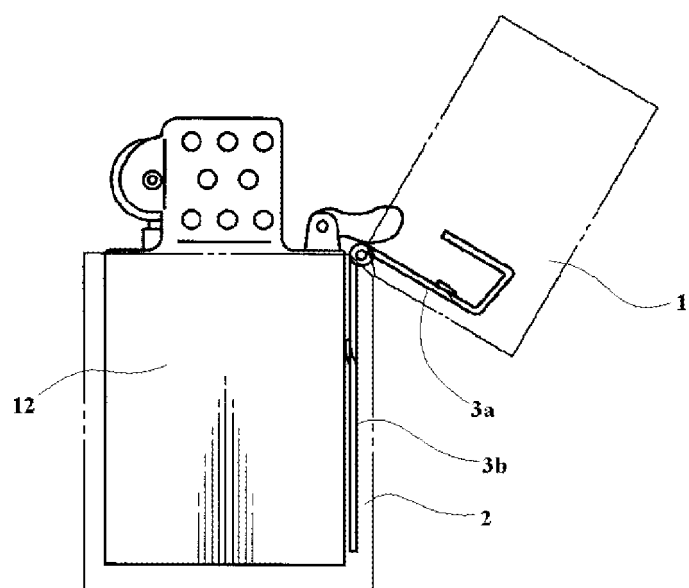
【図 11】



【図 10】



【図12】



Patent/Publication: JP2001165437A

Bibliography

DWPI Title

Lighter case for refillable lighter has hinge with stopper protrusions that are inserted into hinge insertion grooves formed on upper and lower casings, to turnably coupling casings

Original Title

LIGHTER CASE

English Title

LIGHTER CASE

Assignee/Applicant

Standardized: TSUBOTA PEARL CO LTD

Original: TSUBOTA PEARL CO LTD

Inventor

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Abstract

Abstract

PROBLEM TO BE SOLVED: To provide a fixing means for a hinge member, which is useful especially for a lighter case material in which a welding of metal hinge member is impossible to a resin of a portable lighter case, in which a fuel tank and an ignition part are integrated with each other.

SOLUTION: The lighter case comprises an upper case and a lower case, a fuel tank and an ignition part are integrally provided in the lower case. Slip- stop protrusions are formed by partly louvering edges of both side metal sheet members of the upper and the lower sheet members, which are connected rotatably by a hinge. Respective sheet members are inserted in hinge-insertion grooves formed respectively in the upper and lower cases, in which the slip-stop protrusions are fit in the grooves formed in the inside wall to ensure a slip-stop function and at the same time both the upper and lower cases are connected to each other.

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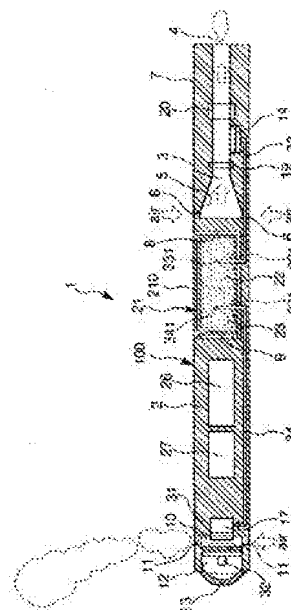
(54) 【発明の名称】 電子タバコ

(57) 【要約】

【課題】喫煙者が擬似喫煙を行なうときに、喫煙開始時から十分な量の香味成分が得られ、タバコと同じような感覚が得られる電子タバコを提供する。

【解決手段】電子タバコ1は、吸引口4を有し、全体形状が略棒状をなすケーシング2と、前記ケーシング2内に設けられ、アクチュエータを駆動して液状の香味生成媒体が充填されたキャビティ内の圧力を変化させることにより前記キャビティに連通するノズルから前記香味生成媒体を液滴として吐出する少なくとも1つの吐出ヘッドを有する吐出手段(第1吐出手段14)と、前記ケーシング2内に設けられ、前記吐出手段の駆動を制御する制御手段27とを備える。

【選択図】 図2



【特許請求の範囲】

【請求項 1】

吸引口を有し、全体形状が略棒状をなすケーシングと、
前記ケーシング内に設けられ、アクチュエータを駆動して液状の香味生成媒体が充填されたキャビティ内の圧力を変化させることにより前記キャビティに連通するノズルから前記香味生成媒体を液滴として吐出する少なくとも 1 つの吐出ヘッドを有する吐出手段と、
前記ケーシング内に設けられ、前記吐出手段の駆動を制御する制御手段とを備えることを特徴とする電子タバコ。

【請求項 2】

前記ケーシング内に設けられ、前記吐出手段から吐出された香味生成媒体の液滴を霧化させる霧化手段を有する請求項 1 に記載の電子タバコ。

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【請求項 3】

前記霧化手段は、前記吐出手段から吐出された香味生成媒体の液滴を加熱して霧化させる加熱手段である請求項 2 に記載の電子タバコ。

【請求項 4】

前記霧化手段は、前記吐出手段から吐出された香味生成媒体の液滴を振動させて霧化させる振動手段である請求項 2 に記載の電子タバコ。

【請求項 5】

前記霧化手段を前記ケーシングに着脱自在とした請求項 2 ないし 4 のいずれかに記載の電子タバコ。

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【請求項 6】

液状の香味生成媒体が収納された収納部を有するカートリッジが着脱自在に装着される装着部を備える請求項 1 ないし 5 のいずれかに記載の電子タバコ。

【請求項 7】

前記カートリッジに前記吐出手段が設けられている請求項 6 に記載の電子タバコ。

【請求項 8】

前記カートリッジの前記装着部への着脱によって電源を ON/OFF させる電源スイッチを有する請求項 7 に記載の電子タバコ。

【請求項 9】

前記ケーシング内に電源を設けた請求項 1 ないし 8 のいずれかに記載の電子タバコ。

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【請求項 10】

前記ケーシング内を流通する風量を検出する検出手段を有する請求項 1 ないし 9 のいずれかに記載の電子タバコ。

【請求項 11】

前記検出手段の検出結果に基づいて、前記制御手段により前記吐出手段の駆動を制御するように構成した請求項 10 に記載の電子タバコ。

【請求項 12】

前記ケーシングの先端部に発光手段を設け、前記検出手段の検出結果に基づいて、前記制御手段により前記発光手段の駆動を制御するように構成した請求項 10 または 11 に記載の電子タバコ。

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【請求項 13】

前記ケーシングの先端部から擬似的な煙を発生する煙発生手段を有し、前記検出手段の検出結果に基づいて、前記制御手段により前記煙発生手段の駆動を制御するように構成した請求項 10 ないし 12 のいずれかに記載の電子タバコ。

【請求項 14】

前記ケーシング内を流通する空気、または空気と香味成分とを含む混合気を加熱する加熱手段を有する請求項 1 ないし 13 のいずれかに記載の電子タバコ。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】

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本発明は、電子タバコに関するものである。

【0002】

【従来の技術】

近年、タバコを燃焼させることなく、タバコに似た香味を嗜好するための擬似喫煙具として、種々のタイプのものが提案されている。

例えば、断熱チューブ内に加熱素子と固形状の香味発生媒体とを設け、この断熱チューブと加熱素子の電源とを上包み紙で包んでタバコ状に形成した擬似喫煙具が提案されている（例えば、特許文献1参照）。

【0003】

このような構成の擬似喫煙具は、電源から加熱素子に電気エネルギーを供給することにより、香味発生媒体が加熱されて香味成分を生成し、この香味成分と擬似喫煙具内に取り込んだ空気との混合気を吸い込むことにより、タバコに似た香味を嗜好することができるものである。

しかしながら、このような構成の擬似喫煙具にあっては、香味発生媒体を昇温させるのに時間がかかるため、香味発生媒体が十分な量の香味成分を生成するまでに時間がかかり、擬似喫煙の開始時に十分な量の香味成分が得られず、擬似喫煙の開始時からタバコと同じような感覚が得られない。

【0004】

また、香味発生媒体が生成する香味成分の量を高精度で制御することができないため、吸い込み量に応じて香味成分の量を調整することができず、タバコと同じような感覚が得られない。

さらに、タバコと同じような煙を発生させる機能やタバコと同じような火種を発生させる機能を備えていないため、タバコに似た感覚が得られない。

【0005】

【特許文献1】

特開平3-232481号公報

【0006】

【発明が解決しようとする課題】

本発明の目的は、喫煙者が擬似喫煙を行なうときに、喫煙開始時から十分な量の香味成分が得られてタバコと同じような感覚が得られる電子タバコを提供することにある。

【0007】

【課題を解決するための手段】

このような目的は、下記の本発明により達成される。

本発明の電子タバコは、吸引口を有し、全体形状が略棒状をなすケーシングと、前記ケーシング内に設けられ、アクチュエータを駆動して液状の香味生成媒体が充填されたキャビティ内の圧力を変化させることにより前記キャビティに連通するノズルから前記香味生成媒体を液滴として吐出する少なくとも1つの吐出ヘッドを有する吐出手段と、前記ケーシング内に設けられ、前記吐出手段の駆動を制御する制御手段とを備えることを特徴とする。

【0008】

これにより、制御手段により吐出手段を駆動させることによって、ケーシング内に香味生成媒体の液滴が吐出され、ケーシング内に香味成分が供給される。そして、この状態でケーシングの吸引口側を口に咥えて息を吸い込むことにより、ケーシング内に流入した空気とケーシング内の香味成分との混合気が口内に流入し、香味成分が口内に拡散し、タバコに似た香味を嗜好することができる。

【0009】

この場合、吐出手段の駆動開始時から十分な量の香味生成媒体の液滴がケーシング内に吐出されるので、吸引の開始時から十分な量の香味成分が得られ、タバコと同じような感覚が得られる。

また、香味生成媒体に有害な物質、不快な臭い、味等を含まないものを使用することによ

り、喫煙時に周囲の人々や喫煙者自身に、害を及ぼしたり、不快感を与えたりするのを防止できる。

【0010】

本発明の電子タバコでは、前記ケーシング内に設けられ、前記吐出手段から吐出された香味生成媒体の液滴を霧化させる霧化手段を有するのが好ましい。

これにより、吐出手段の駆動によりケーシング内に吐出された香味生成媒体の液滴は霧化手段によって霧化（微細化）される。そして、この状態でケーシングの吸引口側を口に咥えて息を吸い込むことにより、ケーシング内に流入した空気とケーシング内の霧状の香味成分との混合気が口内に流入し、香味成分が口内に拡散し、タバコに似た香味を嗜好することができる。

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この場合、霧化手段によって霧状となった香味成分を口内に吸い込むことができるので、タバコの煙を吸い込んだときのような感覚が得られる。

【0011】

本発明の電子タバコでは、前記霧化手段は、前記吐出手段から吐出された香味生成媒体の液滴を加熱して霧化させる加熱手段であるのが好ましい。

これにより、霧化手段の加熱手段によって加熱されて霧状となった香味成分の粒子を口内に吸い込むことができるので、口内に効率良く香味成分を拡散させることができ、タバコの煙を吸い込んだときのような感覚が得られる。

【0012】

本発明の電子タバコでは、前記霧化手段は、前記吐出手段から吐出された香味生成媒体の液滴を振動させて霧化させる振動手段であるのが好ましい。

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これにより、霧化手段の振動手段によって振動されて霧状となった香味成分を口内に吸い込むことができるので、口内に効率良く香味成分を拡散させることができ、タバコの煙を吸い込んだときのような感覚が得られる。

【0013】

本発明の電子タバコでは、前記霧化手段を前記ケーシングに着脱自在としたのが好ましい。

これにより、必要に応じて、容易に霧化手段をケーシングに取り付けることができる。

本発明の電子タバコでは、液状の香味生成媒体が収納された収納部を有するカートリッジが着脱自在に装着される装着部を備えるのが好ましい。

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これにより、ケーシングの装着部にカートリッジを取り付けることによって、その収納部から吐出手段に香味生成媒体が供給され、ケーシングの装着部からカートリッジを取り外すことによって、その収納部から吐出手段への香味生成媒体の供給が停止される。

【0014】

本発明の電子タバコでは、前記カートリッジに前記吐出手段が設けられているのが好ましい。

これにより、カートリッジをケーシングの装着部に着脱させることによって、カートリッジと一体的に吐出手段がケーシングに着脱されることになる。

本発明の電子タバコでは、前記カートリッジの前記装着部への着脱によって電源をON/OFFさせる電源スイッチを有するのが好ましい。

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これにより、カートリッジをケーシングの装着部に取り付けることによって電源スイッチを介して電源がONされ、カートリッジをケーシングの装着部から取り外すことによって電源スイッチを介して電源がOFFされることになる。

【0015】

本発明の電子タバコでは、前記ケーシング内に電源を設けたのが好ましい。

本発明の電子タバコでは、前記ケーシング内を流通する風量を検出する検出手段を有するのが好ましい。

これにより、ケーシング内を流通する空気、または空気と香味成分との混合気の風量が検出手段によって検出され、この検出手段の検出結果に基づいて（検出手段からの信号に応じて）、制御手段により各種の制御を行うことができる。

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【0016】

本発明の電子タバコでは、前記検出手段の検出結果に基づいて、前記制御手段により前記吐出手段の駆動を制御するように構成したのが好ましい。

これにより、ケーシング内を流通する空気、または空気と香味成分との混合気の風量が検出手段によって検出され、この検出手段の検出結果に基づいて（検出手段からの信号に応じて）、制御手段により吐出手段の駆動が制御され、吐出手段のON/OFF、吐出手段から吐出される香味生成媒体の液滴の吐出量が制御されることになる。

従って、喫煙者の吸い込み力に応じた量の香味成分を口内に取り込むことができるので、タバコの煙を吸い込んだときのような感覚が得られる。

【0017】

本発明の電子タバコでは、前記ケーシングの先端部に発光手段を設け、前記検出手段の検出結果に基づいて、前記制御手段により前記発光手段の駆動を制御するように構成したのが好ましい。

これにより、ケーシング内を流通する空気、または空気と香味成分との混合気の風量が検出手段によって検出され、この検出手段の検出結果に基づいて（検出手段からの信号に応じて）、制御手段により発光手段の駆動が制御され、発光手段のON/OFF、光量が制御されることになる。

従って、喫煙者の吸い込み力に応じて発光手段の光量を増やしたり、減らしたりすることができるので、タバコの煙を吸い込んだときのような感覚が得られる。

【0018】

本発明の電子タバコでは、前記ケーシングの先端部から擬似的な煙を発生する煙発生手段を有し、前記検出手段の検出結果に基づいて、前記制御手段により前記煙発生手段の駆動を制御するように構成したのが好ましい。

これにより、ケーシング内を流通する空気、または空気と香味成分との混合気の風量が検出手段によって検出され、この検出手段の検出結果に基づいて（検出手段からの信号に応じて）、制御手段により煙発生手段の駆動が制御され、煙発生手段のON/OFF、煙量が制御されることになる。

従って、喫煙者の吸い込み力に応じて煙発生手段から擬似的な煙を発生させたり、煙の発生を停止させたり、煙の発生量を調整したりすることができるので、タバコの煙を吸い込んだときのような感覚が得られる。

【0019】

本発明の電子タバコでは、前記ケーシング内を流通する空気、または空気と香味成分とを含む混合気を加熱する加熱手段を有するのが好ましい。

これにより、ケーシング内を流通する空気、または空気と香味成分との混合気は加熱手段によって加熱されることになるので、タバコの煙を吸い込んだときのような感覚が得られる。

【0020】

【発明の実施の形態】

以下、本発明の電子タバコ（擬似喫煙具）を添付図面に示す好適実施形態に基づいて詳細に説明する。

図1～図5には、本発明による電子タバコの第1実施形態が示されていて、図1は、電子タバコの全体を示す平面図、図2は、図1の断面図、図3は、図2の部分拡大図、図4は、吐出手段の構成例を示す断面図、図5は、電子タバコのブロック図である。

なお、説明の都合上、図1および図2中、左側を「先端」、右側を「基端」として説明する。

【0021】

図1および図2に示すように、電子タバコ1は、全体形状が丸棒状（棒状）、すなわち、略円柱状をなすタバコ本体100と、液状の香味生成媒体が収納された収納部を有するカートリッジ21とを備えている。

タバコ本体100は、ケーシング2と、ケーシング2内に香味生成媒体の液滴を吐出させ

る第1吐出手段（吐出手段）14および第2吐出手段（煙発生手段）17と、第1吐出手段14および第2吐出手段17の駆動等を制御する制御手段27とを備えている。

【0022】

ケーシング2の全体形状は、丸棒状（棒状）、すなわち、略円柱状をなしている。このケーシング2のタバコのフィルタに相当する基端部（長手方向の一端部）には、啜え部7が設けられており、この啜え部7の中心部には、空気や、空気と香味成分とを含む混合気等を流通させる所定の長さの流路3が、長手方向に沿って設けられている。

【0023】

流路3は、本実施形態においては横断面が円形状をなすものであって、その基端が啜え部7の基端側の端面中央部に開口（開放）し、この開口部が香味成分（空気と香味成分とを含む混合気）を口内に吸い込むための吸引口4に形成されている。

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流路3の先端部は、先端に向かって順次拡径するテーパ面5に形成され、このテーパ面5の最大径部には、ケーシング2を径方向に貫通する取り込み口（側口）6が周方向に所定の間隔ごとに複数設けられ、この取り込み口6を介して流路3内がケーシング2の外面側に開放されるようになっている。取り込み口6の形状は、例えば、断面方形状、断面円形状等とすることができる（本実施形態においては断面方形状としている）。啜え部7を口に啜えて息を吸い込むと、取り込み口6を介して流路3内に空気が取り込まれ、この空気は流路3内を吸引口4に向かって流通し、吸引口4から口内に流入する。

【0024】

流路3の長手方向の中央部に対応するケーシング2の部分には、吐出手段である第1吐出手段14が流路3に面するように設けられ、この第1吐出手段14の駆動によって流路3内に香味生成媒体の微細な液滴が吐出される。第1吐出手段14によって流路3内に吐出された香味生成媒体の液滴は、流路3内を流通する空気と混合されて流路3内を流れ、混合気となって吸引口4から口内に流入する。

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前記ケーシング2の構成材料は、特に限定されず、例えば、各種樹脂、各種金属、各種セラミックス、木、紙等が挙げられる。

【0025】

香味生成媒体は、燃焼によることなく、それを液滴として吐出することにより香味を生成することのできる媒体であり、用途等に応じて適宜選択される。この香味生成媒体には、例えば、種々の天然物からの抽出物質や、それらの構成成分等のうちの所定のものが含まれる。香味生成媒体が含有する香味物質としては、例えば、メントール、カフェイン、熱分解により香味を生成する配糖体等の前駆体、タバコ抽出成分やタバコ煙凝縮物成分等のタバコ成分等を用いることができる。この場合、香味生成媒体を無害化するのが好ましく、有害成分は取り除かれるのが好ましい。

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また、香味生成媒体は、香味に煙を加えるため、例えば、加熱時にエアロゾルを生成する物質を含むことができる。エアロゾルを生成する物質としては、例えば、グリセリン、プロピレングリコール等のポリオール類、低級アルコール類、糖類や、これらの混合物等を用いることができる。

【0026】

第1吐出手段14には、流体ジェット方式（例えば、インクジェット方式）を採用する。流体ジェット方式は、アクチュエータを駆動して液体等の流体が充填されたキャビティ（圧力室）内の圧力を変化させることによりそのキャビティに連通するノズルから前記流体を液滴として吐出する方式である。この流体ジェット方式としては、例えば、サーマルジェット方式（バブルジェット方式（「バブルジェット」は登録商標））等の膜沸騰流体ジェット方式、圧電方式（ピエゾ方式）、静電方式等を挙げることができる。但し、これらの方式に限らず、同様の機能を有するものであればよい。

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【0027】

サーマルジェット方式（バブルジェット方式（「バブルジェット」は登録商標））等の膜沸騰流体ジェット方式の吐出ヘッドは、通電により発熱する発熱体（ヒーター）を有する膜沸騰式アクチュエータを備えている。この膜沸騰流体ジェット方式では、例えば、通電

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により発熱体を発熱させ、これにより気泡（バブル）を発生させ、この気泡の圧力（気泡による液圧の変化）により液滴を吐出させる。

【0028】

また、圧電方式（ピエゾ方式）の吐出ヘッドは、圧電素子（ピエゾ素子）を有し、その圧電素子の圧電効果（ピエゾ効果）を利用した圧電式アクチュエータを備えている。この圧電方式では、例えば、圧電素子に電圧を印加し、圧電素子を変位（変形）させてキャビティ（圧力室）の容積を変化させ、これによりキャビティ51内の圧力を変化させることにより液滴を吐出させる。

【0029】

また、静電方式の吐出ヘッドは、静電式アクチュエータを備えている。この静電方式では、例えば、静電式アクチュエータの対向電極間に電圧を印加してクーロン力を発生させ、振動板を変位（変形）させてキャビティ（圧力室）の容積を変化させ、これによりキャビティ51内の圧力を変化させることにより液滴を吐出させる。

【0030】

本実施形態においては、第1吐出手段14は、図3に示すように、香味生成媒体の液滴を吐出させるノズル16を有する流体ジェット方式の吐出ヘッド15を複数（図示例では4つ）備えている。すなわち、第1吐出手段14は、流体ジェット方式の複数の吐出ヘッド15を有するヘッドユニットを備えている。なお、吐出ヘッド15の数は、4つに限らず、1つ、2つ、3つ、または5つ以上としてもよい。

各吐出ヘッド15は、ノズル16の径がそれぞれ異なる大きさに形成され、例えば、これらの吐出ヘッド15のON/OFFを組み合わせて、香味生成媒体の吐出量を所定量に調整することができる。

【0031】

以下、代表的に、図4に基づいて、静電方式を採用した場合の吐出ヘッド15の構成例を説明する。なお、図4には、複数の吐出ヘッド15のうちの1つのみが示されている。

図4に示すように、吐出ヘッド15は、シリコン基板42の上側にシリコン製のノズルプレート41を積層し、下側にガラス基板43を積層した3層構造をなしている。

【0032】

シリコン基板42とノズルプレート41との間には、香味生成媒体が充填されるキャビティ（圧力室）51と、リザーバ53と、リザーバ53とキャビティ51とを相互に連通するオリフィス（供給口）52とが設けられている。ノズルプレート41のキャビティ51に対応する部分には、キャビティ51内外を連通するノズル（出口）16が設けられている。キャビティ51に面するシリコン基板42の部分は、他の部分よりも薄肉の振動板（底壁）45に形成されている。

【0033】

振動板45は、その面外方向（厚さ方向）、すなわち、上下方向に弾性変形（弾性変位）可能に構成されている。

この振動板45と、ガラス基板43の上部に配置されるセグメント電極46と、これらの間の絶縁層47および空隙（凹部）54とによって静電式アクチュエータ（アクチュエータ）44の主要部が構成される。

【0034】

セグメント電極46と、このセグメント電極46に対向する共通電極48との間（対向電極間）に駆動電圧を印加するための駆動回路を含む吐出ヘッド駆動回路（電圧印加手段）29は、後述するCPU28から入力される信号（吐出用データ）に応じて、各対向電極間の充放電を行う。吐出ヘッド駆動回路29の一方の出力端子は、個々のセグメント電極46に接続され、他方の出力端子は、シリコン基板42に形成された共通電極48の入力端子49に接続されている。なお、シリコン基板42には不純物が注入されており、それ自体が導電性をもつため、入力端子49から振動板45（共通電極48全体）に電圧を印加（供給）することができる。

【0035】

吐出ハツフ駆動回路29から対向電極間に駆動電圧が印加されると、対向電極間にクーロソ力が発生し、振動板45は、図4に示す初期状態に対して、セグメント電極46側へ撓み、キヤピタィ51の容量が増大(拡大)する。この状態において、吐出ハツフ駆動回路29の制御により、対向電極間の電荷を急激に放電させると、振動板45は、その弾性復元力によって上方に復元し、図4に示す初期状態における振動板45の位置を越えて上部に移動し、キヤピタィ51の容量が急激に減少(収縮)する。これにより、キヤピタィ51内の圧力が増大し、このキヤピタィ51内に発生する圧縮圧力により、キヤピタィ51を満たす香味生成媒体の一部が、このキヤピタィ51に連通しているノズル16から微細な液滴として吐出される。

【0036】

また、リザーバ53に対応するガラヌ基板43の部分には、リザーバ53に連通する取り入れ口55が設けられている。この取り入れ口55には、後述する第1供給管33の基端側が連結され、この第1供給管33および取り入れ口55を介して後述するカートリッジ21からリザーバ53内に香味生成媒体が供給される。

【0037】

図2に示すように、第1吐出手段14の基端側(図中左側)の流路3の途中(流路3のノズル面5の根元部)には、検出手段である風量センサ19が設けられ、この風量センサ19によって流路3内を流通する流体(空気または空気と香味成分との混合気)の流量が検出される。

第1吐出手段14の先端側(図中右側)の流路3の途中には、加熱手段20が設けられ、この加熱手段20の駆動によって流路3内を流通する流体(空気、または空気と香味成分とを含む混合気)が加熱され、吸引口4から所定の温度に加熱された流体が流出する。加熱手段20としては、流体を加熱することができ、その機能を有するものであれば特に限定されるものではなく、例えば、マイクロヒータ等が挙げられる。マイクロヒータは、電気を熱エネルギーに変換するものであって、その形状、方式は任意に選択することができる。通常は、ヒータ薄膜を形成し、その抵抗に電流を流すことで熱を発生させる。

【0038】

なお、加熱手段20を吸え部7に着脱自在として、必要に応じて吸え部7に取り付けるとしてもよい。

また、加熱手段20を第1吐出手段14の上流側、すなわち先端側(図2中左側)に設け、加熱手段20の駆動によって、流路3内を流通し、第1吐出手段14に到達する前の空気(香味生成媒体の液滴と混合される前の空気)を加熱するように構成してもよい。

【0039】

ケーシング2の長手方向の中央部(流路3の図中左側の部分)には、上面がケーシング2の外面側に開口する所定の深さのカートリッジ室(装着部)8が設けられ、このカートリッジ室8内に、液状の香味生成媒体が収納(充填)されたカートリッジ21が着脱自在に装着される。カートリッジ室8の軸方向の一方(図2中左側)の端面には、カートリッジ検出兼電源スイッチ9が設けられている。カートリッジ21がカートリッジ室8に装着される(取り付けられる)と、カートリッジ検出兼電源スイッチ9がONし、カートリッジ21の装着状態が検出されるとともに、電源26がONし、カートリッジ検出兼電源スイッチ9がOFFされる(取り外される)と、カートリッジ検出兼電源スイッチ9がOFFし、カートリッジ21の未装着状態が検出されるとともに、電源26がOFFする。

【0040】

カートリッジ21は、全体形状が箱状をなすカートリッジ本体(ケーシング)210を有している。カートリッジ本体210の内部は、第1室22と第2室23の2室に区画されており、これら第1室22および第2室23内にそれぞれ液状の香味生成媒体が所定量収納(充填)されている。第1室22内に収納される香味生成媒体と、第2室23内に収納される香味生成媒体とは、同一のものでよく、また、異なるものでもよい。

【0041】

カートリッジ本体(ケーシング)210の構成材料は、特に限定されず、例えば、各種樹

脂等が挙げられる。

なお、カートリッジ本体 210 の内部を 1 室としてもよい。また、カートリッジ 21 に前述した第 1 吐出手段 14 を設け（カートリッジ 21 と第 1 吐出手段 14 とを一体化し）、これらが、一体的に、ケーシング 2（タバコ本体 100）のカートリッジ室（装着部）8 に着脱自在に装着されるように構成してもよい。

【0042】

カートリッジ本体 210 の第 1 室 22 の下面側には、後述する第 1 供給管 33 の先端側の鋭利な端部 331 が穿刺される被穿刺部 221 が形成されている。同様に、第 2 室 23 の下面側には、後述する第 2 供給管 34 の基端側の鋭利な端部 341 が穿刺される被穿刺部 231 が形成されている。カートリッジ 21 がカートリッジ室 8 に装着されると、第 1 供給管 33 の鋭利な端部 331 および第 2 供給管 34 の鋭利な端部 341 が、それぞれ、カートリッジ本体 210 の被穿刺部 221 および被穿刺部 231 を穿刺し、貫通する。これにより、第 1 室 22 内と第 1 供給管 33 とが連通し、第 2 室 23 内と第 2 供給管 34 とが連通する。

【0043】

ケーシング 2 の外周縁部には、カートリッジ室 8 の第 1 室 22 に対応する部位と前述した第 1 吐出手段 14 との間を軸線方向に相互に連通する第 1 供給管 33 と、カートリッジ室 8 の第 2 室 23 に対応する部位と後述する第 2 吐出手段 17 との間を軸線方向に相互に連通する第 2 供給管 34 とが、それぞれ埋設されている。第 1 供給管 33 の先端部には、鋭利な端部（穿刺針）331 が形成されており、第 2 供給管 34 の基端部には、鋭利な端部（穿刺針）341 が形成されている。これら第 1 供給管 33、第 2 供給管 34 を介して、カートリッジ 21 の第 1 室 22 から第 1 吐出手段 14 に、第 2 室 23 から第 2 吐出手段 17 に、それぞれ香味生成媒体が供給される。

【0044】

ケーシング 2 の長手方向の中央部（ケーシング室 8 の図中左側の部分）には、基端側に電源（電源部）26 が、その先端側に、第 1 吐出手段 14、第 2 吐出手段 17、風量センサ 19、加熱手段 20、電源 26、後述する発光手段 32 等の駆動を制御する制御手段 27 が、それぞれ内蔵されている。なお、電源 26 が、ケーシング 2 内に着脱自在に装着し得るように構成してもよい。

【0045】

電源 26 としては、例えば、一次電池、二次電池等の電池等を使用することができる。この場合、エネルギー密度の高い燃料電池を使用することにより、小型、軽量化を図ることができる。燃料電池をカートリッジ形状にして、簡易に交換できるようにしてもよい。ケーシング 2 の先端部（長手方向の他端部）には、所定の空間 10 が設けられており、この空間 10 に臨むケーシング 2 の部分には、ケーシング 2 を径方向に貫通する取り込み・放出口（側口）11 が周方向に所定の間隔ごとに複数設けられ、これらの取り込み・放出口 11 を介して空間 10 内がケーシング 2 の外面側に開放されるようになっている。取り込み・放出口 11 の形状は、例えば、断面方形状、断面円形状等とすることができる（本実施形態においては断面方形状としている）。

【0046】

空間 10 に隣接するケーシング 2 の図中右側の部分には、空間 10 に面するように煙発生手段である第 2 吐出手段 17 が設けられ、この第 2 吐出手段 17 の駆動によって空間 10 内に香味生成媒体の微細な液滴が吐出されるようになっている。この場合、例えば、香味生成媒体の選択や組合せ等により、タバコの煙（副流煙）に似せた擬似的な煙（副流煙）を発生させることができる。

【0047】

第 2 吐出手段 17 の構成は、前述した第 1 吐出手段 14 と同様であるので、図示およびその説明は、省略する。

第 2 吐出手段 17 の駆動によって、空間 10 内に香味生成媒体の液滴が吐出され、これにより、空間 10 内にタバコの煙（副流煙）に似た擬似的な煙（副流煙）が発生し、これが

取り込み・放出口 11 から外部に放出される。この場合、発生する（放出する）擬似的な煙は、無害であるのが好ましい。また、発生する擬似的な煙は、無臭であってもよく、また、有臭であってもよい。また、有臭の擬似的な煙を発生する場合は、その臭いは、例えば、タバコの副流煙のような臭いではなく、好まれる臭いとするのが好ましい。

【0048】

ケーシング 2 の先端部（空間 10 に隣接する部分）には、ケーシング 2 の先端面に開口する所定の深さの凹部 12 が設けられ、この凹部 12 の開口部は湾曲形状の拡散レンズ 13 によって閉塞されている。

凹部 12 の底面側には発光手段 32 が設けられ、この発光手段 32 を駆動させて発光させることにより、タバコの火種に似せた擬似的な安全な火種を発生することができ、これにより、タバコの火種と同じような視覚的効果が得られる。

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【0049】

発光手段 32 は、風量センサ 19 からの信号に応じて（風量センサ 19 の検出結果に基づいて）発光量が調整される。発光手段 32 としては、例えば、赤色の LED（発光ダイオード）、有機 EL（Electro Luminescence）等が挙げられるが、これに限定することなく、同様の機能を有するものであればよい。

制御手段 27 は、図 5 に示すように、第 1 吐出手段 14、第 2 吐出手段 17、加熱手段 20、風量センサ 19、発光手段 32 および電源 26 等の駆動を制御する CPU（Central Processing Unit）28 と、第 1 吐出手段 14、第 2 吐出手段 17 を駆動させる回路が組み込まれた吐出ヘッド駆動回路 29 とを備えている。

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【0050】

本実施形態による電子タバコ 1 は、上記のような制御手段 27 を有することにより、各種の制御を行うことができる。

例えば、第 2 吐出手段 17 の ON/OFF を制御することによるタバコの煙（副流煙）に似た擬似的な煙の発生の ON/OFF の制御や、発光手段 32 の発光の ON/OFF の制御等が可能となる。従って、タバコの喫煙が禁止されているような場所（例えば、公共の場所、駅、レストラン等）においては、擬似的な煙の発生を OFF、発光手段の発光を OFF とすることができる。

【0051】

また、加熱手段 20 による空気、または空気と香味成分とを含む混合気の加熱は、夏場には OFF とし、冬場には暖かさが望まれるために ON とするような制御が可能となる。

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また、タバコに近づけるため、喫煙の最初においては、タバコの長い流路を通る弱い香り、低い温度に似せた状態を再現することができ、喫煙の終盤においては、短い流路を通るための強い香り、高い温度に似せた状態を再現するような制御が可能となる。

【0052】

また、これらの制御は、電子タバコ 1 に銘柄を付して、銘柄に応じた擬似喫煙プログラミングデータを切り替えることにより、銘柄単位で変化を付けることも可能となる。または、個人毎に嗜好をカスタマイズすることもできる。例えば、ロングフィルタによって香りをマイルドにした状態を再現したり、仮想的な一本の吸い込み回数の多少を設定したりすることが可能となる。

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【0053】

また、これらの擬似喫煙プログラムを ROM に書き込んでその ROM をカートリッジ 21 や別のカートリッジ（図示せず）に取り付け、カートリッジ 21 や別のカートリッジを介してケーシング 2（タバコ本体 100）にその ROM を着脱自在に装着し得るようにしてもよい。また、ケーシング 2（タバコ本体 100）に着脱自在に装着し得るカートリッジ 21 や別のカートリッジ（図示せず）に RAM を設け、この RAM に、前記擬似喫煙プログラムを、例えば、ブルートゥースといった無線インターフェースでダウンロードする、または赤外線にて伝送するような形態としてもよい。

【0054】

また、ケーシング 2（タバコ本体 100）に、所定の擬似喫煙プログラムが書き込まれた

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メモリーを組み込んでおいて、ダイヤル等でその嗜好パターンのどれかを選択するようにしてもよい。この場合、例えば、対となるライターもどきの別ユニットによって、その擬似喫煙プログラムの格納や嗜好パターンの選択を行えるようにしてもよい。

【0055】

また、例えば、RFID（無線タグ）といったものをケーシング2（タバコ本体100）、カートリッジ21や別のカートリッジ（図示せず）、別ユニットに取り付け、擬似喫煙プログラムを切り替えたり、擬似喫煙プログラム中のパラメータを切り替えることが可能のようにしてもよい。

上記のように構成した本実施形態による電子タバコ1の吐き部7を唇で挟んで息を吸い込むと、取り込み口6から空気が流路3内に流入し、流路3内を流通する風量が風量センサ19で検出され、風量センサ19からの信号に応じて（風量センサ19の検出結果に基づいて）制御手段27により第1吐出手段14が駆動され、吐出ヘッド15のノズル16から所定量の香味生成媒体の液滴が流路3内に吐出され、流路3内を流通する空気と香味成分とが混合されて、それらの混合気が吸引口4から口内に流入し、口内に香味成分が拡散し、タバコに似た香味を嗜好することができる。

【0056】

この場合、第1吐出手段14の駆動開始時から十分な量の香味生成媒体の液滴がケーシング2内に吐出されるので、擬似喫煙の開始時（吸引の開始時）から十分な量の香味成分が得られ、タバコと同じような感覚が得られる。

また、風量センサ19からの信号に応じて（風量センサ19の検出結果に基づいて）制御手段27により第2吐出手段17が駆動され、第2吐出手段17の吐出ヘッドのノズルから所定量の香味生成媒体の液滴が空間10内に吐出され、これにより、空間10内にタバコの煙（副流煙）に似た擬似的な煙が発生し、その煙が取り込み・放出口11から空間10外に流出し、このタバコの副流煙もどきの煙が周囲に拡散される。

さらに、風量センサ19からの信号に応じて（風量センサ19の検出結果に基づいて）発光手段32が発光し、タバコの火種と同様の視覚的効果が与えられる。

【0057】

次に、第2実施形態について説明する。

図6および図7には、本発明による電子タバコの第2実施形態が示されていて、図6は、部分拡大説明図、図7は、電子タバコのブロック図である。

以下、第2実施形態の電子タバコ1について、前述した第1実施形態との相違点を中心に説明し、同様の事項については、その説明を省略する。

【0058】

図6に示すように、第2実施形態の電子タバコ1では、第1吐出手段14の各吐出ヘッド15のノズル16に対向させて、各ノズル16から吐出された香味生成媒体の液滴を霧化させる（微細化する）霧化手段18が設けられている。図示しないが、同様に、第2吐出手段17の各吐出ヘッド15のノズル16に対向させて、各ノズル16から吐出された香味生成媒体の液滴を霧化させる（微細化する）霧化手段18が設けられている。また、図7に示すように、制御手段27は、霧化手段18を駆動させる回路が組み込まれた霧化手段駆動回路30を有している。その他の構成は、前記第1実施形態に示すものと同様である。

【0059】

この場合、霧化手段18としては、例えば、吐出ヘッド15のノズル16から吐出された香味生成媒体の液滴を受け取って加熱することにより霧化させる加熱手段や、香味生成媒体の液滴を受け取って振動させることにより霧化させる振動手段等が挙げられる。加熱手段としては、例えば、マイクロヒータ等が挙げられ、振動手段としては、例えば、超音波振動発生装置等が挙げられる。

【0060】

なお、第1吐出手段14側の霧化手段18と、第2吐出手段17側の霧化手段18とのうち的一方を省略してもよい。

また、霧化手段１８が、ケーシング２（タバコ本体１００）に着脱自在に装着されるように構成してもよい。

また、カートリッジ２１に霧化手段１８を設け（カートリッジ２１と霧化手段１８とを一体化し）、これらが、一体的に、ケーシング２（タバコ本体１００）のカートリッジ室（装着部）８に着脱自在に装着されるように構成してもよい。

【００６１】

本実施形態においては、第１吐出手段１４および第２吐出手段１７のノズル１６から吐出された香味生成媒体の液滴は、それぞれ、対応する霧化手段１８によって霧化される。

すなわち、第１吐出手段１４のノズル１６から吐出された香味生成媒体の液滴は、対応する霧化手段１８によって霧化されることになるので、ケーシング２の啞え部７を口に啞えて息を吸い込んだときに、取り込み口６からケーシング２内に流入した空気とケーシング２内の霧状の香味成分との混合気が口内に流入し、口内に香味成分が拡散し、タバコと似た香味を嗜好することができる。この場合、霧化手段１８によって霧状となった香味成分を口内に吸い込むことができるので、タバコの煙を吸い込んだときのような感覚が得られる。

【００６２】

霧化手段１８をマイクロヒータで構成した場合には、加熱されて霧状となった香味生成媒体の粒子が口内に流入することになるので、口内に効率良く香味成分を拡散させることができ、タバコの煙を吸い込んだときのような感覚が得られる。

霧化手段１８を超音波振動発生装置によって構成した場合には、振動されて霧状となった香味生成媒体の粒子が口内に流入することになるので、口内に効率良く香味成分を拡散させることができ、タバコの煙を吸い込んだときのような感覚が得られる。

【００６３】

同様に、ケーシング２の啞え部７を口に啞えて息を吸い込んだときに、第２吐出手段１７のノズル１６から吐出された香味生成媒体の液滴は、対応する霧化手段１８によって霧化され、これにより、空間１０内にタバコの煙（副流煙）に似た擬似的な煙が発生し、これが取り込み・放出口１１から外部に流出し、このタバコの副流煙もどきの煙が周囲に拡散される。この場合、第２吐出手段１７から吐出された香味生成媒体の液滴が霧化手段１８によって霧状になるので、タバコの副流煙に非常に近似した擬似的な煙が発生することができる。

【００６４】

また、この電子タバコ１によれば、前述した第１実施形態と同様の効果も得られる。以上、本発明を、図示の実施形態に基づいて説明したが、本発明はこれに限定されるものではなく、各部の構成は、同様の機能を有する任意の構成のものに置換することができる。また、本発明に、他の任意の構成物が付加されていてもよい。

【図面の簡単な説明】

【図１】本発明による電子タバコの第１実施形態の平面図。

【図２】図１の断面図。

【図３】図２の部分拡大図。

【図４】吐出手段の構成例を示す断面図。

【図５】第１実施形態の電子タバコのブロック図。

【図６】第２実施形態の電子タバコの部分拡大図。

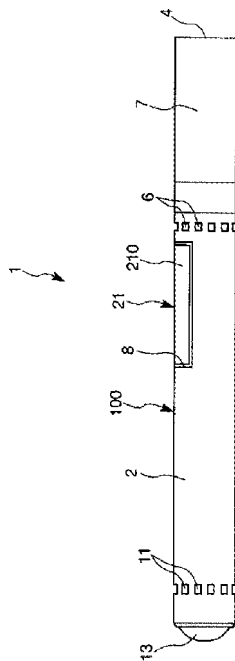
【図７】第２実施形態の電子タバコのブロック図。

【符号の説明】

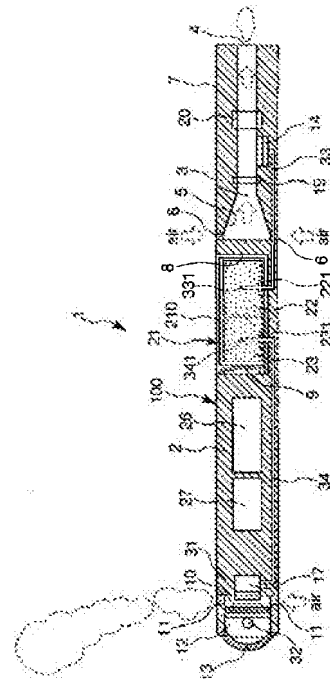
１……電子タバコ ２……ケーシング ３……流路 ４……吸引口 ５……テーパ面 ６……取り込み口 ７……啞え部 ８……カートリッジ室 ９……検出兼電源スイッチ １０……空間 １１……取り込み・放出口 １２……凹部 １３……拡散レンズ １４……第１吐出手段 １５……吐出ヘッド １６……ノズル １７……第２吐出手段 １８……霧化手段 １９……風量センサ ２０……加熱手段 ２１……カートリッジ ２２……第１室 ２２１……被穿刺部 ２３……第２室 ２３１……被穿刺部 ２６……電源 ２７

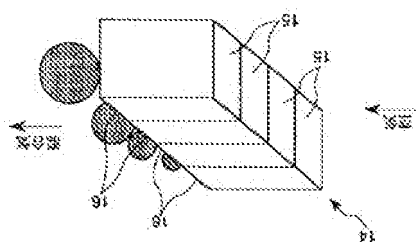
……制御手段 28 ……CPU 29 ……吐出ヘッド駆動回路 30 ……霧化手段駆動回路
 31 ……煙発生手段 32 ……発光手段 33 ……第1供給管 331 ……鋭利な端部
 34 ……第2供給管 341 ……鋭利な端部 41 ……ノズルプレート 42 ……シリコン基板
 43 ……ガラス基板 44 ……静電式アクチュエータ 45 ……振動板 46 ……セグメント電極
 47 ……絶縁層 48 ……共通電極 49 ……入力端子 51 ……キャビティ
 52 ……オリフィス 53 ……リザーバ 54 ……空隙 55 ……取り入れ口
 100 ……タバコ本体 210 ……カートリッジ本体

【図1】

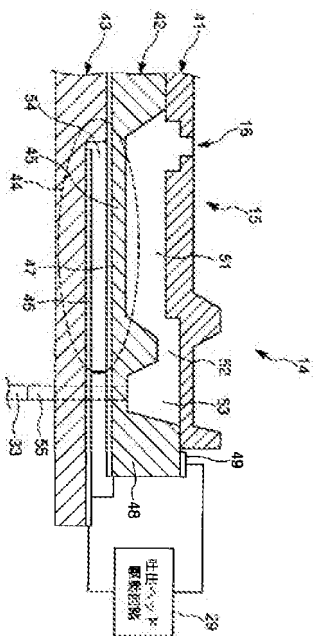


【図2】

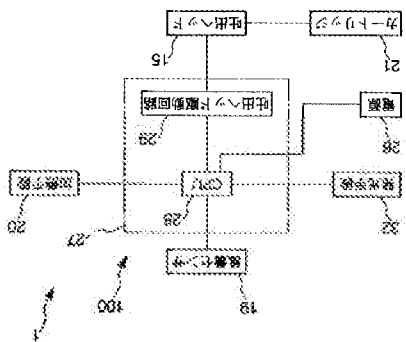




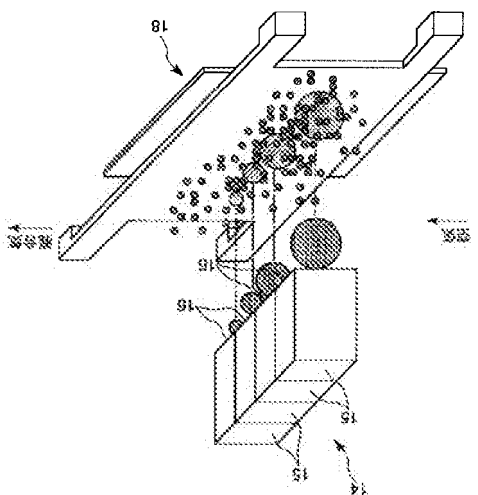
【図 3】



【図 4】

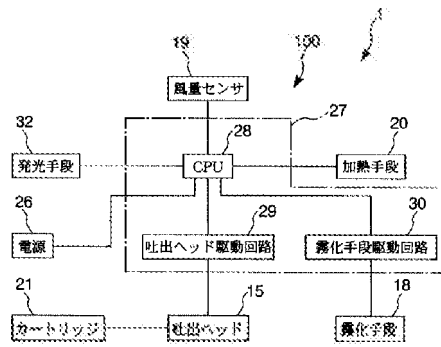


【図 5】



【図 6】

【図 7】





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(54) **ELECTRONIC CIGARETTE**

Publication Classification

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(52) **U.S. Cl. 131/194; 131/360**

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(57) **ABSTRACT**

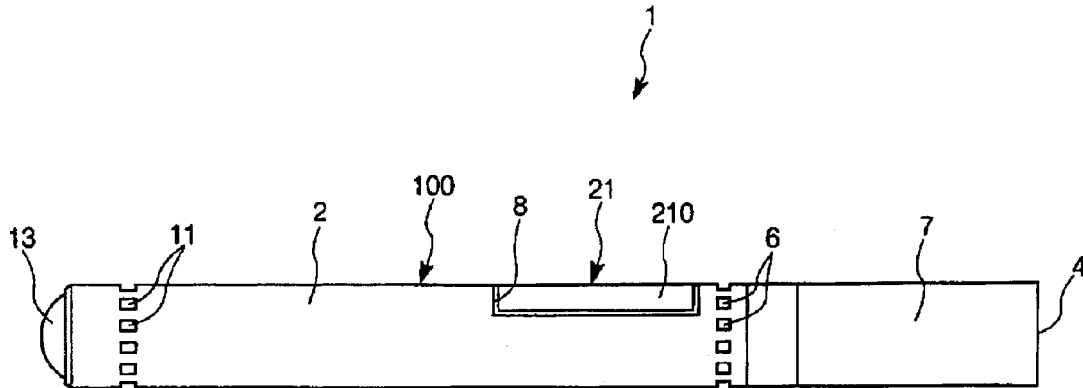
An electronic cigarette is provided. The electronic cigarette includes a casing having an inhalation hole and a substantially cylindrical configuration, ejection means (first ejection means) provided in the casing and at least one ejection head. Pressure in a cavity filled with a liquid flavor generating medium is changed by driving an actuator to eject the flavor generating medium as droplets from a nozzle in communication with the cavity. Control means provided in the casing controls the driving of the ejection means.

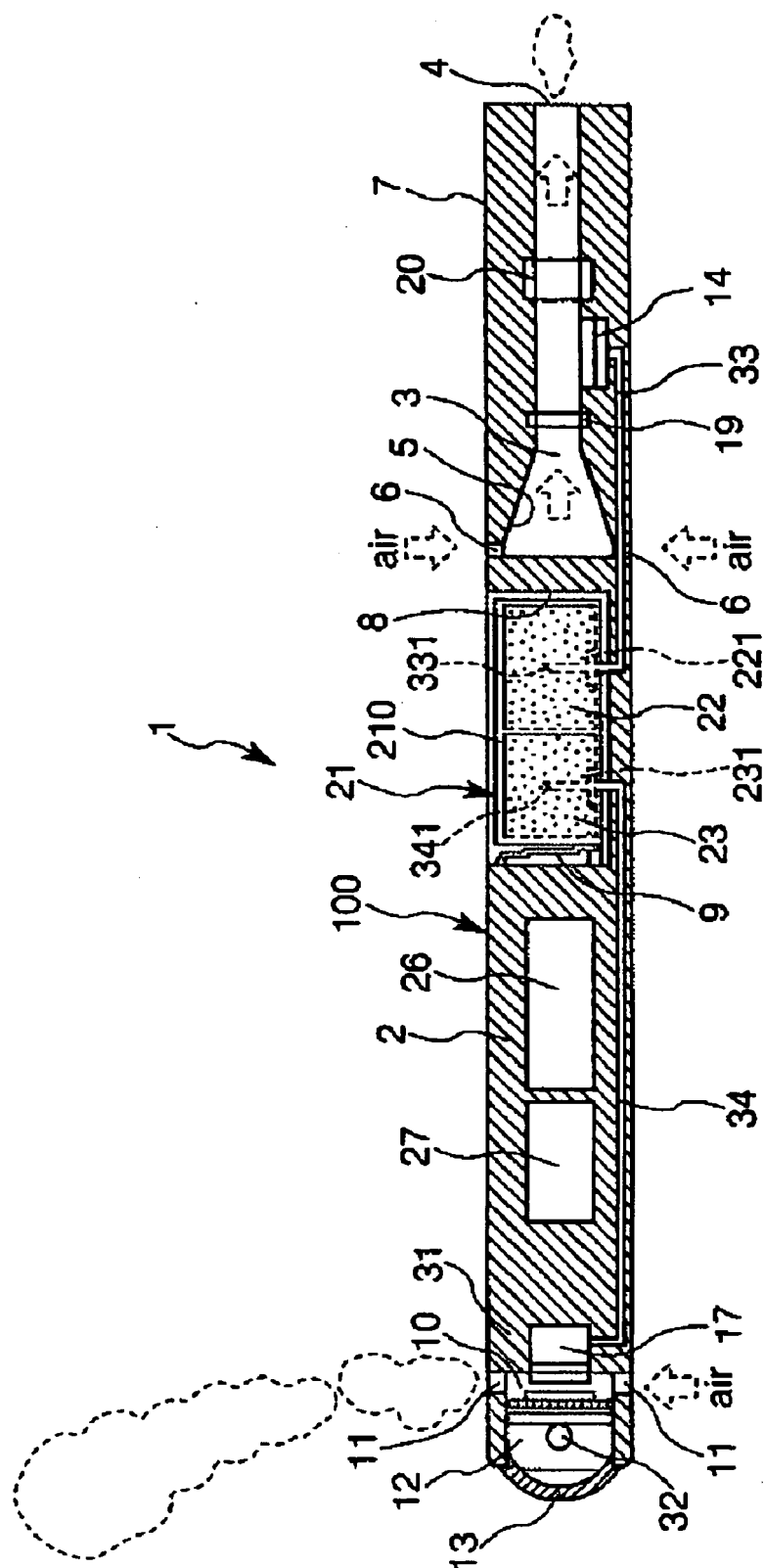
(21) **Appl. No.: 10/886,508**

(22) **Filed: Jul. 7, 2004**

(30) **Foreign Application Priority Data**

Jul. 17, 2003 (JP) 2003-198701





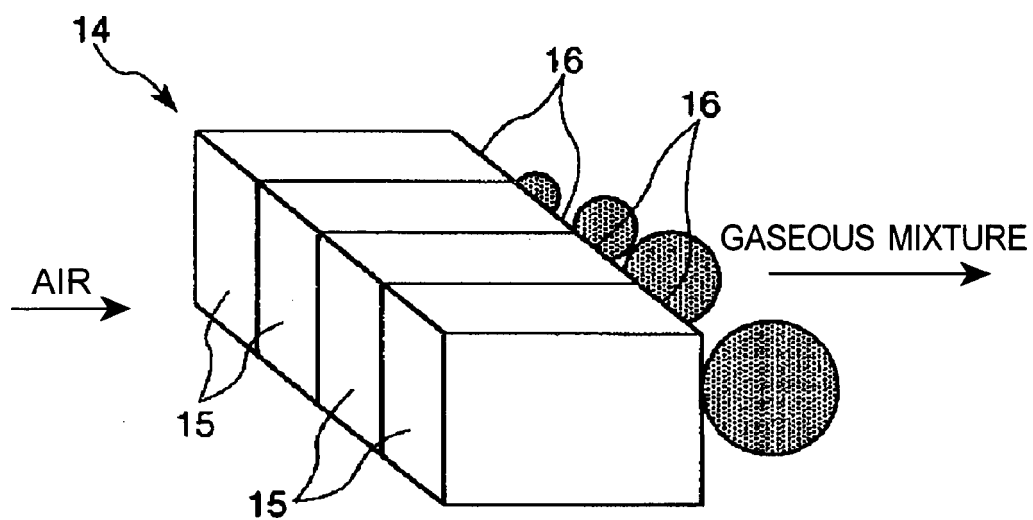


FIG. 3

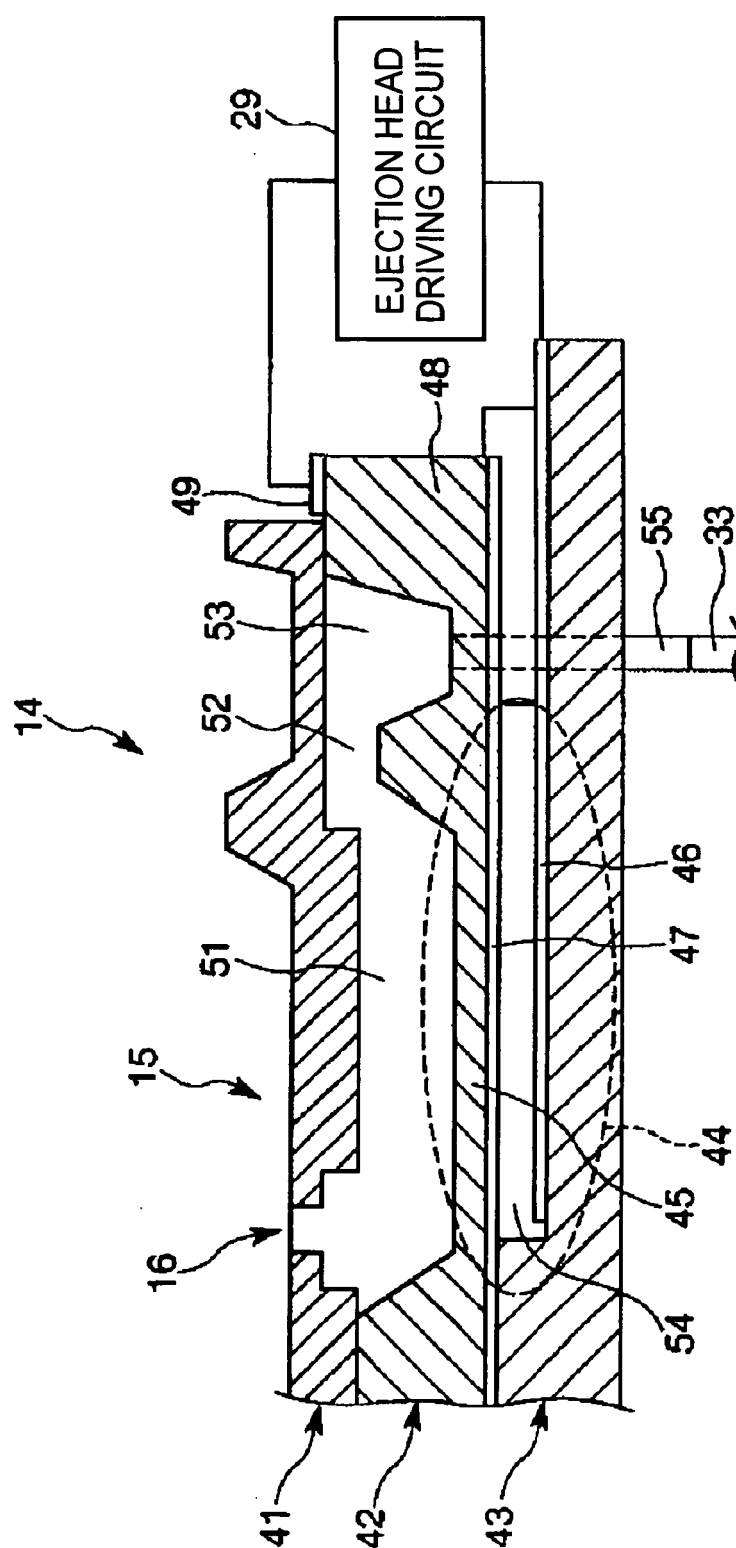


FIG. 4

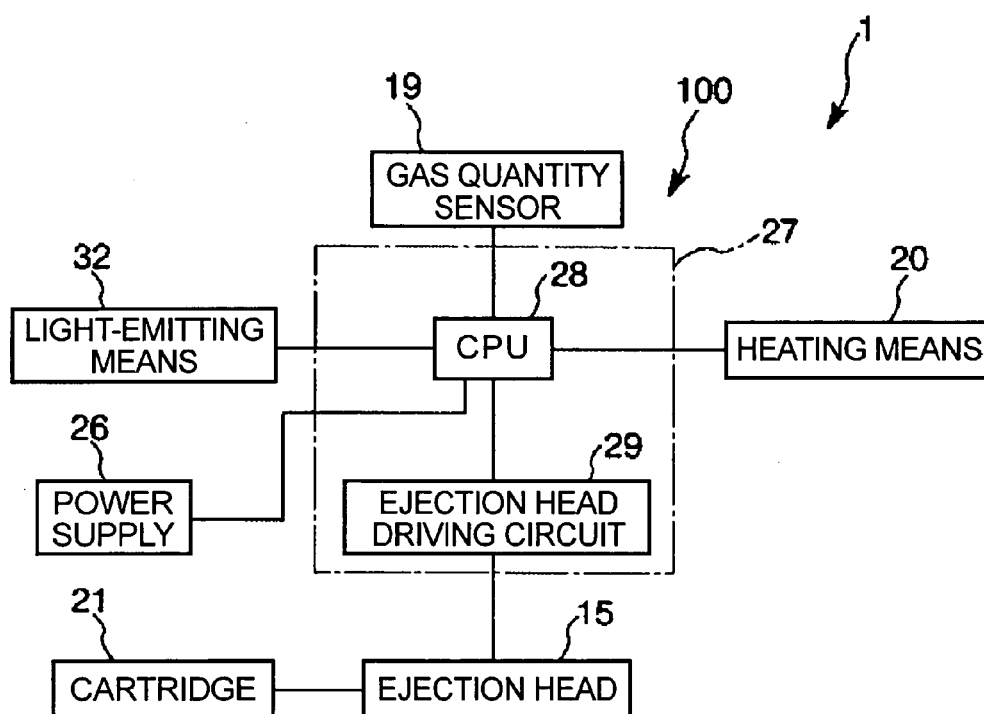


FIG. 5

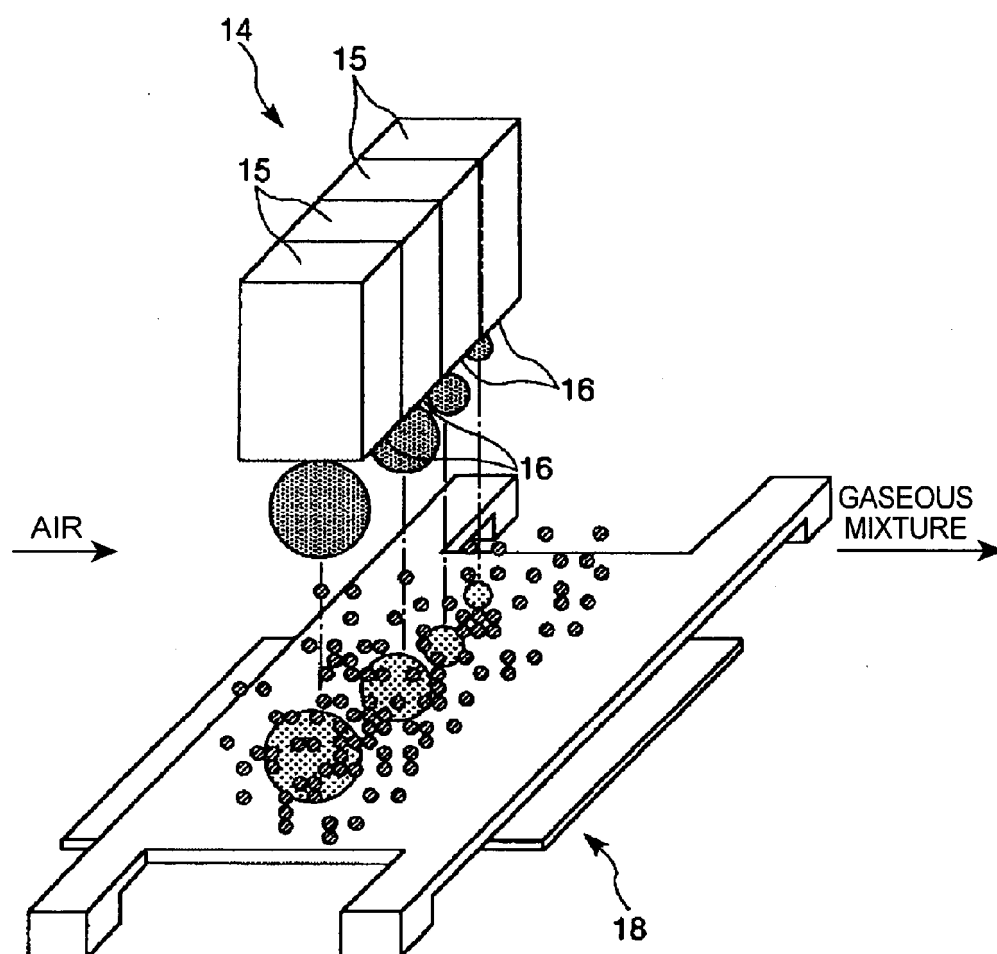


FIG. 6

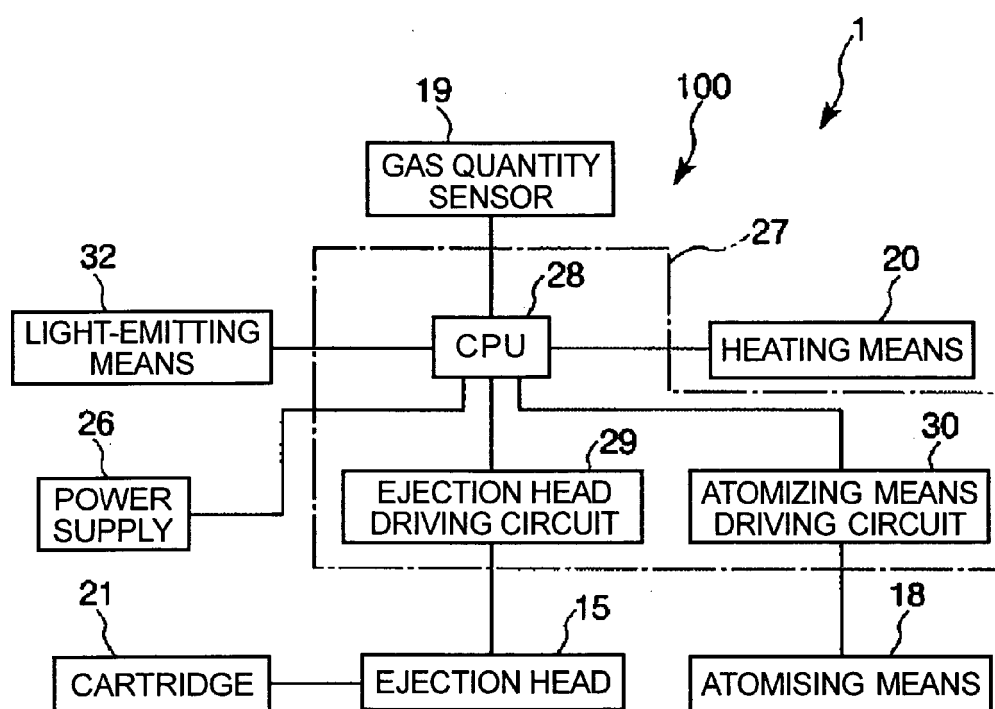


FIG. 7

ELECTRONIC CIGARETTE

RELATED APPLICATIONS

[0001] This application claims priority to Japanese Patent Application No. 2003-198701 filed Jul. 17, 2003 which is hereby expressly incorporated by reference herein in its entirety.

BACKGROUND

[0002] 1. Technical Field to which the Invention Belongs

[0003] The present invention relates to an electronic cigarette.

[0004] 2. Related Art

[0005] Recently, various types of smoking simulators for tasting a flavor resembling that of a cigarette without burning a cigarette have been proposed.

[0006] For example, smoking simulators have been proposed, in which a heating element and solid flavor generating medium are provided in a heat-insulating tube and in which the heat-insulating tube and a power supply of the heating element are wrapped in fine quality wrapping paper and formed like a cigarette (for example, see Japanese Patent Laid-Open No. JP-A-3-232481).

[0007] In a smoking simulator having such a configuration, electrical energy is supplied from the power supply to the heating element to heat the flavor generating medium which in turn generates flavor components. A flavor resembling that of a cigarette can be tasted by inhaling a gaseous mixture of the flavor components and air which has been taken into the smoking simulator.

[0008] In a smoking simulator having such a configuration, however, since it takes time to increase the temperature of the flavor generating medium, a long time is required for the flavor generating medium to generate a sufficient amount of flavor components. Thus, a sufficient amount of flavor components can not be obtained at the beginning of simulated smoking, and a feeling similar to that of a cigarette cannot be provided from the beginning of simulated smoking.

[0009] Since the amount of flavor components generated by the flavor generating medium cannot be controlled with high accuracy, the amount of flavor components cannot be adjusted according to the amount of inhalation. As a result, a feeling similar to that of a cigarette cannot be provided.

[0010] Further, since there is no function of generating smoke similar to that of a cigarette and no function of generating a fire similar to that of a cigarette, a feeling similar to that of a cigarette cannot be provided.

[0011] It is an object of the invention to provide an electronic cigarette which provides a sufficient amount of flavor components from the beginning of smoking when a smoker inhales to smoke on a simulated basis which allows the smoker to have feelings similar to those a cigarette provides.

SUMMARY

[0012] The above and other objects are achieved by the invention as described below.

[0013] An electronic cigarette according to the invention comprising: a casing having an inhalation hole and having a substantially bar-like configuration as a whole; ejection means which is provided in the casing and has at least one ejection head and which changes a pressure in a cavity filled with a liquid flavor generating medium by driving an actuator to eject the flavor generating medium as droplets from a nozzle in communication with the cavity; and control means which is provided in the casing and which controls the driving of the ejection means.

[0014] Thus, droplets of the flavor generating medium are ejected into the casing by driving the ejection means with the control means, and flavor components are supplied into the casing. When the smoker inhales with the inhalation hole side of the casing held in the mouth, a gaseous mixture of air which has flowed into the casing and the flavor components in the casing flows into the mouth, and the flavor components spread in the mouth to allow the smoker to taste a flavor resembling that of a cigarette.

[0015] In this case, since a sufficient amount of droplets of the flavor generating medium are ejected into the casing from the beginning of the driving of the ejection means, a sufficient amount of flavor components can be provided from the beginning of inhalation to obtain a feeling similar to that of a cigarette.

[0016] By using a flavor generating medium which has no harmful substance, no uncomfortable smell, taste, and the like, it is possible to prevent people around the smoker and the smoker him or herself from being damaged or made uncomfortable by smoking.

[0017] The electronic cigarette according to the invention preferably has atomizing means which is provided in the casing and which atomizes droplets of the flavor generating medium ejected from the ejection means.

[0018] Thus, droplets of the flavor generating medium ejected into the casing by driving the ejection means are atomized (refined) by the atomizing means. When the smoker inhales with the inhalation hole side of the casing held in the mouth, a gaseous mixture of air which has flowed into the casing and the atomized flavor components in the casing flows into the mouth, and the flavor components spread in the mouth to allow the smoker to taste a flavor resembling that of a cigarette.

[0019] In this case, the flavor components which have been atomized by the atomizing means can be inhaled into the mouth, the smoker can feel as if he or she was inhaling smoke of a cigarette.

[0020] In the electronic cigarette according to the invention, the atomizing means is preferably heating means which heats droplets of the flavor generating medium ejected from the ejection means to atomize them.

[0021] Thus, since particles of flavor components atomized by being heated with the heating means of the atomizing means can be inhaled into the mouth, the flavor components can be efficiently spread in the mouth, and the smoker can feel as if he or she was inhaling smoke of a cigarette.

[0022] In the electronic cigarette according to the invention, the atomizing means is preferably vibration means

which vibrates droplets of the flavor generating medium ejected from the ejection means to atomize them.

[0023] Thus, since flavor components atomized by being vibrated with the vibration means of the atomizing means can be inhaled into the mouth, the flavor components can be efficiently spread in the mouth, and the smoker can feel as if he or she was inhaling smoke of a cigarette.

[0024] In the electronic cigarette according to the invention, the atomizing means is preferably mountable and removable in and from the casing.

[0025] Thus, the atomizing means can be easily attached in the casing as occasion demands.

[0026] The electronic cigarette according to the invention preferably has a mounting portion in which a cartridge having a containing portion containing the liquid flavor generating medium is removably mounted.

[0027] Thus, the flavor generating medium is supplied from the containing portion to the ejection means by attaching the cartridge in the mounting portion of the casing, and the supply of the flavor generating medium from the containing portion to the ejection means is stopped by detaching the cartridge from the mounting portion of the casing.

[0028] In the electronic cigarette according to the invention, the ejection means is preferably provided at the cartridge.

[0029] Thus, the ejection means is mounted and removed to and from the casing integrally with the cartridge by mounting and removing the cartridge in and from the mounting portion of the casing.

[0030] The electronic cigarette according to the invention preferably has a power supply switch which turns a power supply on/off when the cartridge is mounted and removed in and from the mounting portion.

[0031] Thus, the power supply is turned on through the power supply switch by attaching the cartridge to the mounting portion of the casing, and the power supply is turned off through the power supply switch by detaching the cartridge from the mounting portion of the casing.

[0032] In the electronic cigarette according to the invention, the power supply is preferably provided in the casing.

[0033] The electronic cigarette according to the invention preferably has detection means which detects the quantity of a gas flowing through the casing.

[0034] Thus, the quantity of air or a gaseous mixture of air and flavor components flowing through the casing is detected by the detection means, and various types of control can be performed with control means based on the result of the detection with the detection means (according to a signal from the detection means).

[0035] The electronic cigarette according to the invention is preferably configured such that the driving of the ejection means is controlled by the control means based on the result of the detection with the detection means.

[0036] Thus, the quantity of air or a gaseous mixture of air and flavor components flowing through the casing is detected by the detection means, and the driving of the ejection means is controlled by the control means based on

the result of the detection with the detection means (according to a signal from the detection means) to control turning on/off of the ejection means and the ejection amount of droplets of the flavor generating medium ejected from the ejection means.

[0037] Since smokers can therefore take flavor components into the mouth in an amount according to the inhalation capacity of the smoker, the smoker can feel as if he or she was inhaling smoke of a cigarette.

[0038] The electronic cigarette according to the invention preferably has light-emitting means provided at a tip end of the casing and has a configuration in which the driving of the light-emitting means is controlled by the control means based on the result of the detection with the detection means.

[0039] Thus, the quantity of air or a gaseous mixture of air and flavor components flowing through the casing is detected by the detection means, and the driving of the light-emitting means is controlled by the control means based on the result of the detection with the detection means (according to a signal from the detection means) to control the turning on/off of the light emitting means and the quantity of light of the same.

[0040] Since this makes it possible to increase or decrease the quantity of light of the light-emitting means according to the inhalation capacity of a smoker, the smoker can feel as if he or she was inhaling smoke of a cigarette.

[0041] The electronic cigarette according to the invention preferably has smoke generating means which generates simulated smoke from a tip end of the casing and has a configuration in which the driving of the smoke generating means is controlled by the control means based on the result of the detection with the detection means.

[0042] Thus, the quantity of air or a gaseous mixture of air and flavor components flowing through the casing is detected by the detection means, and the driving of the smoke generating means is controlled by the control means based on the result of the detection with the detection means (according to a signal from the detection means) to control the turning on/off of the smoke generating means and the amount of smoke.

[0043] Since this makes it possible to generate simulated smoke from the smoke generating means, to stop the generating of smoke, and to adjust the amount of smoke generated according to the inhalation capacity of a smoker, the smoker can feel as if he or she was inhaling smoke of a cigarette.

[0044] The electronic cigarette according to the invention preferably has heating means which heats air or a gaseous mixture including air and flavor components flowing through the casing.

[0045] Thus, since the air or the gaseous mixture of air and flavor components flowing through the casing is heated by the heating means, the smoker can feel as if he or she was inhaling smoke of a cigarette.

BRIEF DESCRIPTION OF THE DRAWINGS

[0046] FIG. 1 is a plan view of a first embodiment of an electronic cigarette according to the invention.

[0047] FIG. 2 is a sectional view of FIG. 1.

[0048] FIG. 3 is an enlarged view of a part of FIG. 2

[0049] FIG. 4 is a sectional view showing an example of a configuration of ejection means.

[0050] FIG. 5 is a block diagram of the electronic cigarette according to the first embodiment.

[0051] FIG. 6 is a partial enlarged view of an electronic cigarette according to a second embodiment.

[0052] FIG. 7 is a block diagram of the electronic cigarette according to the second embodiment.

DETAILED DESCRIPTION

[0053] An electronic cigarette (smoking simulator) according to the invention will now be described in detail based on a preferred embodiment shown in the accompanying drawings.

[0054] FIGS. 1 to 5 show a first embodiment of an electronic cigarette according to the invention. FIG. 1 is a plan view showing the electronic cigarette as a whole; FIG. 2 is a sectional view of FIG. 1; FIG. 3 is an enlarged view of a part of FIG. 2; FIG. 4 is a sectional view showing an example of a configuration of ejection means; and FIG. 5 is a block diagram of the electronic cigarette.

[0055] For convenience in description, the left side and the right side in FIGS. 1 and 2 will be described as "tip end" and "base end", respectively.

[0056] As shown in FIGS. 1 and 2, an electronic cigarette 1 has a cigarette main body 100 having a round bar-like (bar-like) or cylindrical configuration as a whole and a cartridge 21 having a containing portion containing a liquid flavor generating medium.

[0057] The cigarette main body 100 has a casing 2, first ejection means (ejection means) 14 which ejects droplets of the flavor generating medium into the casing 2 and second ejection means (smoke generating means) 17, and control means 27 which controls the driving and the like of the first ejection means 14 and the second ejection means 17.

[0058] The configuration as a whole of the casing 2 is in the form of a round bar (in the form of a bar) or substantially cylindrical. A mouthpiece portion 7 is provided at a base end of the casing 2 (one end in the longitudinal direction) which corresponds to a filter of a cigarette. A channel 3 with a predetermined length allowing air, a gaseous mixture including air and flavor components, or the like to flow through is provided along the longitudinal direction in the central part of the mouthpiece portion 7.

[0059] The channel 3 has a circular cross section in the present embodiment. A base end of the same opens (is exposed) in the central part of an end face on the base end side of the mouthpiece portion 7, and the opening is formed in an inhalation hole 4 for inhaling flavor components (a gaseous mixture including air and flavor components) into the mouth.

[0060] A tip end portion of the channel 3 is formed with a tapered surface 5 whose diameter gradually increases toward the tip end, and a plurality of intake holes (side holes) 6 penetrating through the casing 2 in the radial direction thereof are provided at the portion of the tapered surface 5 having the maximum diameter, the intake holes being pro-

vided at predetermined intervals in the circumferential direction. The channel 3 is exposed to the outer surface side of the casing 2 through the intake holes 6. Referring to the shape of the intake holes 6, for example, they may have a square sectional shape, a circular sectional shape, or the like (they have a square sectional shape in the present embodiment). When the smoker inhales with the mouth piece portion 7 held in the mouth, air is taken into the channel 3 through the intake holes 6, and the air flows through the channel 3 toward the inhalation hole 4 and flows into the mouth through the inhalation hole 4.

[0061] The first ejection means 14 which is ejection means is provided in a part of the casing 2 corresponding to a central part of the channel 3 in the longitudinal direction thereof such that it faces the channel 3, and microscopic droplets of the flavor generating medium are ejected into the channel 3 by driving the first ejection means 14. The droplets of the flavor generating medium ejected into the channel 3 by the first ejection means 14 are mixed with air flowing through the channel 3 and flow in the channel 3, and a resultant gaseous mixture flows into the mouth through the inhalation hole 4.

[0062] There is no particular limitation on the configuration material of the casing 2, and various resins, various metals, various ceramics, wood, paper, and the like may be listed by way of example.

[0063] The flavor generating medium is a medium which can be ejected as droplets to generate a flavor instead of burning the same and is appropriately chosen depending on usage or the like. For example, the flavor generating medium includes substances extracted from various natural substances or predetermined ones among components constituting them. For example, as flavoring substances included in the flavor generating medium, menthol, caffeine, precursors such as glycosides which generate a flavor when thermally decomposed, components of tobacco such as components extracted from tobacco and components that are condensates of tobacco smoke, and the like may be used. In this case, it is preferable to make the flavor generating medium harmless and to eliminate harmful components.

[0064] For example, the flavor generating medium may include a substance which generates aerosol when heated in order to add smoke to the flavor. As the substance for generating aerosol, for example, glycerin, polyols such as propylene glycol, lower alcohols, sugars, mixtures of them, and the like may be used.

[0065] The first ejection means 14 employs a fluid jet method (e.g., an ink jet method). A fluid jet method is a method in which a pressure in a cavity (pressure chamber) filled with a fluid such as a liquid is changed by driving an actuator to eject the fluid as droplets from a nozzle that is in communication with the cavity. For example, such fluid jet methods include film boiling fluid jet methods such as the thermal jet method (bubble jet method ("bubble jet" is a registered trademark), piezoelectric methods, and electrostatic methods. The invention is not limited to those methods, and any method having the same function may be employed.

[0066] An ejection head according to a film boiling fluid jet method such as the thermal jet method (bubble jet method ("bubble jet" is a registered trademark)) is equipped with a

film boiling type actuator having a heating body (heater) which generates heat when energized. According to the film boiling fluid jet method, for example, the heating body is heated by energizing to generate bubbles, and droplets are ejected by the pressure of the bubbles (a change in a liquid pressure caused by the bubbles).

[0067] An ejection head according to a piezoelectric method has a piezoelectric element and a piezoelectric actuator which utilizes a piezoelectric effect of the piezoelectric element. According to the piezoelectric method, for example, a voltage is applied to the piezoelectric element to displace (deform) the piezoelectric element and to thereby change the volumetric capacity of the cavity (pressure chamber), and droplets are ejected by a resultant change in the pressure in the cavity 51.

[0068] An ejection head according to an electrostatic method has an electrostatic actuator. According to the electrostatic method, for example, a voltage is applied between counter electrodes of the electrostatic actuator to generate a Coulomb force; a diaphragm is thereby displaced (deformed) to change the volumetric capacity of the cavity (pressure chamber); and droplets are ejected by a resultant change in the pressure in the cavity 51.

[0069] In the present embodiment, as shown in FIG. 3, the first ejection means 14 has a plurality of (four in the illustrated example) ejection heads 15 according to a fluid jet method having a nozzle 16 for ejecting droplets of a flavor generating medium. That is, the first ejection means 14 has a head unit having a plurality of ejection heads 15 according to a fluid jet method. The number of the ejection heads 15 is not limited to four, and it may be one, two, three, or five or more.

[0070] The nozzle 16 of each ejection head 15 is formed with a different diameter, and the amount of the flavor generating medium ejected can be adjusted to a predetermined amount by turning on/off those ejection heads 15 in a certain combination, for example.

[0071] A typical example of a configuration of the ejection heads 15 when an electrostatic method is adapted will now be described based on FIG. 4. FIG. 4 shows only one of the plurality of ejection heads 15.

[0072] As shown in FIG. 4, the ejection head 15 has a three-layer structure in which a nozzle plate 41 made of silicon is stacked on top of a silicon substrate 42 and a glass substrate 43 is stacked on the underside of the same.

[0073] Between the silicon substrate 42 and the nozzle plate 41, there is provided a cavity (pressure chamber) 51 filled with a flavor generating medium, a reservoir 53, and an orifice (supply hole) 52 which communicates the reservoir 53 and the cavity 51 with each other. A nozzle (outlet) 16 which establishes communication between the inside and outside of the cavity 51 is provided in a part of the nozzle plate 41 associated with the cavity 51. A part of the silicon substrate 42 that faces the cavity 51 is formed as a diaphragm (bottom wall) 45 which is smaller in thickness than other parts.

[0074] The diaphragm 45 is configured such that it can be elastically deformed (elastically displaced) in out-of-plane directions thereof (the direction of the thickness thereof) that is, upward and downward.

[0075] A major part of an electrostatic actuator (actuator) 44 is constituted by the diaphragm 45, a segment electrode 46 provided on top of the glass substrate 43, and an insulation layer 47 and a gap (recess) 54 between them.

[0076] An ejection head driving circuit (voltage application means) 29 including a driving circuit for applying a driving voltage between the segment electrode 46 and a common electrode 48 facing the segment electrode 46 (between counter electrodes) performs charging and discharging between the each counter electrodes according to signals (data for ejection) input from a CPU 28 which will be described later. One output terminal of the ejection head driving circuit 29 is connected to individual segment electrode 46 and another output terminal is connected to an input terminal 49 of the common electrode 48 formed on the silicon substrate 42. An impurity is doped in the silicon substrate 42 which thus has conductivity in itself, a voltage can therefore be applied (supplied) from the input terminal 49 to the diaphragm 45 (the common electrode 48 as a whole).

[0077] When a driving voltage is applied between the counter electrodes from the ejection head driving circuit 29, a Coulomb force is generated between the counter electrodes, and the diaphragm 45 deflects toward the segment electrode 46 from the initial state shown in FIG. 4 to increase (expand) the volumetric capacity of the cavity 51. When electrical charge between the counter electrodes is abruptly discharged in this state under control of the ejection head driving circuit 29, the diaphragm 45 returns upward because of its elastic restoring force and moves upward beyond the position of the diaphragm 45 in the initial state shown in FIG. 4, which abruptly decreases (contracts) the volumetric capacity of the cavity 51. As a result, the pressure in the cavity 51 increases, and the compression pressure generated in the cavity 51 ejects a part of the flavor generating medium filling the cavity 51 as microscopic droplets from the nozzle 16 that is in communication with the cavity 51.

[0078] An intake hole 55 in communication with the reservoir 53 is provided in a part of the glass substrate 43 that is associated with the reservoir 53. A base end side of a first supply pipe 33 to be described later is connected to the intake hole 55, and the flavor generating medium is supplied into the reservoir 53 from a cartridge 21 to be described later through the first supply pipe 33 and the intake hole 55.

[0079] As shown in FIG. 2, a gas quantity sensor 19 that is detection means is provided on the way of the channel 3 (at the base of the tapered surface 5 of the channel 3) on the base end side (left side in the figure) of the first ejection means 14, and the flow rate of a fluid (air or a gaseous mixture of air and flavor components) flowing through the channel 3 is detected by the gas quantity sensor 19.

[0080] Heating means 20 is provided on the way of the channel 3 on the tip end side (right side in the figure) of the first ejection means 14, and the fluid (air or a gaseous mixture including air and flavor components) flowing through the channel 3 is heated by driving the heating means 20. Thus, the fluid heated to a predetermined temperature flows out from the inhalation hole 4. There is no particular limitation on the heating means 20 as long as it has the function of allowing a fluid to be heated, and it may be a micro-heater or the like, for example. A micro-heater con-

verts electricity into thermal energy, and its configuration and type may be arbitrarily chosen. Normally, a heater thin film is formed, and a current is passed through such a resistor to generate heat.

[0081] The heating means **20** may be made mountable and removable to and from the mouthpiece portion **7** and may be attached to the mouthpiece portion **7** as occasion demands.

[0082] A configuration may be employed in which the heating means **20** is provided upstream of the first ejection means **14**, i.e., on the tip end side of the same (left side in FIG. 2) and in which the heating means **20** is driven to heat air which flows through the channel **3** and has not reached the first ejection means **14** yet (air which has not been mixed with droplets of the flavor generating medium yet).

[0083] In a central part of the casing **2** in the longitudinal direction thereof (a part of the same on the left side of the channel **3** in the figure), there is provided a cartridge chamber (mounting portion) **8** having a predetermined depth whose top side opens outwardly of the casing **2**, and a cartridge **21** containing (filled with) a liquid flavor generating medium is removably mounted in the cartridge chamber **8**. A cartridge detection/power supply switch **9** is provided on one end face of the cartridge chamber **8** in the axial direction thereof (left side in FIG. 2).

[0084] When the cartridge **21** is mounted in (attached to) the cartridge chamber **8**, the cartridge detection/power supply switch **9** is turned on. Thus, the state in which the cartridge **21** is mounted is detected, and a power supply **26** is turned on. When the cartridge **21** is removed (detached) from the cartridge chamber **8**, the cartridge detection/power supply switch **9** is turned off. Thus, the state in which the cartridge **21** is not mounted is detected, and the power supply **26** is turned off.

[0085] The cartridge **21** has a cartridge main body (casing) **210** having a box-like configuration as a whole. The interior of the cartridge main body **210** is partitioned into two chambers, i.e., a first chamber **22** and a second chamber **23**, and a predetermined amount of a liquid flavor generating medium is contained (filled) in each of the first chamber **22** and the second chamber **23**. The flavor generating medium contained in the first chamber **22** and the flavor generating medium contained in the second chamber **23** may be identical to or different from each other.

[0086] There is no particular limitation on the configuration material of the cartridge main body (casing) **210**, and various resins or the like may be listed by way of example.

[0087] There may be only one chamber in the cartridge main body **210**. A configuration may be employed in which the above-described first ejection means **14** may be provided at the cartridge **21** (the cartridge **21** and the first ejection means **14** may be integrated) and are integrally removably mounted in the cartridge chamber (mounting portion) **8** of the casing **2** (cigarette main body **100**).

[0088] A lancable or stuck portion **221** is formed on the bottom side of the first chamber **22** of the cartridge main body **210**, the stuck portion being lanced or stuck by a sharp end **331** at a tip end side of a first supply pipe **33** to be described later. Similarly, a lancable or stuck portion **231** is formed on the bottom side of the second chamber **23**, the stuck portion being lanced or stuck by a sharp end **341** at a

base end side of a second supply pipe **34** to be described later. When the cartridge **21** is mounted in the cartridge chamber **8**, the sharp end **331** of the first supply pipe **33** and the sharp end **341** of the second supply pipe **34** stick in and penetrate through the stuck portion **221** and the stuck portion **231** of the cartridge main body **210**, respectively. Thus, communication is established between the first chamber **22** and the first supply pipe **33**, and communication is established between the second chamber **23** and the second supply pipe **34**.

[0089] In an outer peripheral portion of the casing **2**, there is embedded the first supply pipe **33** which establishes mutual communication between a part of the cartridge chamber **8** associated with the first chamber **22** and the above-described first ejection means **14** in the axial direction and the second supply pipe **34** which establishes mutual communication between a part of the cartridge chamber **8** associated with the second chamber **23** and second ejection means **17** to be described later in the axial direction. The sharp end (sticking needle) **331** is formed at the tip end side of the first supply pipe **33**, and the sharp end (sticking needle) **341** is formed at the base end side of the second supply pipe **34**. The flavor generating media are supplied from the first chamber **22** of the cartridge **21** to the first ejection means **14** and from the second chamber **23** to the second ejection means **17** through the first supply pipe **33** and the second supply pipe **34**, respectively.

[0090] In a central part of the casing **2** in the longitudinal direction thereof (a part of the same on the left of the cartridge chamber **8**), the power supply (power supply portion) **26** and control means **27** are incorporated on the base end side and tip end side, respectively, the control means controlling the driving of the first ejection means **14**, the second ejection means **17**, the gas quantity sensor **19**, the heating means **20**, the power supply **26**, light-emitting means **32** to be described later, and the like. A configuration may be employed in which the power supply **26** can be removably mounted in the casing **2**.

[0091] For example, a battery such as a primary battery or a secondary battery may be used as the power supply **26**. In this case, compactness and a reduction of weight can be achieved by using a fuel battery which has a high energy density. The fuel battery may be provided in the form of a cartridge to facilitate replacement.

[0092] At the tip end of the casing **2** (the other end in the longitudinal direction thereof), a predetermined space **10** is provided, and a plurality of intake/discharge holes (side holes) **11** are provided at predetermined intervals in the circumferential direction of a part of the casing **2** facing the space **10**, the intake/discharge holes **11** penetrating through the casing **2** in the radial direction thereof. The space **10** is exposed to the outside of the casing **2** through the intake/discharge holes **11**. Referring to the shape of the intake/discharge holes **11**, for example, it may have a square sectional shape, a circular sectional shape, or the like (it has a square sectional shape in the present embodiment).

[0093] The second ejection means **17** which is smoke generating means is provided in a part of the casing **2** that is adjacent to the space **10** on the right side of the same in FIG. 2 so as to face the space **10**, and microscopic droplets of the flavor generating media are ejected into the space **10** by driving the second ejection means **17**. In this case, for

example, simulated smoke (sidestream smoke) that resembles smoke (sidestream smoke) of a cigarette can be generated through selection, combination, or the like of the flavor generating media.

[0094] The configuration of the second ejection means 17 is not be illustrated and described because it is similar to that of the above-described first ejection means 14.

[0095] Droplets of the flavor generating media are ejected into the space 10 by driving of the second ejection means 17, and simulated smoke (sidestream smoke) resembling smoke (sidestream smoke) of a cigarette is thus generated in the space 10 and discharged from the intake/discharge holes 11. In this case, the generated (discharged) simulated smoke is preferably harmless. The simulated smoke thus generated may be odorless, or it may have an odor. When simulated smoke with an odor is to be generated, for example, the odor is preferably a pleasant odor rather than an odor like that of sidestream smoke of a cigarette.

[0096] At the tip end of the casing 2 (the part adjacent to the space 10), there is provided a recess 12 having a predetermined depth which opens at the tip end face of the casing 2. The opening of the recess 12 is closed by a diffusing lens 13 having a curved shape.

[0097] Light-emitting means 32 is provided on the bottom surface side of the recess 12, and the light-emitting means 32 can be driven for emission to generate a simulated safe fire that resembles the fire of a cigarette, which provides a visual effect that resembles the fire of a cigarette.

[0098] The amount of light emitted by the light-emitting means 32 is adjusted according to a signal from the gas quantity sensor 19 (based on the result of detection by the gas quantity sensor 19). For example, the light-emitting means 32 may be a red LED (light-emitting diode), an organic EL (Electro Luminescence), or the like. However, the invention is not limited to them, and any device having a similar function may be used.

[0099] As shown in FIG. 5, the control means 27 has a CPU (Central Processing Unit) 28 for controlling the driving of the first ejection means 14, the second ejection means 17, the heating means 20, the gas quantity sensor 19, the light-emitting means 32, the power supply 26, and the like and the ejection head driving circuit 29 incorporating a circuit for driving the first ejection means 14 and the second ejection means 17.

[0100] The provision of the control means 27 as described above allows the electronic cigarette 1 according to the present embodiment to perform various types of control.

[0101] For example, controlling of the turning on/off of the generation of simulated smoke resembling smoke (sidestream smoke) of a cigarette by controlling the turning on/off of the second ejection means 17, controlling of the turning on/off of the emission of the light-emitting means 32 or the like may be possible. Therefore, the generation of simulated smoke can be turned off and the emission of the light-emitting means may be turned off in places where smoking is prohibited (e.g., public places, railway stations, restaurants, and so on).

[0102] The heating of air or a gaseous mixture including air and flavor components with the heating means 20 can be

controlled such that it is turned off in summer and turned on in winter when a warm feel is desired.

[0103] In order to improve resemblance to a cigarette, control can be performed to reproduce states that resemble a weak odor and a low temperature at the beginning of smoking attributable to the long channel through which the smoke of the cigarette flows and to reproduce states that resemble a strong odor and a high temperature at the end of smoking attributable to the short channel through which the smoke flows.

[0104] By branding electronic cigarettes 1 and switching simulated smoking programming data depending on the brands; such control can be varied for each of the brands. Further, customization can be made depending on the preference of individual. For example, a mild odor provided by a long filter can be reproduced, and the number of times of inhalation to smoke one virtual cigarette may be set.

[0105] Such programs for simulated smoking may be written in a ROM, and the ROM may be attached to the cartridge 21 or a separate cartridge (not shown) to allow the ROM to be removably mounted in the casing 2 (cigarette main body 100) through the cartridge 21 or the separate cartridge. Another mode is possible, in which a RAM is provided in the cartridge 21 or a separate cartridge (not shown) that can be removably mounted in the casing 2 (cigarette main body 100) and in which the program for simulated smoking is downloaded using, for example, a radio interface such as Bluetooth or transmitted on a infrared basis to the RAM.

[0106] Alternatively, a memory having predetermined programs for simulated smoking written therein may be incorporated in the casing 2 (cigarette main body 100), and any of the patterns of preference may be selected using a dial or the like. In this case, for example, the storage of the programs for simulated smoking and the selection of the patterns of preference may be performed using a separate unit resembling a lighter to be paired.

[0107] For example, an RFID (radio tag) or the like may be attached to the casing 2 (cigarette main body 100), the cartridge 21, the separate cartridge (not shown), or the separate unit to allow the programs for simulated smoking to be switched or to allow parameters in the programs for simulated smoking to be changed.

[0108] When the smoker inhales with the mouthpiece portion 7 of the electronic cigarette 1 according to the present embodiment having the above-described configuration held in the mouth, air flows into the channel 3 through the intake holes 6; the quantity of the gas flowing through the channel 3 is detected by the gas quantity sensor 19; the first ejection means 14 is driven by the control means 27 according to a signal from the gas quantity sensor 19 (based on the result of detection by the gas quantity sensor 19); a predetermined amount of droplets of the flavor generating media is ejected into the channel 3 from the nozzles 16 of the ejection heads 15; the air and flavor components flowing through the channel 3 are mixed; and a gaseous mixture of them flows into the mouth through the inhalation hole 4; and the flavor components spread in the mouth to allow a flavor resembling that of a cigarette to be tasted.

[0109] In this case, since a sufficient amount of droplets of the flavor generating media is ejected into the casing 2 from

the beginning of driving of the first ejection means **14**, a sufficient amount of flavor components can be obtained from the beginning of simulated smoking (the beginning of inhalation) to provide a feeling similar to that of a cigarette.

[0110] The second ejection means **17** is driven by the control means **27** according to a signal from the gas quantity sensor **19** (based on the result of detection by the gas quantity sensor **19**), and a predetermined amount of droplets of the flavor generating media is ejected from the nozzles of the ejection heads of the second ejection means **17** into the space **10**. As a result, simulated smoke resembling smoke (sidestream smoke) of a cigarette is generated in the space **10**; the smoke flows out the space **10** through the intake/discharge holes **11**; and the smoke resembling sidestream smoke of a cigarette spreads.

[0111] Further, the light-emitting means **32** emits light according to a signal from the gas quantity sensor **19** (based on the result of detection by the gas quantity sensor **19**), which provides a visual effect that seems similar to the fire of a cigarette.

[0112] A second embodiment will now be described.

[0113] FIGS. 6 and 7 show a second embodiment of an electronic cigarette according to the invention. FIG. 6 is an enlarged illustration of a part of the same, and FIG. 7 is a block diagram of the electronic cigarette.

[0114] An electronic cigarette **1** according to the second embodiment will now be described, the description being focused on differences from the above-described first embodiment and omitting items that are identical between them.

[0115] As shown in FIG. 6, atomizing means **18** for atomizing (refining) droplets of a flavor generating medium ejected from the nozzle **16** of each ejection head **15** of the first ejection means **14** is provided facing the nozzles **16**. Although not shown, atomizing means **18** for atomizing (refining) droplets of a flavor generating medium ejected from the nozzle **16** of each ejection head **15** of the second ejection means **17** is similarly provided facing the nozzles **16**. As shown in FIG. 7, the control means **27** has an atomizing means driving circuit **30** incorporating a circuit for driving the atomizing means **18**. The configuration is otherwise similar to that shown in the first embodiment.

[0116] In this case, for example, the atomizing means **18** may be heating means which receives and heats droplets of the flavor generating medium ejected by the nozzles **16** of the ejection heads **15** to atomize them or vibration means which receives and vibrates droplets of the flavor generating medium to atomize them. For example, the heating means may be a micro-heater or the like, and the vibration means may be an ultrasonic vibration generator or the like.

[0117] Either of the atomizing means **18** of the first ejection means **14** and the atomizing means **18** of the second ejection means **17** may be omitted.

[0118] A configuration may be employed in which the atomizing means **18** are removably mounted in the casing **2** (cigarette main body **100**).

[0119] A configuration may be employed in which the atomizing means **18** is provided in the cartridge **21** (the cartridge **21** and the atomizing means **18** may be integrated)

and in which they are integrally removably mounted in the cartridge chamber (mounting portion) **8** of the casing **2** (cigarette main body **100**).

[0120] In the present embodiment, droplets of the flavor generating medium ejected by the nozzles **16** of the first ejection means **14** and the second ejection means **17** are atomized by the respective atomizing means **18** associated therewith.

[0121] Specifically, droplets of the flavor generating medium ejected from the nozzles **16** of the first ejection means **14** are atomized by the atomizing means **18** associated therewith. Therefore, when the smoker inhales with a mouthpiece portion **7** of the casing **2** held in the mouth, a gaseous mixture of air which has entered the casing **2** through the intake holes **6** and atomized flavor components in the casing **2** flows into the mouth; the flavor components spread in the mouth to allow a flavor resembling that of a cigarette to be tasted. In this case, since the flavor components can be inhaled into the mouth after being atomized by the atomizing means **18**, the smoker can feel as if he or she was inhaling smoke of a cigarette.

[0122] When the atomizing means **18** is constituted by a micro-heater, particles of the flavor generating medium which have been atomized through heating flow into the mouth. Thus, flavor components can be efficiently spread in the mouth, and the smoker can feel as if he or she was inhaling smoke of a cigarette.

[0123] When the atomizing means **18** is constituted by an ultrasonic vibration generator, particles of the flavor generating medium which have been atomized by vibration flow into the mouth. Thus, flavor components can be efficiently spread in the mouth, and the smoker can feel as if he or she was inhaling smoke of a cigarette.

[0124] Similarly, when the smoker inhales with the mouthpiece portion **7** of the casing **2** held in the mouth, droplets of the flavor generating medium ejected from the nozzles **16** of the second ejection means **17** are atomized by the atomizing means **18** associated therewith. Thus, simulated smoke resembling smoke (sidestream smoke) of a cigarette is generated in the space **10**, and it flows outside through the intake/discharge holes **11**. The smoke resembling sidestream smoke of a cigarette then spreads. In this case, droplets of the flavor generating medium ejected by the second ejection means **17** is atomized by the atomizing means **18**, simulated smoke that is very similar to sidestream smoke of a cigarette can be generated.

[0125] The electronic cigarette **1** can provide advantages similar to those of the above-described first embodiment.

[0126] While the invention has been described based on the illustrated embodiments, the invention is not limited to them, and the configuration of each part may be replaced with any other configuration having the same function. The invention may also be configured with other constituents.

What is claimed is:

1. An electronic cigarette comprising:

a casing having an inhalation hole;

an ejector provided in the casing, the ejector having at least one ejection head and which changes a pressure in a cavity filled with a liquid flavor generating medium

by driving an actuator to eject the flavor generating medium as droplets from a nozzle in communication with the cavity; and

a controller provided in the casing, the controller controlling driving of the ejector.

2. The electronic cigarette according to claim 1, comprising an atomizer provided in the casing, the atomizer atomizing droplets of the flavor generating medium ejected from the ejector.

3. The electronic cigarette according to claim 2, wherein the atomizer comprises a heater, the heater heating droplets of the flavor generating medium ejected from the ejector to atomize them.

4. The electronic cigarette according to claim 2, wherein the atomizer comprises a vibrator, the vibrator vibrating droplets of the flavor generating medium ejected from the ejector to atomize them.

5. The electronic cigarette according to claim 2, wherein the atomizer is removably mounted to the casing.

6. The electronic cigarette according to claim 1, comprising a mounting portion to which a cartridge having a containing portion containing the liquid flavor generating medium is removably mounted.

7. The electronic cigarette according to claim 6, wherein the ejector is provided at the cartridge.

8. The electronic cigarette according to claim 7, comprising a power supply switch which turns a power supply on/off when the cartridge is mounted and removed in and from the mounting portion.

9. The electronic cigarette according to claim 1, wherein the power supply is provided in the casing.

10. The electronic cigarette according to claim 1, comprising detector which detects a quantity of a gas flowing through the casing.

11. The electronic cigarette according to claim 10, wherein the controller controls the driving of the ejector based on a result of the detection by the detector.

12. The electronic cigarette according to claim 10, wherein a light-emitter is provided at a tip end of the casing, the controller controlling the driving of the light-emitter based on a result of the detection by the detector.

13. The electronic cigarette according to claim 10, comprising a smoke generator, the smoke generator generating simulated smoke from a tip end of the casing, the controller controlling the driving of the smoke generator based on a result of the detection with the detector.

14. The electronic cigarette according to claim 1, comprising a heater which heats at least one of air and a gaseous mixture including air and flavor components flowing through the casing.

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(54) 【発明の名称】 オリエンタルタバコを組み入れたタバコブレンド

(57) 【要約】

オリエンタルタバコを組み入れたタバコブレンドの煙のフレーバー及びアロマ特性は、ブレンドに熱処理を施すことにより改善される。相対的に高いショ糖エステル含量を有するオリエンタルタバコは、第二の異なるオリエンタルタバコ材料及び／又は非オリエンタルタバコ材料と組み合わせさせて、タバコ混合物を形成し、このタバコ混合物は、オリエンタルタバコ中のショ糖エステル濃度を減じるのに十分な条件下及び時間の間、加熱される。ショ糖エステルレベルが減じられたタバコブレンドは、これらのショ糖エステルの熱分解産物、即ち、2-メチルプロピオン酸、3-メチル酪酸及び3-メチルペンタン酸によりもたらされる好ましくないオフノートを有さない煙を生じる。

【特許請求の範囲】

【請求項1】

オリエンタルタバコを組み込んだタバコ混合物によって生じる煙の特性を変性させる方法であって、

第一のオリエンタルタバコ材料を第二の異なるオリエンタルタバコ材料又は非オリエンタルタバコ材料と接触させ、タバコ混合物を形成するステップと、

前記タバコ混合物を、タバコ混合物中のショ糖エステル濃度を減じるのに十分な時間及び条件下で加熱するステップと

を含んでなる方法。

【請求項2】

前記タバコ混合物は、黄色種タバコ、バーレー種タバコ又はこれらの混合物を含む請求項1に記載の方法。

【請求項3】

加熱前に、前記第一オリエンタルタバコが、少なくとも約1600ppmのショ糖エステル濃度を有する請求項1に記載の方法。

【請求項4】

加熱前に、前記第一オリエンタルタバコが、少なくとも約2000ppmのショ糖エステル濃度を有する請求項1に記載の方法。

【請求項5】

加熱前に、前記第一オリエンタルタバコが、少なくとも約3000ppmのショ糖エステル濃度を有する請求項1に記載の方法。

【請求項6】

加熱後に、前記第一オリエンタルタバコが、約1500ppm未満のショ糖エステル濃度を有する請求項1に記載の方法。

【請求項7】

加熱後に、前記第一オリエンタルタバコが、約1200ppm未満のショ糖エステル濃度を有する請求項1に記載の方法。

【請求項8】

前記加熱が、前記第一オリエンタルタバコ中のショ糖エステルを少なくとも約20重量%減少させる請求項1に記載の方法。

【請求項9】

前記加熱が、前記第一オリエンタルタバコ中のショ糖エステルを少なくとも約30重量%減少させる、請求項1に記載の方法。

【請求項10】

前記加熱が、前記タバコ混合物に熱を加えて、温度約200°F～約310°Fまで上昇させることを含む請求項1に記載の方法。

【請求項11】

前記加熱が、前記タバコ混合物に熱を加えて、温度約200°F～約250°Fまで上昇させることを含む請求項1に記載の方法。

【請求項12】

前記加熱が、大気中かつ大気圧下で行う請求項1に記載の方法。

【請求項13】

前記加熱が、少なくとも約10分間にわたって前記タバコ混合物に熱を加えることを含む請求項1に記載の方法。

【請求項14】

前記加熱が、約10分から約1時間の間にわたって前記タバコ混合物に熱を加えることを含む請求項1に記載の方法。

【請求項15】

前記加熱は、前記タバコ混合物の含水率が約10重量%～約20重量%にまで減ずるまで、前記タバコ混合物に熱を加えることを含む請求項1に記載の方法。

【請求項 16】

前記タバコ混合物が、混合物中のタバコの全重量に基づいてオリエンタルタバコを少なくとも約 10% 含む請求項 1 に記載の方法。

【請求項 17】

前記タバコ混合物が、混合物中のタバコの全重量に基づいてオリエンタルタバコを約 10% ～ 約 30% 含む請求項 1 に記載の方法。

【請求項 18】

加熱前に、前記タバコ混合物が、少なくとも約 15 重量%の含水率を有する請求項 1 に記載の方法。

【請求項 19】

加熱前に、前記タバコ混合物が、少なくとも約 20 重量%の含水率を有する請求項 1 に記載の方法。

【請求項 20】

加熱前に、前記タバコ混合物が、約 15 重量%～約 50 重量%の含水率を有する請求項 1 に記載の方法。

【請求項 21】

前記タバコ混合物の各タバコ成分が、相互に接触する前に、約 15 重量%～約 50 重量%の含水率を有する請求項 1 に記載の方法。

【請求項 22】

オリエンタルタバコを組み込んだタバコ混合物によって生じる煙の特性を変性させる方法であって、

(i) オリエンタルタバコ材料少なくとも 1 種と、(ii) 黄色種タバコ、パーレー種タバコ又はこれらの組合せとを接触させることにより、含水率が少なくとも約 20 重量%のタバコ混合物を形成するステップと、

少なくとも約 200 ° F の温度で、前記オリエンタルタバコ中のショ糖エステル濃度が約 1500 ppm 未満にまで減じるのに十分な時間にわたり前記タバコ混合物を加熱するステップと

を含んでなる方法。

【請求項 23】

前記加熱が、前記タバコ混合物を少なくとも約 10 分間にわたり加熱することを含む請求項 22 に記載の方法。

【請求項 24】

加熱前に、前記オリエンタルタバコが、少なくとも約 3000 ppm のショ糖エステル濃度を有する請求項 22 に記載の方法。

【請求項 25】

加熱前に、前記オリエンタルタバコが、少なくとも約 4000 ppm のショ糖エステル濃度を有する請求項 22 に記載の方法。

【請求項 26】

オリエンタルタバコを組み込んだタバコ混合物によって生じる煙の特性を変性させる方法であって、

少なくとも約 2000 ppm のショ糖エステル濃度を有するオリエンタルタバコ材料と、黄色種タバコ、パーレー種タバコ又はこれらの組合せとを接触させて、少なくとも約 20 重量%の含水率を有するタバコ混合物を形成するステップと、なお、このタバコ混合物はオリエンタルタバコを少なくとも約 10 重量%含む、

前記オリエンタルタバコ中のショ糖エステル濃度が少なくとも約 20 重量%にまで減少するように、約 200 ° F ～ 約 310 ° F の温度で、少なくとも約 10 分間にわたり前記タバコ混合物を加熱するステップと

を含んでなる方法。

【発明の詳細な説明】

【技術分野】

【0001】

本発明はタバコに関し、特に、喫煙製品の製造に用いるのに適したタバコブレンドの処理方法に関する。

【背景技術】

【0002】

シガレット等の人気のある喫煙製品は、実質的に円柱形で棒状の構造を有しており、裁刻されたタバコ（例えば、切断されたフィラーの形状に）などの喫煙可能な材料の装填物、ロール又はカラムを含む。これらは、巻紙で巻かれることにより、所謂「タバコロッド」を形成する。通常、シガレットは、タバコロッドと端と端とで接して一直線に並んだ円柱形のフィルター要素を有している。一般に、フィルター要素は、「プラグラップ」として知られる紙材料により巻かれた可塑化酢酸セルローストウを含む。ある種のシガレットは、複数の区分（segment）を有するフィルター要素を組み込み、これらの区分のうちの1つは、活性炭粒子を含んでよい。一般的に、フィルター要素は、「チップペーパー」として知られる外接（circumscribing）包装材料を使用して、タバコロッドの一端に取り付けられる。吸い込んだ主流煙を外気で希釈するために、チップ材料及びプラグラップに穿孔することも望ましいものとなっている。喫煙者は、タバコの一端に点火し、タバコロッドを燃やして、シガレットを取り扱う。次いで、喫煙者は、シガレットの反対端（例えば、フィルター端部）から吸い込むことにより、口の中に主流煙を受け取る。

【0003】

シガレット製造のために使用されるタバコは、代表的には、所謂「ブレンド」の形で使用される。例えば、ある種のポピュラーなタバコブレンドは、一般に、「アメリカンブレンド」と呼ばれ、これは、黄色種タバコ、パーレー種タバコ及びオリエンタルタバコを含み、多くの場合に、ある種の加工されたタバコ、例えば再構成タバコ及び加工タバコシステムを含む。特別なシガレットブランドの製造のために使用されるタバコブレンド内のタバコのそれぞれのタイプの正確な量は、ブランド毎に異なる。しかしながら、多くのタバコブレンドにとって、黄色種タバコは、ブレンドの比較的大きな割合を占め、他方、オリエンタルタバコは、ブレンドの比較的小さい割合を占める。例えば、Tobacco Encyclopedia, Vokes (Ed.) p. 44~45 (1984)、Brown, The Design of Cigarettes, 第三版、p. 43 (1990) 及び Tobacco Production, Chemistry and Technology, Davis et al. (Eds.) p. 346 (1999) を参照されたい。

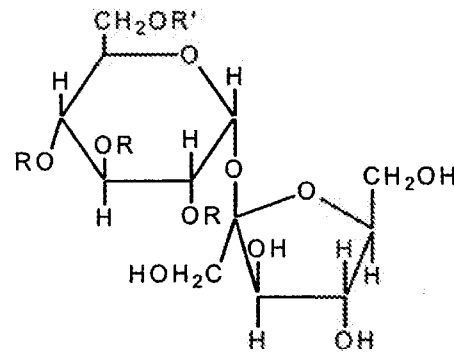
【0004】

オリエンタルタバコは、ある種のユニークで好ましいフレーバー及びアロマ特性を有する煙を生じるので、喫煙製品のタバコブレンドの好ましい成分である。たいていのオリエンタルタバコは、相対的に低いニコチン含量を有し、かつ比較的高濃度の特定の還元糖、酸及び揮発性フレーバー化合物を有する。オリエンタルタバコ煙の幾つかの特徴のあるフレーバー及びアロマ特性は、オリエンタルタバコ中のショ糖エステル及びそのショ糖エステルの熱分解産物の存在に起因する。いくつかのタイプのオリエンタルタバコ中のショ糖エステル濃度は、相対的に高く、これらのショ糖エステルは、タバコを燃やすと生じる煙のフレーバー及びアロマに、所謂「オフノート（異臭）」を導入する化合物の前駆体である。このように、これらのタバコが、相対的に高レベルでタバコブレンドに使用される場合、これらのタバコの煙の好ましいフレーバー及びアロマ特性は、強力になりすぎ、好ましくないので、タバコブレンドに伝統的に使用される特定のオリエンタルタバコの量には制約があった。

【0005】

オリエンタルタバコ中に存在するショ糖エステルのタイプは、共有結合カルボン酸基を有する糖誘導体である。一般にオリエンタルタバコ中に存在するショ糖エステルは、以下の式：

【化 1】



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〔式中、Rは、C₁—C₈カルボキシレートであり、R'は、アセテートである〕により表すことができるものを含む。Tobacco Production, Chemistry and Technology, Davis et al. (Eds.) p. 249 (1999)を参照されたい。ショ糖エステルは、熱的に分解し（例えば、これらのショ糖エステルを含むオリエンタルタバコが燃える時）、分岐鎖低分子量カルボン酸を生じ、これは、2-メチルプロピオン酸、3-メチル酪酸及び3-メチルペンタン酸を含む。オリエンタルタバコの煙の多数のオフノート特性（例えば、自然界における「チーズ臭」又は「汗臭い靴下」様であると特徴付けられたもの）は、これらのカルボン酸に関係している。

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【0006】

オリエンタルタバコを組み入れたタバコブレンド内のショ糖エステル濃度を変える方法を提供することが望まれる。特に、これらのブレンドを組み入れた喫煙製品を使用している間などにおいて、燃えると、ショ糖エステルの熱分解産物と関係して最適なフレーバー及びアロマ特性を与える、オリエンタルタバコを組み入れたタバコを提供することが望まれる。

【発明の開示】

【0007】

本発明はオリエンタルタバコを組み入れたタバコ混合物の煙のフレーバー及びアロマ特性を変える方法に関する。この方法は、湿ったタバコ混合物（例えば、タバコのブレンド）に熱を加えることを含む。タバコ混合物は、第一のオリエンタルタバコ材料、特に、相対的に高い糖エステル含量を有するオリエンタルタバコと、相対的に低い糖エステル含量を有する第二の異なるオリエンタルタバコ及び／又は少なくとも1つの非オリエンタルタバコ、例えば黄色種タバコ、パーレー種タバコ及び／又はメリーランドタバコを含む。意想外にも、そのような湿ったタバコブレンドに、有効な時間、熱処理を施すことは、そのブレンド中の糖エステル濃度、特にオリエンタルタバコ内のショ糖エステル濃度を減じ、このことにより、例えば、タバコブレンドが、シガレットのような喫煙製品の製造に使用される場合、そのタバコブレンドが燃えている間に生じる煙のアロマとフレーバー中のオフノートを減じることが判明した。本発明の結果として、相対的に高い糖エステル濃度を有するタバコのより多い量を、喫煙製品のタバコブレンドを提供するために使用することができる。本発明の方法は、ショ糖エステル含量を望ましく減じるために湿ったタバコと熱を使用するだけなので、処理されたタバコ材料は、慣用の貯蔵条件下に比較的長期間貯蔵でき、予期せぬ重大な化学変化を受けることなく、比較的、化学的に安定なままである。即ち、処理済みタバコブレンドの全体的な、化学的性質（従ってフレーバー及びアロマ特性）は、貯蔵の間、異常な又は望ましくない変化を受けることはない。

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【発明を実施するための最良の形態】

【0008】

以下、本発明を更に完全に記載する。しかしながら、本発明は、多くの異なる形式で実施でき、本明細書中に記載された実施の形態に限定されると解釈すべきではない。むしろ

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、これらの実施形態は、この開示が完全かつ十分なものであり、かつ当業者に本発明の範囲を完全に伝えるために提供される。

【0009】

本発明で使用されるオリエンタルタバコは、様々であってよい。オリエンタル種のタバコ、栽培ブラクティス、収穫ブラクティス及びキュアリングブラクティスについての記述は、Wolf, *Aromatic or Oriental Tobaccos* (1962)、Akehurst, *Tobacco* (1968)、*Tobacco Encyclopedia*, Voges (Ed.), *Tobacco Production, Chemistry and Technology*, Davis et al., (Eds.) (1999) に記載されている。オリエンタル種タバコは、ギリシアタバコ、アロマティックタバコ及びトルコタバコとも呼ばれる。代表的なオリエンタル種タバコは、イズミール (Izmir)、バスマ (Basma)、マヴラ (Mavra) 及びサムスン (Samsun) の種類を含む。他の代表的オリエンタル種タバコは、トラブゾン (Trabzon)、テサリアン (Thesallian)、タソバ (Tasova)、シノプ (Sinop)、イズミット (Izmit)、ヘンデク (Hendek)、エディルネ (Edirne)、シェムディンリ (Semdinli)、アジヤンマン (Adiyanman)、ヤイラダグ (Yayladag)、イスケンデルン (Iskenderun)、デュズジェ (Duzce)、マケドニア (Macedonian)、カテリニ (Katerini)、プリレブ (Prilep)、クルモブグラド (Krumovgrad)、バフラ (Bafra)、ブルサ (Bursa)、ブジャック (Bucak)、ビトリス (Bitlis) 及びバリケシール (Balikesir) タバコ並びに所謂半オリエンタルタバコ、例えばセピンカラヒサル (Sebinkarahisar)、ボルッカ (Borcka) 及びイーストバルカン (East Balkan) タバコを含む。本発明により使用されるオリエンタル種タバコは、世界中の種々の地域で栽培できるが、代表的なオリエンタルタバコは、東地中海地域、例えばトルコ、ギリシア、ブルガリア、マケドニア、シリア、レバノン、イタリア、ユーゴスラビア及びルーマニアで栽培される。好ましいオリエンタルタバコは、日光で乾燥される。好ましい日干しオリエンタルタバコは、キュアリングの終了後、少なくとも1年間熟成させる。

【0010】

本発明を実施するのに使用されるオリエンタル種タバコは、相対的に高いレベルの糖エステルを有する。これらのタバコ中に存在する糖エステルは、代表的には、相対的に高レベルの、2-メチルプロピオン酸、3-メチル酪酸及び3-メチルペンタン酸基からなる酸置換基を有する、シヨ糖エステルである。オリエンタルタバコ中のシヨ糖エステルのレベルは、栽培地域ごとに大幅に変化してもよく、栽培地域内では一様であるが、本発明の方法を実施する際に使用されるオリエンタルタバコ材料は、一般的に、オリエンタルタバコの乾燥重量に基づいて、少なくとも約1600 ppm、通常は少なくとも約2000 ppm、しばしば少なくとも約3000 ppm、頻繁に少なくとも約4000 ppm又はさらに少なくとも約5000 ppmのシヨ糖エステル濃度(メチルエステル当量として表現)を示す。

【0011】

はっきりと識別できるか又は異なるオリエンタルタバコ品種又は非オリエンタルタバコ材料は、第一オリエンタルタバコ材料とブレンド又は混合されて、タバコ混合物を形成する。「はっきりと識別できるか又は異なるオリエンタルタバコ品種 (distinct or dissimilar Oriental tobacco variety)」とは、第一のオリエンタルタバコ材料と遺伝子的かつ化学的に同一ではないオリエンタルタバコ品種を意味する。2つの異なるオリエンタルタバコ品種の典型的ブレンドは、イズミール、バスマ及びサムスンオリエンタルタバコ品種の中の任意の2つの組み合わせである。しかしながら、本発明の工程を実施する目的のために2つ以上のオリエンタル種タバコを相互に混合する場合、ブレンド又は混合物中の少なくとも1つのオリエンタルタバコの糖エステル含量は、他のオリエンタルタバコのよりかなり少ないのが最も好ましい。相対的に高い糖エステル含量を有するオリエンタル種タバコを、他のタイプのタバコ、例えば、黄色種タバコ、パーレー種タバコ又はこれらの組合せ物と混合するのは好ましい。本発明を実施するのに、有利には黄色種タバコ及び

／又はパーレー種タバコと組み合わせて使用できる他のタバコは、スリーランド、ダーク（dark）、ダークフアイヤード（dark-fired）及びルスティカ（Rustica）タバコ並びに他の稀な又は特製のタバコ又はそのブレンドのようなタバコを含むが、これらに限定はされない。例えば、Akehurst, Tobacco (1968) 及び Tso, Production, Physiology, and Biochemistry of Tobacco Plant (1990) を参照されたい。

【0012】

パーレー種タバコのタイプは多種多様であってよい。パーレー種タバコについての記述、栽培プラクティス、収穫プラクティス及びキュアリングプラクティスは、Wiernik et al., Rec. Adv. Tob. Sci., Vol. 21, p. 39-80 (1995)、Tobacco Production, Chemistry and Technology, Davis et al., (Eds.) (1999) 及び Burley Tobacco Information, NCCoap. Ext. Serv. (2002) に記載されている。代表的なパーレー種タバコは、Clay 402、Clay 403、Clay 502、Ky 14、Ky 907、Ky 910、Ky 8959、NC 2、NC 3、NC 4、NC 5、NC 2000、Tn 86、Tn 90、Tn 97、R 610、R 630、R 711、R 712、NCBH 129、Bu 21 x Ky 10、HB 04 P、Ky 14 x L 8、Kt 200、Newton 98、Pedigo 561、Pf 561 及び Va 509 を含む。好ましいパーレー種タバコは、通気乾燥される。好ましい通気乾燥済みパーレー種タバコは、キュアリング完了後少なくとも1年熟成させる。本発明により使用される、乾燥及び熟成させた好ましいパーレー種タバコは、相対的に低いレベルの糖エステルを有し（即ち、タバコ乾燥重量に基づき、0.1%よりかなり少ない糖エステル）、かつ通常は、実質的に糖エステルを含まない。

【0013】

黄色種タバコのタイプは多種多様であってよい。黄色種タバコの記述、栽培プラクティス、収穫プラクティス及びキュアリングプラクティスが、Hawks, Principles of Flue-Cured Tobacco Production (1978)、Sumner et al., Guidelines for Temperature, Humidity, and Airflow Control in Tobacco Curing, Univ. Georgia Res. Bull. 299 (1983)、Todd, Flue-Cured Tobacco-Producing a Healthy Crop (1981)、Tobacco Production, Chemistry and Technology, Davis et al., (Eds.) (1999)、Flue-Cured Tobacco Information, NC Coop. Ext. Serv. (2002) 及び Peele への US Pat. App. Pub. 2001/0000386 に記載される。黄色種タバコは、バージニア（Virginia）、ブライト又はブロンドタバコとも呼ばれる。代表的黄色種タバコは、Coker 48、Coker 176、Coker 371-Gold、Coker 319、Coker 347、GL 939、K149、K326、K340、K346、K358、K394、K399、K730、NC 27 NF、NC 37 NF、NC 55、NC 60、NC 71、NC 72、NC 82、NC 95、NC 297、NC 606、NC 729、NC 2326、McNair 373、McNair 944、Ox 207、Ox 414 NF、Reams 126、Reams 713、Reams 744、RG 8、RG 11、RG 13、RG 17、RG 22、RG 81、RGH 4、RGH 51、Speight H-20、Speight G-28、Speight G-58、Speight G-70、Speight G-108、Speight G-111、Speight G-117、Speight 168、Speight 179、Speight NF-3、Val 16 及び Val 182 を含む。好ましい黄色種タバコは、Peele への US Pat. App. Pub. 2001/0000386 に記載されるタイプの技術及び条件を用いて乾燥させたものである。好ましい黄色種タバコは、キュアリング完了後、少なくとも1年の

間、熟成される。本発明により使用される、乾燥及び熟成させた好ましい黄色種タバコは、相対的に低いレベルの糖エステルを有し、かつ通常は、実質的に糖エステルを含まない。

【0014】

メリーランドタバコのタイプは多種多様であってよい。メリーランドタバコの記述、栽培プラクティス、収穫プラクティス及びキュアリングプラクティスが、Tobacco Encyclopedia, Vokes (Ed.) (1984)、Aycocock et al., Maryland Coop. Ext. (1984)、Aycocock et al., Maryland Coop. Ext. (1995) 及び Tobacco Production, Chemistry and Technology, Davis et al. (Eds.) (1999) に記載される。代表的なメリーランドタバコは、Md10、Md40、Md201、Md609、Md872 及び Md341 を含む。好ましいメリーランドタバコは、通気乾燥され、しばしば、ライト通気乾燥 (light air-cured) タバコと呼ばれる。好ましい通気乾燥メリーランドタバコは、キュアリング完了後、少なくとも1年の間、熟成される。本発明により使用される、乾燥及び熟成させた好ましいメリーランドタバコは、相対的に低いレベルの糖エステルを有し、かつ通常は、実質的に糖エステルを含まない。

【0015】

本発明で使用されるタバコの物理的形狀は多種多様であってよい。タバコは、適切に乾燥及び熟成されたものであるのが最も好ましい。最も好ましくは、シガレット等の喫煙製品の製造の際に、切断されたフィラーとして使用するためにタバコをブレンドするが、そのブレンドに慣用の形状及び方法で、タバコは使用される。タバコは葉形全体で使用することができる。概して、オリエンタル種タバコは、葉形全体で使用される。特にタバコが、黄色種、パーレー種又はメリーランド品種である場合は、タバコは、ラミナ又は細片の形状で使用されることもある。タバコは、又、細かく裁断された又は切断されたフィラー形状を有してもよい。タバコの一部は、加工された形状、例えば加工済みタバコシステム (例えば、カットーロールド (cut-rolled) 又はカットーパフ (cut-puffed) システム)、体積膨張タバコ (例えば、パフタバコ、例えば、ドライアイス膨張タバコ (D I E T)、有利には切断フィラー形状のもの) 又は再生タバコ (例えば、製紙タイプ工程又はキャストシートタイプ工程を使用して、有利には、細片又は切断フィラー形状に製造された再生タバコ) を有することができる。あまり好ましいことではないが、オリエンタル種タバコは、タバコ屑材、例えば微粉、ダスト、スクラップ及びシステムと組み合わせることもある。

【0016】

本発明の工程ステップを実施するのに使用されるタバコ材料を相互に接触させる。接触方法は多様であり、代表的には、湿ったタバコを、熱の存在下に相互に接触させるか又は熱と水分の存在下にタバコを相互に接触させることができるように行う。通常は、タバコ材料は、タバコ加工及びブレンドの技術分野において公知である装置及び方法でブレンドするか混合して、タバコ混合物を提供する。例えば、タバコ材料は、オープン、加熱槽又はシリンダー、バルカー、回転乾燥機、トンネル乾燥機、流動床乾燥機、バンド又はエプロン乾燥機、サスペンションドライヤー等の中で混合することができる。シガレット製造用タバコブレンドの調合に使用するためにこれらのタバコを準備する間に、これらのタイプの装置は、伝統的には、タバコのケーシング、予備処理、リオーダリング (reordering)、増量及び乾燥のために使用されている。最も好ましくは、これらのタイプの装置は、タバコ材料に対流加熱を施す。例えば、米国特許第3345992号 (Lederman et al.)、同3357436 (Wright)、同3386448 (Wochnowski)、同3429317 (Koch et al.)、同4640299 (Ono et al.)、同4887619 (Burcham et al.)、同5022416 (Watson)、同5103842 (Strang et al.)、同5117844 (Spicer) 及び同5383479 (Winterson et al.) を参照されたい。タバコ産業で、タバコ材料の加工に使用するために設計された典型的な乾燥機は、Hauni and Sargenti から市販されている。例えば、米国特許第4298012号 (Wochno

wski)、同4340073 (de la Burde et al.)、同5259403 (Guy et al.) 及び同5908032 (Poindexter et al.) に記載のタイプの方法及び装置を用いて、加熱流体及び空気の流れの中でタバコを接触させてもよい。ブレンド方法は、有利には、2つ以上の異なるタイプのタバコ材料を密に接触させる。有利には、ブレンド方法は、成分を多少均一に物理的混合及びブレンドして、比較的同質の物理的ブレンドをもたらす。相互の接触の間、種々のタイプのタバコ材料に動きが施され、幾分かは定常状態にとどまらせることができ、多少の物理的圧縮又は圧密が施されるか、又は前記の組み合わせが施される。

【0017】

各タバコタイプの相対量は、多様であってよいが、ブレンドは、ブレンドの重量に対し、少なくとも約10%、最も有利には少なくとも約20%のオリエンタルタバコを含むのが好ましい。タバコ混合物中に存在するオリエンタルタバコの量は、熱処理後のタバコ混合物の所望の最終ショ糖エステル濃度、未処理オリエンタルタバコのショ糖エステル濃度、ブレンド中の他のタバコ材料のタイプ及び所望の熱処理条件（例えば、タバコブレンドが曝される温度、混合物の水分量及びブレンドの処理時間）のような因子に依存し得る。従って、例えば、非常に高いショ糖エステル含有量（即ち、ショ糖エステル含有量は、オリエンタルタバコの乾燥重量に基づいて約6000ppmから約7000ppmまでの一般的範囲にある）を有するオリエンタルタバコを含むタバコブレンドは、通常は、このタイプのオリエンタルタバコを、比較的低い量で含む。ブレンドの他の成分は、通常、ブレンド重量の少なくとも約60%を占める。ある実施態様では、2つ以上の好適なオリエンタルタバコ成分が、実質的にタバコブレンドの全てを占める。しかしながら、オリエンタルタバコ少なくとも1種と異種のタバコ少なくとも1種とのブレンドに関しては、ブレンドのオリエンタルタバコ成分は、ブレンドの重量の約10%から約90%までの範囲にあり、有利には、約10%から約30%までの範囲にある。他方、ブレンドの異種タバコ成分は、ブレンドの重量の約10%から約90%までの範囲にあり、有利には、約70%から約90%までの範囲にある。

【0018】

タバコ混合物は、黄色種タバコ、パーレー種タバコ又はこれらの組み合わせを含むのが好ましい。1つの有利な実施態様では、黄色種タバコ及びパーレー種タバコの両方が、オリエンタルタバコとブレンドされる。そのような実施態様では、生じるタバコ混合物は、有利には、黄色種タバコ約5重量%から約75重量%まで、更に有利には、約35重量%から約50重量%まで、パーレー種タバコ約5重量%から約75重量%まで、更に有利には、約10重量%から約50重量%まで、オリエンタルタバコ約5重量%から約40重量%まで、更に有利には約10重量%から約30重量%までを含む。

【0019】

本発明は、オリエンタルタバコ材料と第二の異なるオリエンタルタバコ材料又は非オリエンタルタバコ材料と接触させて、これらのタバコ種の物理的混合物を形成し、オリエンタルタバコ中の（従って、総体的には、タバコ混合物又はブレンド内の）ショ糖エステル濃度を減じるのに十分な時間及び条件下に、生じたタバコ混合物を加熱することを含む。そのようにして、オリエンタルタバコ内に必然的に存在するショ糖エステルの濃度は、そのように処理されるオリエンタルタバコの初期ショ糖エステル含量に基づいて、約20重量%より多く、更に約30重量%より多く、減じることができる。通常、本発明の方法を使用して、そのように処理されるオリエンタルタバコのショ糖エステル含量又は濃度を、オリエンタルタバコ材料の乾燥重量に基づき、約1500ppm未満、しばしば約1200ppm未満まで減じることができる。

【0020】

高レベルのショ糖エステルが、タバコ煙の好ましくない高レベルでの不愉快なフレーバーの原因となることは知られているが、オリエンタルタバコ独特の総合的なアロマ及びフレーバーの破壊を防ぐために、ある程度の最小レベルにショ糖レベルを保持することが好ましい。即ち、ブレンド内に存在するショ糖エステルを完全に除去することなく、タバコ

ブレンドの天然ショ糖エステル濃度を低下させるために本発明を使用することができる。通常、本発明により加工される特定のオリエンタルタバコは、処理後、少なくとも約100ppm、通常は少なくとも約400ppm、しばしば少なくとも約600ppmの最終ショ糖エステルレベルを示す。これらのタバコ中の最終ショ糖エステルレベルは、頻繁には、約1000ppmから約1500ppmまでの範囲にあってよい。

【0021】

本発明のプロセスは、オリエンタルタバコ内の特定のテルペン濃度の幾分かの減少をもたらすことがある。そのようにして、適切な方法で処理されたある種のオリエンタルタバコは、これらのタバコ内のメガスティグマトリエノン (megastigmatrienone)、ソラノン (solanone)、ドバントリエンジオール (duvantriendiol) 及びスクラレオリド (sclareolide) のレベルの減少を経験することもある。

【0022】

熱処理されるタバコ混合物は、湿性である。タバコブレンド又は混合物は、一般的に、本発明による処理前に、タバコ混合物の総重量に基づき、少なくとも約15%、通常少なくとも約20%、しばしば少なくとも約25%の含水率を有する。タバコブレンド又は混合物は、一般的に、本発明による処理前に、約50重量%まで、通常約45重量%まで、しばしば約40重量%までの含水率を有する。タバコブレンド又は混合物は、本発明による処理前に、約30重量%から約35重量%までの間の含水率をしばしば有する。

【0023】

本発明を実施するのに使用される種々のタバコ材料中に所望の含水率が得られる方法は、多様であってよい。例えば、水などの水性液体は、タバコ材料上にスプレーされ、次いで、吸収されることができる。あるいは、タバコ材料を液体中に浸漬させ、所望の水分量を吸収させることもできる。含水率は、タバコ材料上に、ケーシング溶液もしくはトップドレッシング溶液、又は緩衝液、溶媒もしくは天然タバコ材料に無縁の材料を含有する溶液などの他の液体を塗布することにより達成することもできる。タバコ材料及びタバコ材料のブレンドを湿らせる方法及び手順は、タバコ加工技術分野での熟練者には容易に明らかであろう。

【0024】

種々のブレンド成分は、ブレンド前に個々に湿らせるか、及び／又はブレンドを湿してもよい。即ち、混合前に各タバコ材料の水分レベルを調整するか、及び／又はタバコ成分が相互に接触した後で水分レベルを修正することにより、所望の含水率を有するタバコ材料のブレンドを得ることができる。1つの実施態様では、最終段階のタバコ混合物の各タバコ成分は、約15重量%から約50重量%までの範囲内の異なる含水率を有し得るので、タバコブレンドは所望の水分範囲内の最終水分レベルを有することができる。即ち、1つのタバコ成分は、混合前、相対的に低い水分レベルを有し得るが、他の成分は混合前に相対的に高い水分レベルを有し得る。2つのタバコをブレンドすると、中ぐらいの水分レベルのブレンドを形成することが予期される。

【0025】

本発明のタバコブレンドは、所望の場合には、前記のタバコ材料の他に、更に他の成分を含むことができる。しかしながら、さもなければ相対的に高い天然の糖エステル含量を有するオリエンタルタバコを組み込んだタバコブレンドの糖エステル濃度を下げるのに、付加的な試薬又は添加物は、必要ではない。他の成分にはケーシング材料（例えば、糖、グリセリン、ココア及び甘草）及びトップドレッシング材料（例えば風味付け材料、例えばメントール）が挙げられる。特定のケーシング及びトップドレッシング成分の選択は、好ましいという感覚特性のような因子に依存し、かつこれらの成分の選択は、シガレットデザイン及び製造の技術分野での熟練者には容易に明白であろう。Gutcho, Tobacco Flavoring Substances and Methods, Noyes Data Corp. (1972) 及び Leffingwell et al., Tobacco Flavoring for Smoking Products (1972) を参照されたい。

【0026】

ブレンドステップ及び任意の必要な水分調整ステップに続いて、加熱前に均質させるために、有利には、ある時間の間、タバコブレンドを密に接触するように保つ。実時間は多様であってよいが、有利には、約5分から約24時間の間である。通常、タバコブレンドは約5分から約30分までの間、放置したままにする。

【0027】

接触されたタバコは熱に曝される。タバコ混合物は、ショ糖エステル含量を減じるのに十分に高い温度で加熱すべきであるが、タバコ組成物の味覚特性に有毒である成分の形成を回避するのに十分な程度に低くあるべきである。熱処理温度は、一般に少なくとも約200°Fである。有利な範囲は、約200°F～約310°F、更に有利には約200°F～約250°Fである。タバコ材料を高温（例えば400°Fを超える温度）の加熱ガス又は雰囲気に曝す事は可能であるが、そのような曝露は、タバコ材料自体が、感知できるほどの時間の間、約300°Fをはるかに超える温度に曝されるべきでないために、比較的短時間の間実施されるのが望ましい。

【0028】

タバコブレンドに温度処理が施される時間量は、多様であってよい。時間間隔は、オリエンタルタバコのショ糖エステルレベルを所望のレベルにまで減じるのに十分であるべきである。通常、熱処理時間は、少なくとも約10分、有利には約20分である。普通は、その時間間隔は、約3時間未満、有利には約1時間未満である。有利な実施態様では、熱処理時間間隔は、約20分～約1時間である。

【0029】

タバコブレンドの適切な熱処理時間間隔を測定する1つの方法には、熱処理されたタバコブレンドの水分レベルの測定がある。例えば、タバコブレンドを、加熱工程にわたり、少なくとも約10重量%の水分レベルに保持することは好ましい。熱処理後の最終含水率は、約10重量%～約20重量%であることが特に好ましい。

【0030】

熱処理は、有利には、例えば、通気型タンク又は乾燥機を使用して、大気圧下で行う。工程ステップを、タバコ材料を包囲する環境圧を制御するために特別の注意を払わず（即ち、工程ステップを、常気圧条件下で実施することができる）かつタバコを包囲する雰囲気（即ち、工程ステップを通常の大気中で実施することができる）の構成を制御する特別ステップをとることなく（即ち、工程ステップを通常の大気中で実施することができる）、実施することは最も好都合かつ有利である。しかしながら、圧制御された環境を、本発明から逸脱せずに使用することもできる。そのような環境は、例えば、タバコブレンドを気密容器又は気密室中に封入することにより設けられる。通常、圧制御された環境は、相対的に高い圧力に耐えうる圧力容器又は圧力室を使用して設けられる。好ましい圧力容器は、外部加熱源を備える。圧制御された環境を設ける容器例は、Berghof/America Inc. of Concord, Californiaからの高圧オートクレーブ並びにThe Parr Instrument Co.から市販されるParr Reactor Model Nos. 4522及び4552を含み、米国特許第4882128号（Rukyari et al.）に記載される。そのような典型的な容器の操作は、当業者には明らかであろう。例えば、米国特許第6048404号（White）を参照されたい。そのような容器中で行われるそのような圧制御加熱工程の間、タバコブレンドにより経験される代表的な気圧は、しばしば、約10 psigから約1000 psigまで、通常は約20 psigから約500 psigまでの範囲である。

【0031】

大気又は環境大気雰囲気は、本発明を実施するのに好ましい雰囲気である。しかしながら、湿らせたタバコ混合物の加熱は、一般的に不活性な雰囲気のような制御された雰囲気下で遂行することもできる。用語「一般的に不活性な」は、熱処理を、不活性ガス中であつた環境大気雰囲気下に遂行できることを意味する意図がある。大気中での熱処理を用いると、付加的な酸素又は等価の酸化剤は必要ではない。不活性雰囲気を用いるとは、ブレンド中のタバコ材料に対して不活性、即ち、非反応性である雰囲気を使用することである。室

素、アルゴン及び二酸化炭素のようなガスを使用することができる。あるいは、炭化水素ガス（例えば、メタン、エタン又はブタン）又はフッ化炭素ガスも、処理条件及びタバコ材料の選択に依存して、特定の実施態様で、制御された雰囲気但至少とも1部を提供することができる。

【0032】

本発明の工程ステップにより加工されたタバコ材料は、タバコ製品、最も有利にはシガレット等の喫煙製品の製造に使用することができる。所望の場合には、処理済タバコブレンドに、喫煙製品製造に使用する前に、含水率を増加させるリオーダーリング処理を施すことができる。喫煙製品毎に使用される処理済タバコの量は、多様であってよく、シガレットに関しては、通常、ロッド当り約0.6g〜約1gの喫煙材料を有する。典型的なタバコブレンド、典型的にはシガレット成分及びそこから製造される典型的シガレットは、米国特許第4836224号（Lawson et al.）、同4924888（Perfetti et al.）、同5056537（Brown et al.）、同5220930（Gentry）、及び同5360023（Blakley et al.）、米国特許出願2002/0000235（Shafer et al.）及び国際公開第02/37990号に記載される。これらのタバコ材料は、又、米国特許第4793365号（Sensabaugh）、同4917128（Clearman et al.）、同4947974（Brooks et al.）、同4961438（Korte）、同4920990（Lawrence et al.）、同5033483（Clearman et al.）、同5074321（Gentry et al.）、同5105835（Drewett et al.）、同5178167（Riggs et al.）、同5183062（Clearman et al.）、同5211684（Shannon et al.）、同5247949（Deevi et al.）、同5551451（Riggs et al.）、同5285798（Banerjee et al.）、同5593792（Farrier et al.）、同5595577（Bensalem et al.）、同5816263（Counts et al.）、同5819751（Barnes et al.）、同6095153（Beven et al.）、同6311694（Nichols et al.）及び同6367481（Nichols et al.）並びに国際公開第97/48294号及び国際公開第98/16125号に記載されるタイプのシガレットの製造のために使用することができる。また、Chemical and Biological Studies on New Cigarette Prototypes that Heat Instead of Burn Tobacco, R. J. Reynolds Tobacco Company Monograph (1988) 及び Inhalation Toxicology, 12:5, p. 1-58 (2000) に記載される市販のシガレットタイプも参照されたい。

【0033】

本発明は、他の態様では、エステル交換反応機構を使用して、タバコ材料内のショ糖エステルを公知のメチルエステルに変換することによって、タバコ材料のショ糖エステルレベルまたは濃度を測定する方法に關している。この方法は、タバコ抽出物を生じるのに好適な抽出溶剤とタバコを接触させることにより、タバコ材料からショ糖エステルを抽出するステップと、タバコ抽出物内からのショ糖エステルをエステル交換させ、公知の相当するメチルエステルを形成するステップと、抽出溶剤を使用してタバコ材料から抽出したメチルエステルの量を決定する（例えば測定する）ステップと、ショ糖エステル前駆体のエステル交換反応から生じるメチルエステルの濃度に基づき、ショ糖エステルの濃度を決定するステップとを含む。エステル交換反応は、タバコ抽出物と強塩基、例えばメトキシド塩（例えばナトリウムメトキシド）、とを混合することにより達成することができる。ガスクロマトグラフィー／選択されたイオンモニター質量分析法は、タバコの単位質量あたりの収量として表現されるメチルエステルの量または濃度を決定する好ましい方法である。メチルエステルの決定は、公知濃度での公知メチルエステルの検量基準を使用して製作されるメチルエステル濃度検量線を製作することにより実施する。

【0034】

本発明の分析方法の根拠とする基礎化学は、強塩基仲介エステル交換反応機構に基づく。具体的には、この変換は、オリエンタルタバコ中のショ糖に共有結合することが知られ

ているイソブチレート、3-メチルブチレート及び3-メチルペンタノエート基を相当するメチルエステルにするナトリウムメトキシド（即ち強塩基）仲介エステル交換反応に関連しており、それぞれメチルイソブチレート、メチルー3-メチルブチレート及びメチルー3-メチルペンタノエートを生じる。エステル交換されたタバコ抽出物のメチルエステル濃度を定量化するために、広い濃度範囲にわたり定量的に用意された検量基準を使用し、3つの公知メチルエステル（即ち、メチルイソブチレート、メチルー3-メチルブチレート及びメチルー3-メチルペンタノエート）の直線の検量線を製作することができる。このように、タバコのショ糖エステル含量を分析する一般的な方法は、ショ糖エステルを溶解させる抽出溶剤を使用して、タバコ抽出物を形成することを含む。好ましい溶剤は、塩化メチレンである。矛盾のない結果を得るために、タバコ試料と抽出溶剤とを混合し、混合物を攪拌し、混合物を有意の時間（例えば一晩）、放置し、次いで混合物を再び攪拌するのが好ましい。次いで、有利には、抽出混合物を濾過し、強塩基、例えばナトリウムメトキシドまたは他のメトキシド塩（例えば、アルカリ金属又はアルカリ土類金属の塩）を濾液に添加する。ナトリウムメトキシドは、タバコ抽出物中のショ糖エステルとの反応を被り、ショ糖エステルのカルボキシレート基のエステル交換反応が生じ、その結果、相当するメチルエステルが生じる。生じたメチルエステル化合物は公知であり、市販されているので、検量線は、検量基準を使用して形成でき、各メチルエステル濃度は、ガスクロマトグラフィー／選択イオンモニター質量分析法（GC／SIM-MS）から得られた応答を用いて計算することができる。

〔実施例〕

【0035】

本発明を説明するために、以下の例を記載するが、本発明を限定するものと考えべきではない。これらの実験結果から示されるように、タバコが相対的に穏やかな条件下で、水と熱を用いて加工される時に、オリエンタルタバコ及びオリエンタルタバコを含有するブレンドにおいて重要な化学的变化が起こることが示された。例えば、水分ほぼ35%に調整されたオリエンタルタバコのショ糖エステル含量（そのメチルエステル当量として表される）は、SARGENT Tray Dryer中で200°Fで1時間、タバコを加熱することにより、ファクター2まで減じられた。これらのブレンドから製造されたシガレットの煙を知覚により評価し、未加工の対照物から製造されたシガレットの煙と比較すると、これらの加工タバコの感覚的な属性において有意なシフトが示された。このように、オリエンタルタバコの性質における変化は、本発明により加工されたタバコで調製されたシガレットの官能特性を変えることが示された。

【0036】

比較例1〜20は、オリエンタルタバコを異なるオリエンタルタバコ又は非オリエンタルタバコとブレンドせずに、湿ったオリエンタルタバコだけを加熱しても、ショ糖エステル含量において有意な減少をもたらさないことを示す。例1〜8は、オリエンタルタバコと、1種以上の、異なるオリエンタルタバコ又は非オリエンタルタバコとを含む湿ったタバコブレンドを加熱することから、ショ糖エステル含量に有意な減少が生じることを示す。他に記述がなければ、全ての部及び%は、重量部及び重量%である。

〔比較例1〕

【0037】

オリエンタルタバコ、マヴラ（Mavra）を、水分35%に調整し、対流乾燥機中で200°Fで約60分間加熱した。処理後、メチルエステル当量として測定したショ糖エステルレベルは、234 ppmであった。未処理オリエンタルタバコ（即ち対照）のメチルエステルレベルは、278 ppmであった。

〔比較例2〕

【0038】

熱処理時間を約45分にした以外は、比較例1と同様である。処理済みタバコのメチルエステルレベルは278 ppmであった。

〔比較例3〕

【0039】

熱処理時間を約30分にした以外は、比較例1と同様である。処理済みタバコのメチルエステルレベルは271ppmであった。

〔比較例4〕

【0040】

熱処理時間を約15分にした以外は、比較例1と同様である。処理済みタバコのメチルエステルレベルは266ppmであった。

〔比較例5〕

【0041】

熱処理温度を約250°Fにした以外は、比較例1と同様である。処理済みタバコのメチルエステルレベルは230ppmであった。

〔比較例6〕

【0042】

熱処理時間を約45分にした以外は、比較例5と同様である。処理済みタバコのメチルエステルレベルは260ppmであった。

〔比較例7〕

【0043】

熱処理時間を約30分にした以外は、比較例5と同様である。処理済みタバコのメチルエステルレベルは261ppmであった。

〔比較例8〕

【0044】

熱処理時間を約15分にした以外は、比較例5と同様である。処理済みタバコのメチルエステルレベルは289ppmであった。

〔比較例9〕

【0045】

オリエンタルタバコがイズミールであった以外は、比較例1と同様である。未処理オリエンタルタバコ（即ち対照）のメチルエステルレベルは、2930ppmであった。処理済みタバコのメチルエステルレベルは2537ppmであった。

〔比較例10〕

【0046】

熱処理時間を約45分にした以外は、比較例9と同様である。処理済みタバコのメチルエステルレベルは2732ppmであった。

〔比較例11〕

【0047】

熱処理時間を約30分にした以外は、比較例9と同様である。処理済みタバコのメチルエステルレベルは2888ppmであった。

〔比較例12〕

【0048】

熱処理時間を約15分にした以外は、比較例9と同様である。処理済みタバコのメチルエステルレベルは2928ppmであった。

〔比較例13〕

【0049】

熱処理温度を約250°Fにした以外は、比較例9と同様である。処理済みタバコのメチルエステルレベルは3073ppmであった。

〔比較例14〕

【0050】

熱処理時間を約45分にした以外は、比較例13と同様である。処理済みタバコのメチルエステルレベルは2755ppmであった。

〔比較例15〕

【0051】

熱処理時間を約30分にした以外は、比較例13と同様である。処理済みタバコのメチルエステルレベルは2973 ppmであった。

〔比較例16〕

【0052】

熱処理時間を約15分にした以外は、比較例13と同様である。処理済みタバコのメチルエステルレベルは3499 ppmであった。

〔比較例17〕

【0053】

水分レベルを16%に調整した以外は、比較例1と同様である。処理済みタバコのメチルエステルレベルは246 ppmであった。

〔比較例18〕

【0054】

熱処理温度を約250°Fにした以外は、比較例17と同様である。処理済みタバコのメチルエステルレベルは264 ppmであった。

〔比較例19〕

【0055】

水分レベルを16%に調整した以外は、比較例9と同様である。処理済みタバコのメチルエステルレベルは2603 ppmであった。

〔比較例20〕

【0056】

熱処理温度を約250°Fにした以外は、比較例19と同様である。処理済みタバコのメチルエステルレベルは3115 ppmであった。

【実施例1】

【0057】

水分50%の黄色種タバコ約50%、水分16.5%のパーレー種タバコ約27%及び水分14.5%のオリエンタルタバコ約23%を含む、タバコブレンドを形成した。このブレンドを、水分約35%に調整し、対流乾燥機中で310°Fで5分間加熱した。処理後、メチルエステルレベルは、750 ppmであった。未処理タバコブレンド（即ち対照）のメチルエステルレベルは、1350 ppmであった。このように、非オリエンタルタバコと、相対的に高いショ糖エステル含量を有するオリエンタルタバコとのブレンドは、本発明により高い水分レベルで効果的な時間の間、熱処理を施されて、ショ糖エステル含量において有意な減少を受ける。

【実施例2】

【0058】

ブレンド全体が一度に水分35%に調整されること以外は、例1と同様である。処理済みタバコのメチルエステルレベルは750 ppmであった。

【実施例3】

【0059】

熱処理温度が200°Fであり、処理時間が約20分である以外は、例1と同様である。処理済みタバコのメチルエステルレベルは500 ppmであった。

【実施例4】

【0060】

処理時間が約60分である以外は、例3と同様である。処理済みタバコのメチルエステルレベルは475 ppmであった。

【実施例5】

【0061】

水分16%のイズミールタバコ約50%と、水分50%のサムスン約50%とを含む、オリエンタルタバコブレンドを形成した。このブレンドを、24時間熟成させ、次いで、対流乾燥機中で200°Fで約60分間加熱した。処理後、メチルエステルレベルは、3100 ppmであった。未処理タバコブレンド（即ち対照）のメチルエステルレベルは、

4700 ppmであった。

【実施例6】

【0062】

イズミールの水分レベルが50%であり、サムスンの水分レベルが16%である以外は、例5と同様である。処理済みタバコのメチルエステルレベルは3100 ppmであった。

【実施例7】

【0063】

タバコブレンドが、水分50%のサムスン約50%と、水分16%の黄色種タバコ約50%とを含む以外は、例5と同様である。処理後、メチルエステルレベルは950 ppmであった。未処理タバコブレンド（即ち対照）のメチルエステルレベルは、3200 ppmであった。

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【実施例8】

【0064】

サムスンの水分レベルが16%であり、黄色種タバコの水分レベルが50%である以外は、例7と同様である。処理済みタバコのメチルエステルレベルは1600 ppmであった。

【0065】

本発明の多数の変更及び他の実施態様は、明細書中に提示された教示の利益を有する本発明が関係する当業者には、思い浮かぶものである。それゆえ、本発明は開示された特定の実施態様に限定されず、かつ変更及び他の実施態様は、添付クレームの範囲の中に含まれる意図を有すると理解されるべきである。特定の用語が明細書中に使用されるが、これらは、一般的かつ記述的意味でのみ使用され、限定を目的とはしない。

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【國際調查報告】

INTERNATIONAL SEARCH REPORT

International Application No.
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A. CLASSIFICATION OF SUBJECT MATTER IPC 7 A24B15/00		
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) IPC 7 A24B		
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 practical, search terms used) EPO-Internal, WPI Data, FSTA, PAJ, COMPENDEX		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 821 886 A (REYNOLDS TOBACCO CO R) 4 February 1998 (1998-02-04) example 4	1, 2, 12, 16, 17
Y	-----	13, 14
Y	US 4 638 916 A (COX RICHARD H ET AL) 27 January 1987 (1987-01-27) column 1, line 14 - line 16 column 5, line 16 - line 22	13, 14
A	US 4 091 823 A (KALLIANOS ANDREW GEORGE ET AL) 30 May 1978 (1978-05-30) column 1, line 13 - line 32	1
☐ Further documents are listed in the continuation of box C. ☒ Patent family members are listed in annex.		
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(54) Title: TOBACCO BLENDS INCORPORATING ORIENTAL TOBACCOS

(57) Abstract: The flavor and aroma characteristics of the smoke of a tobacco blend incorporating Oriental tobacco are improved by subjecting that blend to heat treatment. Oriental tobacco having a relatively high sucrose ester content is combined with a second dissimilar Oriental tobacco material and/or a non-Oriental tobacco material to form a tobacco mixture, and that mixture is heated for a time and under conditions sufficient to reduce the concentration of sucrose esters in the Oriental tobacco. Tobacco blends having reduced levels of sucrose esters yield smoke that does not possess undesirable off-notes provided by pyrolysis products of those sucrose esters; namely, 2-methylpropionic acid, 3-methylbutyric acid and 3-methylpentanoic acid.



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TOBACCO BLENDS INCORPORATING ORIENTAL TOBACCOS

FIELD OF THE INVENTION

The invention relates to tobacco, and in particular, to methods for processing tobacco blends suitable for use in manufacturing smoking articles.

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BACKGROUND OF THE INVENTION

Popular smoking articles, such as cigarettes, have a substantially cylindrical rod shaped structure and include a charge, roll or column of smokable material such as shredded tobacco (e.g., in cut filler form) surrounded by a paper wrapper thereby forming a so-called "tobacco rod." Normally, a cigarette has a cylindrical filter element aligned in an end-to-end relationship with the tobacco rod. Typically, a filter element comprises plasticized cellulose acetate tow circumscribed by a paper material known as "plug wrap." Certain cigarettes incorporate a filter element having multiple segments, and one of those segments can comprise activated charcoal particles.

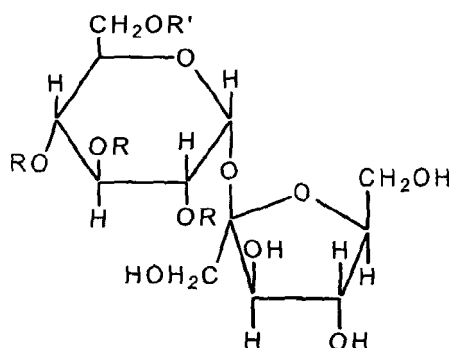
Typically, the filter element is attached to one end of the tobacco rod using a circumscribing wrapping material known as "tipping paper." It also has become desirable to perforate the tipping material and plug wrap, in order to provide dilution of drawn mainstream smoke with ambient air. A cigarette is employed by a smoker by lighting one end thereof and burning the tobacco rod. The smoker then receives mainstream smoke into his/her mouth by drawing on the opposite end (e.g., the filter end) of the cigarette.

The tobacco used for cigarette manufacture is typically used in a so-called "blended" form. For example, certain popular tobacco blends, commonly referred to as "American blends," comprise mixtures of flue-cured tobacco, burley tobacco and Oriental tobacco, and in many cases, certain processed tobaccos, such as reconstituted tobacco and processed tobacco stems. The precise amount of each type of tobacco within a tobacco blend used for the manufacture of a particular cigarette brand varies from brand to brand. However, for many tobacco blends, flue-cured tobacco makes up a relatively large proportion of the blend, while Oriental tobacco makes up a

relatively small proportion of the blend. See, for example, *Tobacco Encyclopedia*, Voges (Ed.) p. 44-45 (1984), Browne, *The Design of Cigarettes*, 3rd Ed., p.43 (1990) and *Tobacco Production, Chemistry and Technology*, Davis et al. (Eds.) p. 346 (1999).

5 Oriental tobaccos are desirable components of the tobacco blends of smoking products because Oriental tobaccos yield smoke possessing certain unique and desirable flavor and aroma characteristics. Most Oriental tobaccos possess relatively low nicotine content, and possess relatively high levels of certain reducing sugars, acids and volatile flavor compounds. Some of the distinct flavors and aromas
10 characteristic of Oriental tobacco smoke are attributed to the presence of sucrose esters in Oriental tobaccos, and the pyrolysis products of those sucrose esters. The sucrose ester concentrations in some types of Oriental tobaccos are relatively high, and those sucrose esters are precursors to compounds that introduce so-called "off-notes" to the flavor and aroma of smoke that results from the burning of those
15 tobaccos. Thus, there have been constraints upon the amount of certain Oriental tobaccos traditionally used in tobacco blends, because the desirable flavor and aroma characteristics of the smoke of those tobaccos become overpowering and undesirable when relatively high levels of those tobaccos are used in tobacco blends.

The types of sucrose esters that are present in Oriental tobaccos are sugar
20 derivatives possessing covalently bound carboxylic acid groups. Sucrose esters typically present in Oriental tobaccos include those that can be represented by the following formula:



where R is C₃-C₈ carboxylate and R' is acetate. See, also, *Tobacco Production, Chemistry and Technology*, Davis et al. (Eds.) p. 294 (1999). Sucrose esters thermally decompose (e.g., such as when the Oriental tobacco incorporating those sucrose esters is burned) to yield branched chain low molecular weight carboxylic
25

acids, including 2-methylpropionic acid, 3-methylbutyric acid and 3-methylpentanoic acid. Many of the off-notes characteristic of the smoke of Oriental tobaccos (e.g., those that are characterized as being "cheesy" or likening "sweaty sock" in nature) are associated with those carboxylic acids.

- 5 It would be desirable to provide a method for altering the sucrose ester concentration within a tobacco blend incorporating an Oriental tobacco. In particular, it would be desirable to provide tobacco blends incorporating Oriental tobaccos that when burned, such as during the use of smoking articles incorporating those blends, would provide optimized flavor and aroma characteristics associated with the
- 10 pyrolysis products of sucrose esters.

SUMMARY OF THE INVENTION

- The present invention relates to a method of altering the flavor and aroma characteristics of the smoke of a tobacco mixture incorporating Oriental tobacco.
- 15 That method involves subjecting a moist mixture of tobaccos (e.g., a blend of tobaccos) to the application of heat. The mixture of tobaccos includes a first Oriental tobacco material, and in particular, an Oriental tobacco having a relatively high sugar ester content, with a second dissimilar Oriental tobacco having a relatively low sugar ester content and/or at least one non-Oriental tobacco, such as flue-cured tobacco,
- 20 burley tobacco and/or Maryland tobacco. Surprisingly, it has been discovered that heat-treating such a moist tobacco blend for an effective period of time reduces the concentration of sugar esters in that blend, particularly sucrose ester concentration within the Oriental tobacco, thereby reducing off-note in the aroma and flavor of the smoke generated during the burning of that tobacco blend, such as when that tobacco
- 25 blend is used for the manufacture of smoking articles such as cigarettes. As a result of the present invention, greater amounts of tobaccos having relatively high sugar ester concentrations can be used for providing the tobacco blends for smoking articles. Since the method of the invention only involves the use of moist tobacco and heat to accomplish the desired sucrose ester content reduction, the treated tobacco
- 30 material can be stored for relatively long periods of time under conventional storage conditions and remain relatively chemically stable without undergoing significant unexpected chemical change. That is, the overall chemical nature (and hence the

flavor and aroma characteristics) of the treated tobacco blend does not undergo unusual or undesirable changes during storage.

5 DETAILED DESCRIPTION OF THE INVENTION

The present invention now will be described more fully hereinafter. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully
10 convey the scope of the invention to those skilled in the art.

The Oriental tobacco used in the invention can vary. Descriptions of Oriental-type tobaccos, growing practices, harvesting practices and curing practices are set forth in Wolf, *Aromatic or Oriental Tobaccos* (1962), Akehurst, *Tobacco* (1968), *Tobacco Encyclopedia*, Voges (Ed.) (1984), *Tobacco Production, Chemistry and Technology*, Davis et al. (Eds.) (1999). Oriental-type tobaccos also are referred to as
15 Greek, aromatic and Turkish tobaccos. Representative Oriental-type tobaccos include the Izmir, Basma, Mavra and Samsun varieties. Other representative Oriental-type tobaccos include Trabzon, Thesalian, Tasova, Sinop, Izmit, Hendek, Edirne, Semdinli, Adiyaman, Yayladag, Iskenderun, Duzce, Macedonian, Katerini, Prilep,
20 Krumovgrad, Bafra, Bursa, Bucak, Bitlis and Balikesir tobaccos, as well as the so-called semi-Oriental tobaccos such as Sebinkarahisar, Borgka and East Balkan tobaccos. Although Oriental-type tobaccos that are employed in accordance with the present invention can be grown in a variety of locations throughout the world, typical Oriental tobaccos are grown in eastern Mediterranean regions such as Turkey, Greece,
25 Bulgaria, Macedonia, Syria, Lebanon, Italy, Yugoslavia, and Romania. Preferred Oriental tobaccos are sun cured. Preferred sun cured Oriental tobaccos are aged for at least one year after curing is complete.

Oriental-type tobaccos that are used in carrying out the present invention possess relatively high levels of sugar esters. The sugar esters present in those
30 tobaccos typically are sucrose esters that possess relatively high levels of acid substituents comprised of 2-methylpropionic, 3-methylbutyric, and 3-methylpentanoic acid groups. Although the level of sucrose esters in Oriental tobaccos can vary considerably from growing region to growing region, and even within growing

regions, Oriental tobacco material used in carrying out the method of the invention typically exhibits a sucrose ester concentration (expressed as methyl ester equivalents) of at least about 1,600 ppm, usually at least about 2,000 ppm, often at least about 3,000 ppm, frequently at least about 4,000, or even at least about 5,000 ppm, based on the dry weight of that Oriental tobacco.

A distinct or dissimilar Oriental tobacco variety or non-Oriental tobacco material can be blended or mixed with the first Oriental tobacco material to form the tobacco mixture. By "distinct or dissimilar Oriental tobacco variety" is meant an Oriental tobacco variety that is not genetically and chemically identical to the first Oriental tobacco material. An exemplary blend of two dissimilar Oriental tobacco varieties is a combination of any two of the Izmir, Basma and Samsun Oriental tobacco varieties. However, when two or more Oriental-type tobaccos are mixed together for purposes of carrying out the process of the present invention, it is most preferable that the sugar ester content of at least one of the Oriental tobaccos be considerably less than the other Oriental tobaccos in the blend or mixture. It is preferred that an Oriental-type tobacco having a relatively high sugar ester content be mixed with another type of tobacco, such as flue-cured tobacco, a burley tobacco, or a combination thereof. Other tobaccos that can be used in carrying out the present invention, preferably in combination with flue-cured and/or burley tobaccos, include, but are not limited to, tobaccos such as Maryland, dark, dark-fired and *Rustica* tobaccos, as well as other rare or specialty tobaccos, or blends thereof. See, for example, Akehurst, *Tobacco* (1968) and Tso, *Production, Physiology, and Biochemistry of Tobacco Plant* (1990).

The type of burley tobacco can vary. Descriptions of burley tobaccos, growing practices, harvesting practices and curing practices are set forth in Wiernik et al, *Rec. Adv. Tob. Sci.*, Vol. 21, p. 39-80 (1995), *Tobacco Production, Chemistry and Technology*, Davis et al. (Eds.) (1999) and *Burley Tobacco Information*, NC Coop. Ext. Serv. (2002). Representative burley tobaccos include Clay 402, Clay 403, Clay 502, Ky 14, Ky 907, Ky 910, Ky 8959, NC 2, NC 3, NC 4, NC 5, NC 2000, Tn 86, Tn 90, Tn 97, R 610, R 630, R 711, R 712, NCBH 129, Bu 21 x Ky 10, HB04P, Ky 14 x L 8, Kt 200, Newton 98, Pedigo 561, Pf 561 and Va 509. Preferred burley tobaccos are air cured. Preferred air cured burley tobaccos are aged for at least one year after curing is complete. Preferred cured and aged burley tobaccos that are used in

accordance with the present invention possess relatively low levels of sugar esters (i.e., much less than 0.1 percent sugar esters, based on the dry weight of that tobacco), and normally are virtually absent of sugar esters.

The type of flue-cured tobacco can vary. Descriptions of flue-cured tobaccos, growing practices, harvesting practices and curing practices are set forth in Hawks, *Principles of Flue-Cured Tobacco Production* (1978), Sumner et al., *Guidelines for Temperature, Humidity, and Airflow Control in Tobacco Curing*, Univ. Georgia Res. Bull. 299 (1983), Todd, *Flue-Cured Tobacco – Producing a Healthy Crop* (1981), *Tobacco Production, Chemistry and Technology*, Davis et al. (Eds.) (1999), *Flue-Cured Tobacco Information*, NC Coop. Ext. Serv. (2002) and US Pat. App. Pub. 2001/0000386 to Peele. Flue-cured tobaccos are also referred to as Virginia, bright or blond tobaccos. Representative flue-cured tobaccos include Coker 48, Coker 176, Coker 371-Gold, Coker 319, Coker 347, GL 939, K 149, K 326, K 340, K 346, K 358, K 394, K 399, K 730, NC 27NF, NC 37NF, NC 55, NC 60, NC 71, NC 72, NC 82, NC 95, NC 297, NC 606, NC 729, NC 2326, McNair 373, McNair 944, Ox 207, Ox 414 NF, Reams 126, Reams 713, Reams 744, RG 8, RG 11, RG 13, RG 17, RG 22, RG 81, RG H4, RG H51, Speight H-20, Speight G-28, Speight G-58, Speight G-70, Speight G-108, Speight G-111, Speight G-117, Speight 168, Speight 179, Speight NF-3, Va 116 and Va 182. Preferred flue-cured tobaccos are those that are cured using the types of techniques and conditions set forth in US Pat. App. Pub. 2001/0000386 to Peele. Preferred flue-cured tobaccos are aged for at least one year after curing is complete. Preferred cured and aged flue-cured tobaccos that are used in accordance with the present invention possess relatively low levels of sugar esters, and normally are virtually absent of sugar esters.

The type of Maryland tobacco can vary. Descriptions of Maryland tobaccos, growing practices, harvesting practices and curing practices are set forth in *Tobacco Encyclopedia*, Voges (Ed.) (1984), Aycock et al., Maryland Coop. Ext. (1984), Aycock et al., Maryland Coop. Ext. (1995), and *Tobacco Production, Chemistry and Technology*, Davis et al. (Eds.) (1999). Representative Maryland tobaccos include Md 10, Md 40, Md 201, Md 609, Md 872 and Md 341. Preferred Maryland tobaccos are air cured, and often are referred to as light air cured tobaccos. Preferred air cured Maryland tobaccos are aged for at least one year after curing is complete. Preferred cured and aged Maryland tobaccos that are used in accordance with the present

invention possess relatively low levels of sugar esters, and normally are virtually absent of sugar esters.

The physical form of the tobacco materials used in the invention can vary. Most preferably, the tobaccos are those that have been appropriately cured and aged.

5 Most preferably, the tobaccos are used in forms, and in manners, that are traditional for the blending of tobaccos for use as cut filler for the manufacture of smoking articles, such as cigarettes. The tobacco can be used in whole leaf form. Typically, Oriental-type tobaccos are used in whole leaf form. The tobacco also can be used in the form of laminae or strip, particularly when the tobacco is of a flue-cured, burley or

10 Maryland variety. The tobacco also can have a shredded or cut filler form. Portions of the tobacco can have a processed form, such as processed tobacco stems (e.g., cut-rolled or cut-puffed stems), volume expanded tobacco (e.g., puffed tobacco, such as dry ice expanded tobacco (DIET), preferably in cut filler form), or reconstituted tobacco (e.g., reconstituted tobaccos manufactured using paper-making type or cast

15 sheet type processes, preferably in strip or cut filler form). Though less preferred, Oriental-type tobaccos also can be combined with tobacco waste materials, such as fines, dust, scrap and stem.

The tobacco materials used in carrying out the process steps of the present invention are contacted with one another. The manner of contact can vary, and

20 typically is such that moist tobacco tobaccos can be subjected to contact with one another in the presence of heat, or tobaccos can be subjected to contact with one another in the presence of heat and moisture. Typically, the tobacco materials are blended or mixed in equipment and methods known in the art of tobacco processing and blending, so as to provide a tobacco mixture. For example, the tobacco materials

25 can be mixed in ovens, heated tanks or cylinders, bulkers, rotary dryers, tunnel dryers, fluidized bed dryers, belt or apron dryers, suspension dryers, and the like. Those types of equipment traditionally have been used for the casing, conditioning, reordering, bulking and drying of tobaccos during the preparation of those tobaccos for use in the formulation of tobacco blends for cigarette manufacture. Most

30 preferably, those types of equipment provide convection heating of the tobacco material. See, for example, US Pat. Nos. 3,345,992 to Lederman et al.; 3,357,436 to Wright; 3,386,448 to Wochnowski; 3,429,317 to Koch et al.; 4,640,299 to Ono et al.; 4,887,619 to Burcham et al.; 5,022,416 to Watson; 5,103,842 to Strang et al.;

5,117,844 to Spicer; and 5,383,479 to Winterson et al. Exemplary dryers designed for use in processing tobacco materials within the tobacco industry are commercially available from Hauni and Sargent. Tobaccos also can be contacted in streams of heated steam and air, for example, using the types of methods and equipment set forth in US Pat. Nos. 4,298,012 to Wochnowski; 4,340,073 to de la Burde et al.; 5,259,403 to Guy et al.; and 5,908,032 to Poindexter et al. The method of blending preferably brings the two or more dissimilar types of tobacco materials into intimate contact. Preferably, the blending method provides a somewhat uniform physical mixing or blending of the components into a relatively homogenous physical blend. During contact with one another, the various types of tobacco materials can be subjected to movement, allowed to remain in a somewhat stationary state, subjected to some physical compression or compaction, or subjected to some combination of the foregoing.

Although the relative amounts of each tobacco type may vary, it is preferable for the blend to include at least about 10 percent, more preferably at least about 20 percent, Oriental tobacco, by weight of that blend. The amount of Oriental tobacco present in the tobacco mixture can depend upon factors such as the desired final sucrose ester concentration of the tobacco mixture after heat treatment, the sucrose ester concentration of the untreated Oriental tobacco, the type of other tobacco materials in the blend, and the desired heat treatment conditions (e.g., temperature to which the tobacco blend is exposed, moisture level of the mixture, and treatment time of the blend). Thus, for example, a tobacco blend possessing an Oriental tobacco having a very high sugar ester content (i.e., a sugar ester content in the general range of about 6,000 ppm to about 7,000 ppm, based on the dry weight of that Oriental tobacco) typically possesses a relatively low amount of that type of Oriental tobacco. The other components of the blend typically comprise at least about 60 percent of the weight of that blend. In some embodiments, two or more suitable Oriental tobacco components comprise substantially all of the tobacco blend. However, for blends of at least one type of Oriental tobacco with at least one other dissimilar type of tobacco, the Oriental tobacco component of the blend of ranges from about 10 percent to about 90 percent, and preferably ranges from about 10 percent to about 30 percent, by weight of that blend; while the dissimilar tobacco component of that blend ranges

from about 10 percent to about 90 percent, and preferably ranges from about 70 percent to about 90 percent, by weight of that blend.

It is preferable for the tobacco mixture to comprise flue-cured tobacco, burley tobacco, or a combination thereof. In one preferred embodiment, both flue-cured tobacco and burley tobacco are blended with the Oriental tobacco. In such an embodiment, the resulting tobacco mixture preferably comprises about 5 percent to about 75 percent, more preferably about 35 percent to about 50 percent, by weight of flue-cured tobacco; about 5 percent to about 75 percent, more preferably about 10 percent to about 50 percent, by weight of burley tobacco; and about 5 percent to about 40 percent, more preferably about 10 percent to about 30 percent, by weight of Oriental tobacco.

The present invention involves contacting an Oriental tobacco material with a second dissimilar Oriental tobacco material or a non-Oriental tobacco material to form a physical mixture of those tobacco types, and heating the resulting tobacco mixture for a time and under conditions sufficient to reduce the concentration of sucrose esters in the Oriental tobacco (and hence, overall within that mixture or blend of tobaccos). As such, the concentration of sugar esters naturally present within the Oriental tobacco can be decreased by more about 20 percent, and even by more than about 30 percent, by weight, based on the initial sugar ester content of that Oriental tobacco so treated. Typically, the process of the present invention can be employed to reduce the sugar ester content or concentration of the Oriental tobacco so treated to below about 1,500 ppm, and often below about 1,200 ppm, based on the dry weight of that Oriental tobacco material.

Although high levels of sucrose esters are known to cause unpleasant flavors in tobacco smoke at undesirably high levels, it is desirable to maintain the sucrose levels at a certain minimum level in order to prevent disruption of the distinctive overall aroma and flavor of Oriental tobacco. That is, the present invention can be employed to lower the natural sucrose ester concentration of a tobacco blend without totally eliminating the presence of sucrose esters within that blend. Typically, certain Oriental tobaccos that are processed in accordance with the present invention exhibit final sucrose ester levels, after treatment, of at least about 100 ppm, usually at least about 400 ppm, and often at least about 600 ppm; and frequently, the final sucrose ester levels in those tobaccos can range from about 1,000 ppm to about 1,500 ppm.

The process of the present invention also can provide some reduction in the concentration of certain terpenes within the Oriental tobacco; and as such, certain Oriental tobaccos treated in appropriate manners can experience a reduction in the levels of megastigmatrienones, solanone, duvantriendiols and sclareolide within those tobaccos.

The mixture of tobacco that is heat-treated is moist. The tobacco blend or mixture typically possesses a moisture content, prior to treatment in accordance with the present invention, of at least about 15 percent, usually at least about 20 percent, and often at least about 25 percent, based on the total weight of the tobacco mixture.

The tobacco blend or mixture typically possesses a moisture content, prior to treatment in accordance with the present invention, of up to about 50 weight percent, usually up to about 45 weight percent, and often up to about 40 weight percent. The tobacco blend or mixture often possesses a moisture content, prior to treatment in accordance with the present invention, of between about 30 weight percent and about 35 weight percent.

The method for achieving the desired moisture content in the various tobacco materials used in carrying out the present invention can vary. For example, an aqueous liquid, such as water, can be sprayed on, and subsequently absorbed by the tobacco materials. Alternatively, the tobacco materials can also be dipped into the liquid to absorb the desired amount of moisture. The moisture content can also be reached by spreading onto the tobacco materials casing solution or top dressing solution, or other liquids such as buffers, solvents, or solutions containing materials extraneous to natural tobacco materials. Manners and methods for moistening tobacco materials and blends of tobacco materials will be readily apparent to those skilled in the art of tobacco processing.

The various blend components can be moistened individually prior to blending, and/or the blend can be moistened. That is, blends of tobacco materials of desired moisture contents can be achieved by adjusting the moisture levels of each tobacco material prior to mixing and/or by modifying the moisture level after the tobacco components are contacted with one another. In one embodiment, each tobacco component of the ultimate tobacco mixture can have a different moisture content within a range of about 15 percent to about 50 percent by weight, such that the tobacco blend can have a final moisture level within the desired moisture range.

That is, one tobacco component can have a relatively low moisture level prior to mixing, and another can have a relatively high moisture level prior to mixing. Blending of the two tobaccos would be expected to form a blend having an intermediate moisture level.

5 If desired, in addition to the aforementioned tobacco materials, the tobacco blend of the present invention can further include other components. However, no additional reagents or additives are required to reduce the sugar ester concentration of the tobacco blends incorporating Oriental tobaccos otherwise having relatively high natural sugar ester contents. Other components include casing materials (e.g., sugars,
10 glycerine, cocoa and licorice) and top dressing materials (e.g., flavoring materials, such as menthol). The selection of particular casing and top dressing components is dependent upon factors such as the sensory characteristics that are desired, and the selection of those components will be readily apparent to those skilled in the art of cigarette design and manufacture. See, Gutcho, *Tobacco Flavoring Substances and*
15 *Methods*, Noyes Data Corp. (1972) and Leffingwell et al., *Tobacco Flavoring for Smoking Products* (1972).

 Following the blending step and any necessary moisture adjustment steps, the tobacco blend is preferably allowed to stay in intimate contact for a period of time in order to equilibrate prior to heating. The actual time will vary, but is preferably
20 between about 5 minutes to about 24 hours. Typically, the tobacco blend is allowed to stand for about 5 to about 30 minutes.

 The tobaccos that have been contacted are exposed to heat. The tobacco mixture should be heated at a temperature sufficiently high to reduce the sucrose ester content, but low enough to avoid the formation of components that are deleterious to
25 the taste characteristics of the tobacco composition. The temperature of the heat treatment is generally at least about 200°F. A preferred range is about 200°F to about 310°F, more preferably about 200°F to about 250°F. Although it is possible to expose the tobacco materials to heated gases or atmospheres of high temperatures (e.g., temperatures in excess of 400°F), it is desirable that such exposure be carried out for a
30 relatively short period of time, in order that the tobacco material itself not be exposed to temperatures much in excess of about 300°F for any appreciable period of time.

 The amount of time that the tobacco blend is subjected to the temperature treatment can vary. The time period should be sufficient to reduce the sucrose ester

levels of the Oriental tobacco to the desired level. Typically, the heat treatment period is at least about 10 minutes, preferably at least about 20 minutes. Normally, the time period is less than about 3 hours, preferably less than about 1 hour. In a preferred embodiment, the heat treatment time period is about 20 minutes to about 1
5 hour.

One method for gauging the appropriate heat treatment time period of a tobacco blend involves measurement of the moisture level of the heat-treated tobacco blend. For example, it is preferable for the tobacco blend to maintain a moisture level of at least about 10 percent by weight throughout the heating process. A final
10 moisture content following heat treatment of about 10 percent to about 20 percent, by weight, is particularly desirable.

The heat treatment preferably occurs at atmospheric pressure using, for example, a vented tank or dryer. It is most convenient and preferable for the process steps to be carried out without taking special care to control the pressure of the
15 atmosphere that surrounds the tobacco material (i.e., the process steps can be carried out under normal atmospheric pressure conditions), and without taking special steps to control the make up of the atmosphere that surrounds the tobacco (i.e., the process steps can be carried out in normal atmospheric air). However, a pressure-controlled environment can be used without departing from the invention. Such an environment
20 is provided, for example, by enclosing the tobacco blend in an air-sealed vessel or chamber. Typically, a pressure-controlled environment is provided using a pressure vessel or chamber capable of withstanding relatively high pressures. Preferred pressure vessels are equipped with an external heating source. Examples of vessels that provide a pressure-controlled environment include a high pressure autoclave from
25 Berghof/America Inc. of Concord, California, and Parr Reactor Model Nos. 4522 and 4552 available from The Parr Instrument Co. and described in U.S. Pat. No. 4,882,128 to Hukvari et al. Operation of such exemplary vessels will be apparent to the skilled artisan. See, for example, US Pat. No. 6,048,404 to White. Typical atmospheric pressures experienced by the tobacco blend during such a pressure-controlled heating
30 process conducted in such vessels often range from about 10 psig to about 1,000 psig, normally from about 20 psig to about 500 psig.

Atmospheric air, or ambient atmosphere, is the preferred atmosphere for carrying out the present invention. However, heating moistened tobacco mixtures

also can be performed under a controlled atmosphere, such as a generally inert atmosphere. The term "generally inert" is intended to mean that the heat treatment can be performed in an inert gas or under ambient atmosphere. With heat treatment in ambient air, no additional oxygen or equivalent oxidizing agent is necessary. With an
5 inert atmosphere, an atmosphere that is inert, i.e., non-reactive, with respect to the tobacco materials in the blend is employed. Gases such as nitrogen, argon and carbon dioxide can be used. Alternatively, a hydrocarbon gas (e.g., methane, ethane or butane) or a fluorocarbon gas also can provide at least a portion of a controlled atmosphere in certain embodiments, depending on the choice of treatment conditions
10 and tobacco materials.

Tobacco materials processed according to the process steps of the present invention can be used for the manufacture of tobacco products, and most preferably, smoking articles, such as cigarettes. If desired, the treated tobacco blend can be subjected to a reordering treatment to increase the moisture content prior to use in
15 smoking article manufacturing. The amount of the treated tobacco employed per smoking article can vary, and for cigarette typically possesses about 0.6 g to about 1 g per rod of smoking material. Representative tobacco blends, representative cigarette components, and representative cigarettes manufactured therefrom, are set forth in US Pat. Nos. 4,836,224 to Lawson et al.; 4,924,888 to Perfetti et al.; 5,056,537 to Brown
20 et al.; 5,220,930 to Gentry; and 5,360,023 to Blakley et al.; US Pat. Application 2002/0000235 to Shafer et al.; and PCT WO 02/37990. Those tobacco materials also can be employed for the manufacture of those types of cigarettes that are described in US Pat. Nos. 4,793,365 to Sensabaugh; 4,917,128 to Clearman et al.; 4,947,974 to Brooks et al.; 4,961,438 to Korte; 4,920,990 to Lawrence et al.; 5,033,483 to
25 Clearman et al.; 5,074,321 to Gentry et al.; 5,105,835 to Drewett et al.; 5,178,167 to Riggs et al.; 5,183,062 to Clearman et al.; 5,211,684 to Shannon et al.; 5,247,949 to Deevi et al.; 5,551,451 to Riggs et al.; 5,285,798 to Banerjee et al.; 5,593,792 to Farrier et al.; 5,595,577 to Bensalem et al.; 5,816,263 to Counts et al.; 5,819,751 to Barnes et al.; 6,095,153 to Beven et al.; 6,311,694 to Nichols et al.; and 6,367,481 to
30 Nichols, et al.; and PCT WO 97/48294 and PCT WO 98/16125. See, also, those types of commercially marketed cigarettes described *Chemical and Biological Studies on New Cigarette Prototypes that Heat Instead of Burn Tobacco*, R. J. Reynolds Tobacco Company Monograph (1988) and *Inhalation Toxicology*, 12:5, p. 1-58 (2000).

The present invention, in another aspect, relates to a method of measuring the sucrose ester level or concentration of a tobacco material, whereby a transesterification mechanism is used to transform the sucrose esters within the tobacco material to known methyl esters. The method involves the steps of extracting the sucrose esters from the tobacco material by contacting the tobacco with a suitable extraction solvent to yield a tobacco extract, transesterifying the sucrose esters from within the tobacco extract to form known corresponding methyl esters, determining (e.g., measuring) the amount of the methyl esters extracted from the tobacco material using the extraction solvent, and determining the concentration of sucrose esters based on the concentration of the methyl esters resulting from the transesterification of the sucrose ester precursor. The transesterification can be accomplished by mixing the tobacco extract with a strong base, such as a methoxide salt (e.g., sodium methoxide). Gas chromatography/selected ion monitoring-mass spectrometry is a preferred method for determining the amount or concentration of methyl ester expressed as a yield per unit mass of tobacco. Determination of methyl ester is carried out by generating a methyl ester concentration calibration curve generated using calibration standards of the known methyl esters at known concentrations.

The fundamental chemistry underlying the analysis method of the invention is based on a strong base mediated transesterification reaction mechanism. Specifically, this conversion relates to the sodium methoxide (i.e., strong base) mediated transesterification of the isobutyrate, 3-methylbutyrate, and 3-methylpentanoate groups known to be covalently bonded to sucrose in Oriental tobacco to their corresponding methyl esters, yielding respectfully, methylisobutyrate, methyl-3-methylbutyrate, and methyl-3-methylpentanoate. In order to quantify the methyl ester concentration of the transesterified tobacco extract, linear calibration curves for the three known methyl esters (i.e., methylisobutyrate, methyl-3-methylbutyrate and methyl-3-methylpentanoate) can be generated using quantitatively prepared calibration standards over a wide concentration range. Thus, the general method of analyzing the sucrose ester content of a tobacco involves forming a tobacco extract using an extraction solvent in which sucrose esters are soluble. A preferred solvent is methylene chloride. To obtain consistent results, it is preferable to mix the tobacco sample and the extraction solvent, agitate the mixture, allow the mixture to stand for a significant period of time (e.g., overnight), and then agitate the mixture again. The

extraction mixture preferably then is filtered, and a strong base, such as sodium methoxide or other methoxide salt (e.g., alkali metal or alkaline earth metal salt), is added to the filtrate. The sodium methoxide undergoes reaction with the sucrose esters in the tobacco extract, resulting in transesterification of the carboxylate groups of the sucrose esters to form corresponding methyl esters. Since the resulting methyl ester compounds are known and commercially available, calibration curves can be formed using calibration standards and the concentration of each methyl ester can be calculated using the responses obtained from gas chromatography/selected ion monitoring-mass spectrometry (GC/SIM-MS).

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EXPERIMENTAL

The following examples are given to illustrate the invention, but should not be considered in limitation of the invention. As indicated by these experimental results, significant changes in the chemistry of Oriental tobaccos and blends containing Oriental tobaccos have been demonstrated to occur when the tobaccos are processed under relatively mild conditions with the use of water and heat. For example, the sucrose ester content (expressed as their methyl ester equivalents) of the Oriental tobaccos adjusted to approximately 35% moisture was reduced by a factor of 2 by heating the tobacco for 1 hour at 200°F in a SARGENT Tray Dryer. Sensory evaluations of the smoke of cigarettes manufactured from those blends indicated significant shifts in sensory attributes of these processed tobaccos when compared to the smoke of cigarettes manufactured from the unprocessed counterparts. Thus, changes in the nature of the Oriental tobaccos have been shown to alter the sensory characteristics of cigarettes prepared with the tobaccos processed according to the invention.

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Comparative Examples 1-20 illustrate that heating moist Oriental tobaccos alone, without blending the Oriental tobacco with a dissimilar Oriental tobacco or a non-Oriental tobacco, does not result in significant decreases in sucrose ester content. Examples 1-8 illustrate that significant decreases in sucrose ester content result from heating moist tobacco blends comprising an Oriental tobacco and one or more dissimilar Oriental tobaccos or non-Oriental tobaccos. Unless otherwise noted, all parts and percentages are by weight.

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Comparative Example 1

An Oriental tobacco, Mavra, was adjusted to 35% moisture and heated at 200°F in a convection dryer for about 60 minutes. Following treatment, the sucrose ester level, determined as methyl ester equivalents, was 234 ppm. The methyl ester
5 level of the untreated Oriental tobacco (i.e., control) was 278 ppm.

Comparative Example 2

The same as Example 1, except the heat treatment time was about 45 minutes. The methyl ester level of the treated tobacco was 278 ppm.

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Comparative Example 3

The same as Example 1, except the heat treatment time was about 30 minutes. The methyl ester level of the treated tobacco was 271 ppm.

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Comparative Example 4

The same as Example 1, except the heat treatment time was about 15 minutes. The methyl ester level of the treated tobacco was 266 ppm.

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Comparative Example 5

The same as Example 1, except the heat treatment temperature was 250°F. The methyl ester level of the treated tobacco was 230 ppm.

Comparative Example 6

The same as Example 5, except the heat treatment time was about 45 minutes.
25 The methyl ester level of the treated tobacco was 260 ppm.

Comparative Example 7

The same as Example 5, except the heat treatment time was about 30 minutes.
30 The methyl ester level of the treated tobacco was 261 ppm.

Comparative Example 8

The same as Example 5, except the heat treatment time was about 15 minutes. The methyl ester level of the treated tobacco was 289 ppm.

Comparative Example 9

The same as Example 1, except the Oriental tobacco was Izmir. The methyl ester level of the untreated Oriental tobacco (i.e., control) was 2930 ppm. The methyl ester level of the treated tobacco was 2537 ppm.

Comparative Example 10

The same as Example 9, except the heat treatment time was about 45 minutes. The methyl ester level of the treated tobacco was 2732 ppm.

Comparative Example 11

The same as Example 9, except the heat treatment time was about 30 minutes. The methyl ester level of the treated tobacco was 2888 ppm.

Comparative Example 12

The same as Example 9, except the heat treatment time was about 15 minutes. The methyl ester level of the treated tobacco was 2928 ppm.

Comparative Example 13

The same as Example 9, except the heat treatment temperature was 250°F. The methyl ester level of the treated tobacco was 3073 ppm.

Comparative Example 14

The same as Example 13, except the heat treatment time was about 45 minutes. The methyl ester level of the treated tobacco was 2755 ppm.

Comparative Example 15

The same as Example 13, except the heat treatment time was about 30 minutes. The methyl ester level of the treated tobacco was 2973 ppm.

Comparative Example 16

The same as Example 13, except the heat treatment time was about 15 minutes. The methyl ester level of the treated tobacco was 3499 ppm.

Comparative Example 17

The same as Example 1, except the moisture level was adjusted to 16%. The methyl ester level of the treated tobacco was 246 ppm.

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Comparative Example 18

The same as Example 17, except the heat treatment temperature was 250°F. The methyl ester level of the treated tobacco was 264 ppm.

Comparative Example 19

10 The same as Example 9, except the moisture level was adjusted to 16%. The methyl ester level of the treated tobacco was 2603 ppm.

Comparative Example 20

The same as Example 19, except the heat treatment temperature was 250°F.
15 The methyl ester level of the treated tobacco was 3115 ppm.

Example 1

A tobacco blend was formed comprising about 50 % flue-cured tobacco at 50% moisture, about 27 % burley tobacco at 16.5% moisture, and about 23 %
20 Oriental tobacco at 14.5% moisture. The blend was adjusted to about 35% moisture and heated at 310°F in a convection dryer for 5 minutes. Following treatment, the methyl ester level was 750 ppm. The methyl ester level of the untreated tobacco blend (i.e., control) was 1350 ppm. Thus, a blend of non-Oriental tobaccos and an Oriental tobacco having a relatively high sucrose ester content that is subjected to heat
25 treatment at an elevated moisture level for an effective period of time in accordance with the present invention undergoes a significant decrease in sucrose ester content.

Example 2

The same as Example 1, except the entire blend was adjusted to 35% moisture
30 at one time. The methyl ester level of the treated tobacco was 750 ppm.

Example 3

The same as Example 1, except the heat treatment temperature was 200°F and the treatment time was about 20 minutes. The methyl ester level of the treated tobacco was 500 ppm.

Example 4

The same as Example 3, except the treatment time was about 60 minutes. The methyl ester level of the treated tobacco was 475 ppm.

Example 5

An Oriental tobacco blend was formed comprising about 50 % Izmir at 16% moisture and about 50 % Samsun at 50% moisture. The blend was aged for 24 hours and then heated at 200°F in a convection dryer for about 60 minutes. Following treatment, the methyl ester level was 3100 ppm. The methyl ester level of the untreated tobacco blend (i.e., control) was 4700 ppm.

Example 6

The same as Example 5, except the Izmir moisture level was 50% and the Samsun moisture level was 16%. The methyl ester level of the treated tobacco was 3100 ppm.

Example 7

The same as Example 5, except the tobacco blend comprised about 50 % Samsun at 50% moisture and about 50 % flue-cured tobacco at 16% moisture. Following treatment, the methyl ester level was 950 ppm. The methyl ester level of the untreated tobacco blend (i.e., control) was 3200 ppm.

Example 8

The same as Example 7, except the moisture level of the Samsun was 16% and the moisture level of the flue-cured was 50%. The methyl ester level of the treated tobacco was 1600 ppm.

Many modifications and other embodiments of the invention will come to mind to one skilled in the art to which this invention pertains having the benefit of the teachings presented in the foregoing description. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that

5 modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

WHAT IS CLAIMED:

1. A method of altering the characteristics of the smoke generated by a tobacco mixture incorporating Oriental tobacco, the method comprising:
 - 5 contacting a first Oriental tobacco material with a second dissimilar Oriental tobacco material or a non-Oriental tobacco material to form a tobacco mixture; and
 - heating the tobacco mixture for a time and under conditions sufficient to reduce the concentration of sucrose esters in the tobacco mixture.
- 10 2. A method according to Claim 1, wherein the tobacco mixture comprises flue-cured tobacco, burley tobacco, or a mixture thereof.
3. A method according to Claim 1, wherein, prior to heating, the first Oriental tobacco has a sucrose ester concentration of at least about 1,600 ppm.
- 15 4. A method according to Claim 1, wherein, prior to heating, the first Oriental tobacco has a sucrose ester concentration of at least about 2,000 ppm.
5. A method according to Claim 1, wherein, prior to heating, the first Oriental tobacco has a sucrose ester concentration of at least about 3,000 ppm.
- 20 6. A method according to Claim 1, wherein, following heating, the first Oriental tobacco has a sucrose ester concentration below about 1,500 ppm.
7. A method according to Claim 1, wherein, following heating, the first Oriental tobacco has a sucrose ester concentration below about 1,200 ppm.
- 25 8. A method according to Claim 1, whereby the heating provides sucrose esters reduction in the first Oriental tobacco by at least about 20% by weight.
- 30 9. A method according to Claim 1, whereby the heating provides sucrose esters reduction in the first Oriental tobacco by at least about 30% by weight.

10. A method according to Claim 1, wherein the heating involves applying heat to raise the tobacco mixture to a temperature of about 200°F to about 310°F.
11. A method according to Claim 1, wherein the heating involves applying
5 heat to raise the tobacco mixture to a temperature of about 200 to about 250°F.
12. A method according to Claim 1, wherein the heating is conducted in atmospheric air and under atmospheric pressure.
- 10 13. A method according to Claim 1, wherein the heating involves applying heat to the tobacco mixture for at least about 10 minutes.
14. A method according to Claim 1, wherein the heating involves applying heat to the tobacco mixture for about 10 minutes to about 1 hour.
- 15 15. A method according to Claim 1, wherein the heating involves applying heat to the tobacco mixture until the moisture content of the tobacco mixture is reduced to between about 10% and about 20% by weight.
- 20 16. A method according to Claim 1, wherein the tobacco mixture comprises at least about 10% Oriental tobacco, based on the total weight of tobacco in the mixture.
17. A method according to Claim 1, wherein the tobacco mixture comprises about 10% to about 30% Oriental tobacco, based on the total weight of tobacco in the
25 mixture.
18. A method according to Claim 1, wherein, prior to heating, the tobacco mixture has a moisture content of at least about 15% by weight.
- 30 19. A method according to Claim 1, wherein, prior to heating, the tobacco mixture has a moisture content of at least about 20% by weight.

20. A method according to Claim 1, wherein, prior to heating, the tobacco mixture has a moisture content of about 15% to about 50% by weight.

21. A method according to Claim 1, wherein each tobacco component of the tobacco mixture have a moisture content of about 15% to about 50% by weight prior to contact with one another.

22. A method of altering the characteristics of the smoke generated by a tobacco mixture incorporating Oriental tobacco, the method comprising:
10 forming a tobacco mixture having a moisture content of at least about 20% by weight by contacting (i) at least one Oriental tobacco material and (ii) flue-cured tobacco, burley tobacco, or a combination thereof; and
heating the tobacco mixture at a temperature of at least about 200°F for a time sufficient to reduce the concentration of sucrose esters in the Oriental tobacco to
15 below about 1,500 ppm.

23. A method according to Claim 22, wherein the heating comprises heating the tobacco mixture for at least about 10 minutes.

20 24. A method according to Claim 22, wherein, prior to heating, the Oriental tobacco has a sucrose ester concentration of at least about 3,000 ppm.

25 25. A method according to Claim 22, wherein, prior to heating, the Oriental tobacco has a sucrose ester concentration of at least about 4,000 ppm.

26. A method of altering the characteristics of the smoke generated by a tobacco mixture incorporating Oriental tobacco, the method comprising:
contacting an Oriental tobacco material having a sucrose ester concentration of at least about 2,000 ppm with flue-cured tobacco, burley tobacco, or a combination thereof, to form a tobacco mixture having a moisture content of at least about 20
30 percent by weight, wherein the tobacco mixture comprises at least about 10 percent by weight Oriental tobacco; and

heating the tobacco mixture at a temperature of about 200°F to about 310°F for at least about 10 minutes in order to reduce the concentration of sucrose esters in the Oriental tobacco by at least about 20 percent by weight.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/33394

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 A24B15/00

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)

IPC 7 A24B

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 practical, search terms used)

EPO-Internal, WPI Data, FSTA, PAJ, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 821 886 A (REYNOLDS TOBACCO CO R) 4 February 1998 (1998-02-04) example 4	1,2,12, 16,17
Y	----	13,14
Y	US 4 638 816 A (COX RICHARD H ET AL) 27 January 1987 (1987-01-27) column 1, line 14 - line 16 column 5, line 16 - line 22	13,14
A	---- US 4 091 823 A (KALLIANOS ANDREW GEORGE ET AL) 30 May 1978 (1978-05-30) column 1, line 13 - line 32 -----	1



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
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- *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
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- *G* document member of the same patent family

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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			JP 10066559 A	10-03-1998
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US 4091823	A	30-05-1978	NONE	

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審査請求 未請求 発明の数 1 (全3頁)

⑭ 発明の名称 嗜好品を加熱気化させて吸喫する方法とその吸喫器具

⑯ 特 願 昭61-120366

⑰ 出 願 昭61(1986)5月26日

⑱ 発 明 者 渡 部 勇 所沢市元町3-18

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明 細 書

1. 発明の名称 嗜好品を加熱気化させて吸喫する方法と、その吸喫器具

2. 特許請求の範囲

(1) 適宜形状の中空容器の一端に発熱装置を設け、所要の箇所に吸入管を設けた吸喫器具により、嗜好品を加熱気化させて吸喫する方法。

(2) イ、適宜形状の中空容器の一端に発熱装置を設ける。

ロ、中空容器の所要の箇所に吸入管を設ける。

以上イ、ロ項の構造からなる吸喫器具。

3. 発明の詳細な説明

この発明は、嗜好品を温熱により加熱気化させて吸喫する方法、及びその器具に関するものである。

従来タバコは、喫ぐ、噛む、喫む嗜好品として広く普及したが、そのなかでも、燃やすことで成分を煙の粒子のかたちで喫い、味、香等の感覚的な喜びを得るやり方が広く普及した。しかし燃やして喫う方法は、嗜好品の成分は別としても、煙を体内に吸い込むこと自体が健康上大いに問題ありとされている。また、本人以外の第三者にも副流煙を吸い込ませ、目や鼻を刺激し、タバコの嫌いな人の反感を買い、同様に有害であるということ、批判をあびるようになった。また、燃やした吸いがらによる火事の被害も欠きなかった。こうした欠陥により、社会的には嫌煙権として、タバコ自体を拒否することになり、その嗜好品としての正当な側面をも否定する動きが生まれるようになった。その結果、喫煙習慣をもつ者は大いに困惑しつつある。

タバコに限らず、燃焼させて喫煙するものは、同じような欠陥をもっている。

本発明は、こうした欠陥を解決するためになされたもので、嗜好品を吸喫するための方法、及び

それを達成するために使用する器具である。

まず第一の方法とは、温熱によつて気化する嗜好品を、中空容器の一端に設けた発熱装置によつて加熱気化させ、その成分を吸喫する、嗜好品の吸喫方法に関するものである。

この方法は、特に口腔より吸喫し、口候粘膜及び気管支粘膜の刺激を通じて、神経の安定や、気分の高揚感を満たす為に吸喫する嗜好品について、従来のタバコなどのように燃焼させたり、芳香剤のように空气中に散散した分子を特別な器具を用いることなく鼻喉より吸喫するのではなく、適宜形状の中空容器の一端に発熱装置を設け、所要の箇所吸入管をもうけた吸喫器具により、嗜好品を加熱気化させて口腔より吸喫する方法である。

この方法を用いると、従来、上記燃焼等の方法で吸喫していたタバコ等の嗜好品の先に述べた欠陥が補われるだけでなく、従来にはない新たなジャンルの、口腔より吸喫する嗜好品群が生まれ、社会生活を豊かにする。その効果についての詳細は、第二項の器具に関する説明の後に述べる。

ける。

(1) 中空容器(1)の一端に吸入管(3)を設ける。

本器具は以上のような構造であるから、これを使用するときは、中空容器(1)内の発熱板(2)の上に嗜好品をのせ、カートリッジ収納カアセル(4)の開ロ部(5)を自在に開閉する弁(6)の操作レバー(7)を操作すると、開ロ部(5)が開き、カートリッジ(4)内の燃料用アルコールが常温、常圧に接して気化が行われる。その結果、気化したアルコール成分が、開ロ部(5)の上方に位置する、白金触媒を塗布したセラミック板(8)に接し、化学反応により発熱し、それに近接するアルミ板(9)を加熱する。その熱により嗜好品が加熱され、嗜好すべき成分が気化する。吸喫者は、その成分の粒子を吸入管(3)より口腔を通じて吸入し楽しむのである。

本発明の方法、および器具を用いることにより、吸喫者は次に述べるような効果を得ることができる。つまり、本器具の使用により、嗜好品は燃焼にともなう煙などの燃焼生成物を体内に吸入することなく、気化した粒子の形でその嗜好すべき成

分は、第二項の器具についで述べると、これは、適宜形状の中空容器の一端に発熱装置を設け、所要の箇所に吸入管を設けた、嗜好品の吸喫器具に関するものである。

その実施例を図面について説明すると、第1図に示すように

(1) 中空容器(1)の一端に化学触媒の発熱装置(2)を設ける。この発熱装置(2)は、従来公知の構造で、燃料用アルコールを充填した燃料用アルコールカートリッジ(4)を収納するカートリッジ収納カアセル(4)を設ける。そのカートリッジ収納カアセル(4)の上部に開口部(5)を設け、開口部(5)を自在に開閉する弁(6)を設け、その弁(6)を操作する操作レバー(7)を設ける。開口部(5)の上方に、表面に白金触媒を付着させたハニカム構造に成型したセラミック板(8)を設け、その上方に近接してアルミ板(9)を設けたものである。

この発熱装置(2)を中空容器(1)の内空に設け、弁(6)の操作レバー(7)は中空容器(1)の外部に設

け、吸入管(3)が口腔から吸入され、吸喫者の舌や口候、気管支等の粘膜を刺激し、吸喫による神経の安定や高揚など、所期の効果を得ることができ

る。しかも燃焼させて吸喫した場合にひき起こされる、燃焼ガスによる大気の汚染問題、本人が吸い込む主流煙の数倍の燃焼生成物、一酸化炭素、窒素化合物、アンモニアなどが含まれるとされる副流煙によりオミヤの目や鼻を刺激し有害な影響を与えることとされる問題も解決する。

また、嗜好品に水分が含まれる場合は、気化粒子による湯気が、煙と同様の夜覚的楽しみを与える。また、本器具の形状、デザイン等に工夫をこらすことで、従来のタバコを喫うパイアのもつ感融や、喫うスタイルの楽しみを味わうことができる。

こうして煙を出さず本発明の方法で喫うことにより、嗜好品としてのタバコの長い面を存在させることができ、とりわけ煙を嫌うということと広がりた煙煙運動の主原因を除くことができる。また、火のついた吸いがらを捨てたり忘れること

による火事の原因をなくすことができる。

また、本発明の方法及び器具を用いて嗜好品を楽しむやり方は、従来にみられなかった新たなジャンルの嗜好品群を生み出す。つまり、この器具を用いて吸喫する嗜好品は、温熱により成分が気化するようにつくられたものであれば、タバコだけでなく、レモン芳香、樹木芳香などいろいろなヴァリエーションを楽しむことができるのである。従つて、本発明により新たなジャンルの嗜好品が生み出され、社会生活を豊かにする。

なお、本発明の発熱装置の熱源としては、上記の実施例で述べた化学触媒発熱以外の化学発熱装置、発光ライター、電気発熱体など適宜なものを選定し、使用するの自由である。

なお、本発明において、中空容器(1)の一端に設ける発熱装置(2)は、上記実施例のように、中空容器(1)と一体としたもののほか、中空容器(1)と発熱装置(2)の両者を分離して設けたもの、あるいは発熱装置(2)を吸喫しようとする嗜好品と一体のものとして設け、中空容器(1)に装填して吸喫する工夫

も自由である。

なお、本発明における中空容器(1)は、その材質は、金属、セラミック、木質、合成樹脂、あるいは紙巻タバコの紙のように紙質であれば、適宜選定して使用するの自由である。

4 図面の簡単な説明

第1図は本発明の器具の斜視図

第2図は本発明の器具の断面図

(1)は中空容器、

(2)は化学触媒発熱装置

(3)は燃料用アルコールカートリッジ

(4)はカートリッジ収納口アセル

(5)は開口部

(6)は弁、(6')は弁の操作レバー

(7)は白金触媒セラミック板

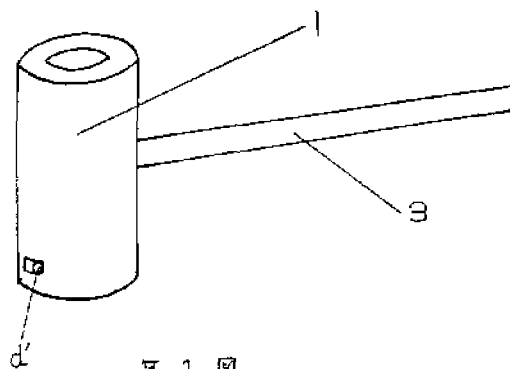
(8)はアルミ板

(9)は吸入管

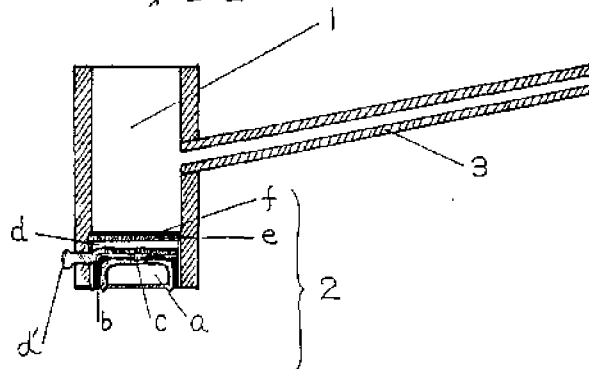
特許出願人 渡部 勇

図 面

第1図



第2図



JP Patent Application Publication No.62-278975 December 3, 1987

"Smoking process for vaporizing flavor and smoking article"

Abstract Translation

a flavoring material in a container (1), where an alcohol cartridge (a) and a ceramic plate (d) having platinum catalyst film are disposed to provide a heater(2), is heated to be vaporized

⑩ 日本国特許庁(JP)

⑪ 特許出願公開

⑫ 公開特許公報(A) 昭64-37276

⑬ Int. Cl.⁴ 識別記号 庁内整理番号 ⑭ 公開 昭和64年(1989)2月7日
A 24 F 47/00 8114-4B
// A 24 C 5/00 6807-4B
審査請求 未請求 請求項の数 74 (全 25 頁)

⑮ 発明の名称 喫煙物品のコンポーネントを組立てるための組立装置

⑯ 特 願 昭63-171082

⑰ 出 願 昭63(1988)7月11日

優先権主張 ⑱ 1987年7月17日 ⑲ 米国(U S) ⑳ 074811

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最終頁に続く

明 細 書

1. 発明の名称

喫煙物品のコンポーネント
を組立てるための組立装置

2. 特許請求の範囲

1) 喫煙物品のためのエアゾール発生モジュールを製造するための装置であって、

回転組立ドラムと、

該ドラムに取付けられており、各々、少なくとも1つのジャケットセグメントを受容し、保持するためのジャケット保持手段と、エアゾール発生カートリッジを受容し、保持するためのカートリッジ保持手段から成る複数の組立ステーションと、

該エアゾール発生カートリッジをジャケットセグメント内へ挿入するためのカートリッジ挿入手段、

とから成るエアゾール発生モジュール製造装置。

2) 前記複数の組立ステーションは、軸線方向に整列した対として配列されていることを特徴とする特許請求の範囲第1項記載のエアゾール発生モジュール製造装置。

3) 前記カートリッジ挿入手段は、前記各組立ステーションに設けられていることを特徴とする特許請求の範囲第1項又は2項記載のエアゾール発生モジュール製造装置。

4) 前記各組立ステーションは、各ジャケットセグメントの少なくとも一部分を貫通する長手方向の孔を形成するための孔形成手段を備えていることを特徴とする特許請求の範囲第1項又は2項記載のエアゾール発生モジュール製造装置。

5) 前記各組立ステーションは、ジャケットセグメント内から支持部材を吐出するための吐出手段を備えていることを特徴とする特許請求の範囲第4項記載のエアゾール発生モジュール製造装置。

6) 前記孔形成手段は、孔形成部材から成り、前記各組立ステーションは、エアゾール発生カー

トリッジをジャケットセグメント内へ挿入すると同時に併行的に該孔形成部材を各ジャケットセグメントから引抜くための手段を備えていることを特徴とする特許請求の範囲第4項記載のエアゾール発生モジュール製造装置。

7) 前記各組立ステーションは、ジャケットセグメント内から支持部材を吐出するための吐出手段を備えていることを特徴とする特許請求の範囲第6項記載のエアゾール発生モジュール製造装置。

8) エアゾール発生カートリッジをジャケットセグメント内へ挿入すると同時に併行的に該孔形成部材を各ジャケットセグメントから引抜くための前記手段は、支持部材を吐出するための前記吐出手段を含むものであることを特徴とする特許請求の範囲第7項記載のエアゾール発生モジュール製造装置。

9) 前記各組立ステーションは、ジャケットセグメント内から支持部材を吐出するための吐出手段を備えていることを特徴とする特許請求の範囲

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記載のエアゾール発生モジュール製造装置。

13) 前記カートリッジ挿入手段は、前記カートリッジ保持手段に近接して設けられた銜接部材と、エアゾール発生カートリッジをジャケットセグメント内へ挿入するために前記摺動自在の支持手段と銜接部材とを相対的に移動させるための手段とから成ることを特徴とする特許請求の範囲第12項記載のエアゾール発生モジュール製造装置。

14) 前記カートリッジ挿入手段は、前記カートリッジ保持手段に近接して設けられた銜接部材と、エアゾール発生カートリッジをジャケットセグメント内へ挿入するために前記摺動自在の支持手段を前記銜接部材の方に向けて移動させるための手段とから成ることを特徴とする特許請求の範囲第12項記載のエアゾール発生モジュール製造装置。

15) エアゾール発生カートリッジをジャケットセグメント内へ挿入するために前記支持手段を前記銜接部材の方に向けて移動させる間該銜接部材

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第1項又は2項記載のエアゾール発生モジュール製造装置。

10) 前記各組立ステーションは、エアゾール発生カートリッジをジャケットセグメント内へ挿入すると同時に併行的に前記支持部材を吐出するための手段を備えていることを特徴とする特許請求の範囲第9項記載のエアゾール発生モジュール製造装置。

11) 前記各組立ステーションにおいて前記ジャケット保持手段は前記カートリッジ保持手段と軸線方向に整列していることを特徴とする特許請求の範囲第1項又は2項記載のエアゾール発生モジュール製造装置。

12) 前記各組立ステーションは、前記ジャケット保持手段及びカートリッジ保持手段を担持した摺動自在の支持手段と、エアゾール発生カートリッジをジャケットセグメント内へ挿入する間該ジャケット保持手段と協同してジャケットセグメントの移動を拘束するための拘束手段を備えていることを特徴とする特許請求の範囲第1項又は2項

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の移動を拘束するための拘束手段を備えていることを特徴とする特許請求の範囲第12項記載のエアゾール発生モジュール製造装置。

16) 前記各組立ステーションは、各ジャケットセグメントの少なくとも一部分を貫通する長手方向の孔を形成するための孔形成手段を備えていることを特徴とする特許請求の範囲第12項記載のエアゾール発生モジュール製造装置。

17) 前記各組立ステーションは、前記ジャケット保持手段及びカートリッジ保持手段を固定した支持手段と、エアゾール発生カートリッジをジャケットセグメント内へ挿入する間該ジャケット保持手段と協同してジャケットセグメントの移動を拘束するための拘束手段を備え、前記カートリッジ挿入手段は、前記カートリッジ保持手段に近接して設けられた銜接部材と、エアゾール発生カートリッジをジャケットセグメント内へ挿入するために前記支持手段と銜接部材とを相対的に移動させるための手段とから成ることを特徴とする特許請求の範囲第1項又は2項記載のエアゾール発生

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モジュール製造装置。

18) 前記各組立ステーションは、各ジャケットセグメントの少なくとも一部分を貫通する長手方向の孔を形成するための孔形成手段を備えていることを特徴とする特許請求の範囲第17項記載のエアゾール発生モジュール製造装置。

19) 前記各組立ステーションは、複数のジャケット保持手段及びカートリッジ保持手段を備えていることを特徴とする特許請求の範囲第1項又は2項記載のエアゾール発生モジュール製造装置。

20) 前記各組立ステーションは、各ジャケットセグメントの少なくとも一部分を貫通する長手方向の孔を形成するための孔形成手段と、該孔形成手段に近接して配置された前記ジャケット保持手段及びカートリッジ保持手段を相対した摺動自在の支持手段を備え、該ジャケット保持手段は、ジャケットセグメントを受容するように賦形された第1凹所から成り、該カートリッジ保持手段は、第1凹所に隣接して配置され、エアゾール発生カートリッジを受容するように賦形された第2凹所

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れる方向に移動させるための手段を備えていることを特徴とする特許請求の範囲第1項又は2項記載のエアゾール発生モジュール製造装置。

21) 前記各組立ステーションは、複数対の第1及び第2凹所を有していることを特徴とする特許請求の範囲第20項記載のエアゾール発生モジュール製造装置。

22) 前記スピンドルと、前記支持手段をスピンドルから離れる方向に移動させるための前記手段と、衝接部材の移動を拘束するための前記拘束手段とで、ジャケットセグメント内から支持部材を吐出するための手段を構成することを特徴とする特許請求の範囲第20項記載のエアゾール発生モジュール製造装置。

23) 前記ジャケット保持手段とカートリッジ保持手段とは支持手段上に互いに隣接して設けられており、該ジャケット保持手段は、エアゾール発生カートリッジをジャケットセグメント内へ挿入する間ジャケットセグメントの移動を拘束するための拘束手段を備え、前記カートリッジ挿入手段

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から成り、第1凹所と第2凹所とは、カートリッジをジャケットセグメント内へ挿入することができるよう軸線方向に整列しており、該ジャケット保持手段は、ジャケットセグメントに前記孔を形成し、エアゾール発生カートリッジをジャケットセグメント内へ挿入する間該ジャケットセグメントの移動を拘束するための拘束手段を含み、前記孔形成手段は、前記第1及び第2凹所と軸線方向に整列したスピンドルから成り、前記カートリッジ挿入手段は、前記カートリッジ保持手段に近接して設けられた衝接部材から成り、ジャケットセグメントに前記孔を形成するために前記摺動自在の支持手段を前記スピンドルの方に向けて移動させるための手段と、前記支持手段が前記スピンドルから離れる方向に移動する間前記衝接部材の移動を拘束するための拘束手段と協同して、ジャケットセグメントを前記スピンドルから引抜き、エアゾール発生カートリッジを該衝接部材に係合させ、該カートリッジをジャケットセグメント内へ挿入するように該支持手段をスピンドルから離

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は、前記カートリッジ保持手段に近接して配置された衝接部材から成り、エアゾール発生カートリッジをジャケットセグメント内へ挿入するために前記支持手段と衝接部材とを相対的に移動させるための手段が設けられていることを特徴とする特許請求の範囲第1項又は3項記載のエアゾール発生モジュール製造装置。

24) 前記各組立ステーションは、各ジャケットセグメントの少なくとも一部分を貫通する長手方向の孔を形成するための孔形成手段を備えていることを特徴とする特許請求の範囲第23項記載のエアゾール発生モジュール製造装置。

25) 前記孔形成手段は、孔形成部材から成り、前記各組立ステーションは、エアゾール発生カートリッジをジャケットセグメント内へ挿入すると同時に併行的に該孔形成部材を各ジャケットセグメントから引抜くための手段を備えていることを特徴とする特許請求の範囲第24項記載のエアゾール発生モジュール製造装置。

26) 前記ジャケットセグメントは、チューブ状

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支持部材の周りに予備形成された断熱材のスリーブから成り、前記カートリッジ挿入手段は、該チューブ状支持部材を該スリーブから吐出するための吐出手段を含むものであることを特徴とする特許請求の範囲第1項又は2項記載のエアゾール発生モジュール製造装置。

27) 前記ジャケットセグメントは、タバコ材のロッドから成り、前記各組立ステーションは、該ロッド内に長手方向の孔を形成するための孔形成手段を備えていることを特徴とする特許請求の範囲第1項又は2項記載のエアゾール発生モジュール製造装置。

28) 喫煙物品のためのエアゾール発生セグメントを製造するための装置であって、

回転組立ドラムと、

該ドラムに取付けられており、各々、ジャケットセグメントを受容し、保持するためのジャケット保持手段と、エアゾール発生カートリッジを受容し、保持するためのカートリッジ保持手段と、該エアゾール発生カートリッジをジャケットセグ

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ていることを特徴とする特許請求の範囲第28項記載のエアゾール発生セグメント製造装置。

32) 前記各組立ステーションは、各ジャケットセグメントの少なくとも一部分を貫通する長手方向の孔を形成するための孔形成手段を備えていることを特徴とする特許請求の範囲第28項記載のエアゾール発生セグメント製造装置。

33) 前記各組立ステーションは、ジャケットセグメント内から支持部材を吐出するための、吐出手段を備えていることを特徴とする特許請求の範囲第32項記載のエアゾール発生セグメント製造装置。

34) 前記孔形成手段は、孔形成部材から成り、前記各組立ステーションは、エアゾール発生カートリッジをジャケットセグメント内へ挿入すると同時に併行的に該孔形成部材を各ジャケットセグメントから引抜くための手段を備えていることを特徴とする特許請求の範囲第32項記載のエアゾール発生セグメント製造装置。

35) 喫煙物品のコンポーネントを組立てるため

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メント内へ挿入し、それによってエアゾール発生モジュールを形成するためのカートリッジ挿入手段とから成る複数の組立ステーションと、

各組立ステーションへ順次にジャケットセグメントを供給するためのジャケット供給手段及びエアゾール発生カートリッジを供給するためのカートリッジ供給手段と、

前記エアゾール発生モジュールを各組立ステーションから順次に取出すための取出し手段と、から成るエアゾール発生セグメント製造装置。

29) 前記ジャケット供給手段は、回転自在の部材から成ることを特徴とする特許請求の範囲第28項記載の喫煙物品のエアゾール発生セグメント製造装置。

30) 前記カートリッジ供給手段は、回転自在の部材から成ることを特徴とする特許請求の範囲第28項記載の喫煙物品のエアゾール発生セグメント製造装置。

31) 前記複数の組立ステーションは、前記ドラムの周りに軸線方向に整列した対として配列され

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の組立装置であって、第1コンポーネントと第2コンポーネントを整列した状態を受容するために周縁に移動自在に取付けられた複数の支持体を有する回転自在のドラムと、該ドラムに関連して設けられており、ドラムが回転することによって作動されて、前記第1及び第2コンポーネントのうちの1つに軸線方向の孔を形成し、第1コンポーネントを第2コンポーネントに押し嵌めして複合体を形成するための手段とから成る喫煙物品のコンポーネント組立装置。

36) 前記ドラム上に円周方向に間隔をおいて前記各支持体に整列してスピンドルが配設されており、該支持体上の第1コンポーネントを抱持して該スピンドルに押し嵌めし、次いで該スピンドルによって突き刺された第1コンポーネントをスピンドルから引抜いて前記第2コンポーネントに押し嵌めするための可動クランプが該各支持体に設けられていることを特徴とする特許請求の範囲第35項記載の喫煙物品のコンポーネント組立装置。

37) 前記孔形成手段は、前記各支持体に整列し

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たスピンドルを含むものであり、該各支持体は、前記第1コンポーネントを受容するための凹所から成り、第1コンポーネントをスピンドルに押し嵌めするために第1方向に移動し、次いで第1コンポーネントをスピンドルから引抜いて第2コンポーネントに押し嵌めするために第2方向に移動するように構成されていることを特徴とする特許請求の範囲第35項記載の喫煙物品のコンポーネント組立装置。

38) 第1コンポーネントが第2コンポーネントに押し嵌めされる間第2コンポーネントの移動を拘束するための衝接手段が設けられていることを特徴とする特許請求の範囲第37項記載の喫煙物品のコンポーネント組立装置。

39) 前記ドラム上の支持体は、軸線方向に隣接した一連の対として配列されており、該ドラム上には、各対の支持体の間に1対の互いに対向したスピンドルが配置されていることを特徴とする特許請求の範囲第35項記載の喫煙物品のコンポーネント組立装置。

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とする特許請求の範囲第41項記載の喫煙物品のコンポーネント組立装置。

43) 前記ドラムは、特定輪郭のカム溝を有する支持部材に取付けられており、前記キャリッジ及びクランプは該カム溝の輪郭に応答して移動するようになされていることを特徴とする特許請求の範囲第40項又は42項記載の喫煙物品のコンポーネント組立装置。

44) 前記第1コンポーネントを第2コンポーネントに押し嵌めする間第2コンポーネントの移動を拘束するための解放自在の、摺動自在衝接部材が設けられていることを特徴とする特許請求の範囲第40項又は42項記載の喫煙物品のコンポーネント組立装置。

45) 前記衝接部材は、前記回転自在ドラムのための支持部材に設けられたカム表面の輪郭に応答して掛止又は解放される構成とされていることを特徴とする特許請求の範囲第44項記載の喫煙物品のコンポーネント組立装置。

46) 前記各スピンドルを回転させるための手段

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40) 前記支持体は、前記ドラム上に摺動自在に取付けられたキャリッジに組合せセットとして取付けられており、該各キャリッジには、該支持体上の第1コンポーネントを保持するための摺動自在のクランプが取付けられていることを特徴とする特許請求の範囲第39項記載の喫煙物品のコンポーネント組立装置。

41) 前記孔形成手段は、前記ドラム上に互いに反対向きの背中合わせの対として設けられたスピンドル対から成り、前記支持体は、該スピンドルの両側に対をなして配置されており、第1コンポーネントと第2コンポーネントを受容するための軸線方向に整列した凹所の組合せセットから成ることを特徴とする特許請求の範囲第35項記載の喫煙物品のコンポーネント組立装置。

42) 前記凹所の組合せセットは、前記ドラムに摺動自在に取付けられた前記キャリッジにセットとして配置されており、各キャリッジには、前記支持体上の第1コンポーネントを保持するための摺動自在のクランプが取付けられていることを特徴

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が設けられていることを特徴とする特許請求の範囲第39～42項のいずれかに記載の喫煙物品のコンポーネント組立装置。

47) 前記スピンドルは前記ドラムの回転によって回転される構成とされていることを特徴とする特許請求の範囲第46項記載の喫煙物品のコンポーネント組立装置。

48) 前記スピンドルを回転させるための前記手段は、前記支持体対の間に配設された歯車手段から成ることを特徴とする特許請求の範囲第47項記載の喫煙物品のコンポーネント組立装置。

49) 喫煙物品のコンポーネントを組立てるための組立装置であって、

特定輪郭のカム表面を有する支持部材と、該支持部材上に取付けられた回転自在のドラムと、該ドラムの周縁上に縦列に配列され、移動自在に取付けられた複数の組立ステーションとから成り、該各組立ステーションは、該喫煙物品の複数の第1コンポーネントと第2コンポーネントを受容するための凹所の整列組合せセットを有し、摺動自

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在に取付けられたキャリッジと、該キャリッジ上に第1コンポーネントを抱持するためにキャリッジに関連して設けられた摺動自在のクランプと、該各凹所セットに整列して配置されており、第2コンポーネントの軸線方向の移動を拘束するための摺動自在の衝接部材と、前記キャリッジ上の第1コンポーネントを抱持するように前記クランプをキャリッジ及び前記衝接部材に対して移動させ、そして該衝接部材を後退位置からキャリッジ上の第2コンポーネントの軸線方向の移動を拘束する係合位置へ移動させ、そして第2コンポーネントを第1コンポーネント内へ挿入するようにキャリッジ及びクランプを衝接部材の方に向って移動させ、そして組立てられた第1及び第2コンポーネントを解放するようにキャリッジをクランプに対して移動させ、そして衝接部材を前記係合位置から後退位置へ移動させるために前記支持部材のカム表面にตอบสนองして作動する手段とから成ることを特徴とする喫煙物品のコンポーネント組立装置。

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動させ、次いで第1コンポーネントを前記衝接部材に向う反対の方向に移動させるために、キャリッジ及び衝接部材に対して相対的に移動されることによってキャリッジの凹所内の第1コンポーネントを抱持する働きをし、該クランプは、スピンドルによって突刺された第1コンポーネントをスピンドルから引抜いて第2コンポーネントに押し嵌めするようにキャリッジと一緒に移動し、次いで、第1コンポーネントとその中に挿入された第2コンポーネントから成る複合体を解放するためにキャリッジに対して相対的に移動するようになされており、前記衝接部材は、前記キャリッジがスピンドルに向って移動している間位置していた後退位置から、キャリッジがスピンドルから離れる方向に移動し第1コンポーネントが第2コンポーネントに押し嵌めされる間第2コンポーネントを拘束する係合位置へ移動することができるように構成されていることを特徴とする喫煙物品のコンポーネント組立装置。

51) 前記各組立ステーションは、各ステーショ

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50) 喫煙物品のコンポーネントを組立てるための組立装置であって、

回転自在のドラムと、該ドラム上に取付けられた複数の組立ステーションとから成り、該各組立ステーションは、スピンドルと、該スピンドルをその長手軸線の周りに回転自在に支持するためのスピンドル支持手段と、摺動自在の衝接部材と、該衝接部材を前記スピンドルの軸線に整列させ、衝接部材から軸線方向に離隔させて支持するための衝接部材支持手段と、該喫煙物品の第1コンポーネント及び第2コンポーネントを搬送するための搬送手段とから成り、該搬送手段は、第1コンポーネントと第2コンポーネントを受容するための凹所の整列組合せセットを有する往復動自在のキャリッジと、前記スピンドル及び衝接部材に対して該キャリッジと一緒に移動することができ、かつ、キャリッジに対して移動自在であるクランプとから成り、該クランプは、第1コンポーネントにスピンドルを突刺するために第1コンポーネントをキャリッジと共にスピンドルに向う方向に移

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ンにおいて同時に複数の第1コンポーネントと第2コンポーネントを組立てるために、同数のスピンドルと、衝接部材と、第1及び第2コンポーネントを受容する凹所の整列した組合せセットを備えていることを特徴とする特許請求の範囲第50項記載の喫煙物品のコンポーネント組立装置。

52) 前記各組立ステーションは、前記回転自在のドラムの周りに縦列対として取付けられており、該各ステーションは、各ステーションにおいて同時に複数の第1コンポーネントと第2コンポーネントを組立てるために、同数のスピンドルと、衝接部材と、第1及び第2コンポーネントを受容する凹所の整列した組合せセットを備えていることを特徴とする特許請求の範囲第50項記載の喫煙物品のコンポーネント組立装置。

53) 前記各スピンドルは、前記各縦列対の組立ステーションのキャリッジとキャリッジの間に互いに反対向きの背中合わせの対として回転自在に取付けられており、スピンドルを回転するための前記手段は、各縦列対のステーションのキャリッ

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ジとキャリッジの間に配設された歯車手段から成ることを特徴とする特許請求の範囲第52項記載の喫煙物品のコンポーネント組立装置。

54) 前記各凹所に連通したオリフィスと、該オリフィスを真空源に接続するための接続手段が設けられていることを特徴とする特許請求の範囲第50項記載の喫煙物品のコンポーネント組立装置。

55) 前記スピンドルに対するキャリッジの移動、及びキャリッジに対する前記クランプの移動を行うためのカム式作動手段が設けられていることを特徴とする特許請求の範囲第50項記載の喫煙物品のコンポーネント組立装置。

56) 前記銜接部材は、摺動自在に取付けられ、前記スピンドルの方に向けてばね偏倚されており、第2コンポーネントが前記キャリッジ上へ装填されるまでは前記銜接部材の移動を拘束するための掛金手段と、第2コンポーネントがキャリッジ上へ装填された後銜接部材を第2コンポーネントに係合させることができるように前記掛金手段

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された非燃焼性材料のスリーブで構成された第1コンポーネントを前記スピンドル及び銜接部材に整列させて支持するように構成されたキャリッジと、該スピンドルをタバコ材のロッドに突刺すために前記キャリッジをスピンドルに向けて移動させるための手段と、エアゾール発生カートリッジ及び該カートリッジの一端に設けられた燃料素子で構成された第2コンポーネントを、前記キャリッジに対する第2コンポーネントの移動を拘束するようにして第1コンポーネントと前記銜接部材との間で前記キャリッジ上に支持するための手段と、第1コンポーネントを前記スピンドルから引抜いて第2コンポーネントに押し嵌めし、第1コンポーネントの前記支持部材を吐出させるためにキャリッジをスピンドルから離れる方向に移動させるための手段とから成ることを特徴とする喫煙物品製造装置。

59) 喫煙物品を製造するための装置であって、

水平軸線の周りに回転自在のドラムと、該ドラムの回転軸線に平行な水平軸線の周りに回転しう

るよう解放するための手段が設けられていることを特徴とする特許請求の範囲第50項記載の喫煙物品のコンポーネント組立装置。

57) 前記クランプが第1コンポーネントを抱持する位置へ移動される前に第1コンポーネントを前記キャリッジの前記凹所へ装填するための第1供給手段と、該キャリッジ及びクランプが第1コンポーネントを前記スピンドルに押し嵌めする位置へ移動された後第2コンポーネントをキャリッジの前記凹所へ装填するための第2供給手段が設けられていることを特徴とする特許請求の範囲第50項記載の喫煙物品のコンポーネント組立装置。

58) 喫煙物品を製造するための装置であって、

回転自在のドラムと、該ドラムに取付けられた複数の組立ステーションとから成り、該各組立ステーションは、スピンドルと、該スピンドルに整列し、スピンドルから離隔して配置された銜接部材と、タバコ材のロッド、該ロッドの一端に設けられた支持部材、及び該支持部材の周りに形成

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るように該ドラムに取付けられた一連のスピンドルと、該スピンドルの軸線と平行な水平軸線の周りに回転しうよう該ドラムによって支持された駆動軸と、該駆動軸の回転によって作動され、前記各スピンドルを回転させるための歯車列と、該ドラムの回転によって前記駆動軸を回転させるための手段と、該各スピンドルに整列し、スピンドルから離隔して配置され、前記ドラムに取付けられた銜接部材と、第1コンポーネント及び第2コンポーネントを対応する数の前記スピンドル及び銜接部材に整列させスピンドルと銜接部材の間に支持するように構成されており、該スピンドルを第1コンポーネントに突刺す方向に前記キャリッジを移動させるために、そして第1コンポーネントを前記スピンドルから引抜いて、キャリッジによって支持され銜接部材によって拘束された第2コンポーネントに押し嵌めするためにキャリッジを反対方向に銜接部材の方に向けて移動させるように前記ドラムの回転によって作動されてキャリッジを往復動させる手段とから成る喫煙物品製

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造装置。

60) 前記キャリッジ上の第1コンポーネントを抱持し、又は解放するために該キャリッジと共に、又はキャリッジに対して相対的に移動するようにキャリッジに取付けられたクランプと、該クランプの移動を行うためのカム式作動手段を備えていることを特徴とする特許請求の範囲第59記載の喫煙物品製造装置。

61) 前記キャリッジは、第1及び第2コンポーネントを受容するための凹所と、該コンポーネントを該凹所内に動かないように拘束するための真空手段を有していることを特徴とする特許請求の範囲第59項又は60項記載の喫煙物品製造装置。

62) 前記ドラムに複数セットの凹所が設けられており、凹所の各セットに対応してスピンドルと銜接部材が該ドラムの回転軸線の周りに円周方向に間隔を置いてドラムに取付けられていることを特徴とする特許請求の範囲第61項記載の喫煙物品製造装置。

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スピンドルを回転させるためのスピンドル回転手段と、該スピンドルに軸線方向に整列し、スピンドルから軸線方向に離隔して配置され、前記ドラムに取付けられた銜接部材と、前記スピンドルと銜接部材の間にそれらと軸線方向に整列して配置され前記ドラムに移動自在に取付けられたキャリッジと、該キャリッジによって支持された喫煙物品の第1コンポーネントに前記スピンドルを突刺するように該第1コンポーネントをスピンドルに向けて移動させるために、そして該突刺された第1コンポーネントをスピンドルから引抜いて、第1コンポーネントをそれと前記銜接部材の間で該キャリッジによって支持された第2コンポーネントに押し嵌めするために、前記フレーム及びドラムに取付けられており、フレームに対するドラムの回転によって作動されるキャリッジ移動手段とから成る喫煙物品製造装置。

66) 前記スピンドル回転手段は、前記フレームに取付けられた輪歯車と、該ドラムに取付けられており、該輪歯車と噛合した平歯車と、該平歯車

63) 前記銜接部材を前記スピンドルに向けて弾性的に偏倚させるための手段と、該銜接部材を前記キャリッジに対して拘束する掛金と、第2コンポーネントがキャリッジ上へ装填された後該掛金を解放するための手段を備えていることを特徴とする特許請求の範囲第59項記載の喫煙物品製造装置。

64) 第2コンポーネントを前記銜接部材と第1コンポーネントの間で前記キャリッジ上に載せるのを容易にするために前記銜接部材をキャリッジに対して後退させるための手段を備えていることを特徴とする特許請求の範囲第59項記載の喫煙物品製造装置。

65) 喫煙物品を製造するための装置であって、

支持フレームと、水平軸線の周りに回転するように該フレームに取付けられたドラムと、該ドラムの回転軸線から離隔し、該回転軸線に平行な水平軸線の周りにドラムと共に回転するように該ドラムに取付けられたスピンドルと、前記フレームに対するドラムの回転によって作動され、該ス

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と噛合した歯車と、該歯車と噛合し、該スピンドルに取付けられた歯車とから成ることを特徴とする特許請求の範囲第65項記載の喫煙物品製造装置。

67) 前記キャリッジ移動手段は、前記フレームに取付けられたカム溝を有するカム円筒体と、該カム溝に係合するように前記キャリッジに取付けられたカム従動とから成ることを特徴とする特許請求の範囲第66項記載の喫煙物品製造装置。

68) 前記カム円筒体は、一端に特定輪郭のカムを備えており、一端において該カムに係合し、他端において前記銜接部材の後退及び解放を行うために該銜接部材に係合することができるレバーが前記フレームに枢動自在に取付けられており、該銜接部材を前記カムに接触させた状態に弾性的に保持するためのばね手段が設けられていることを特徴とする特許請求の範囲第67項記載の喫煙物品製造装置。

69) タバコ材のロッドとその一端に設けられた非燃焼性材料のスリーブとで構成された第1コン

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ポーネントと、エアゾール発生カートリッジで構成された第2コンポーネントとから成る喫煙物品を製造するための装置であつて、

フレームと、水平軸線の周りに回転しうるように該フレームに取付けられたドラムと、ドラムの回転軸線の周りに回転しうるようにドラムにその円周方向に間隔を置いて取付けられた複数のスピンドルと、前記フレームに対するドラムの回転によって作動されて該各スピンドルを回転させるスピンドル回転手段と、各スピンドルに軸線方向に整列して配置され前記ドラムに取付けられた銜接部材と、該各スピンドルと銜接部材の間でドラムに摺動自在に取付けられており、前記第1及び第2コンポーネントを対応するスピンドル及び銜接部材に整列させて受容するように構成されたキャリアッジと、第1コンポーネントを移動させて対応する前記スピンドルに押し嵌めし、次いで、第1コンポーネントを該スピンドルから引抜いて第2コンポーネントに押し嵌めするべく移動させるために各キャリアッジをそれと整列したスピンドル及

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72) 前記カム円筒体は、カム溝を有し、前記カム従節は該カム溝内に挿入されていることを特徴とする特許請求の範囲第70項記載の喫煙物品製造装置。

73) 前記カム円筒体は、カム軌道を有し、前記各銜接部材は、対応する前記各スピンドルに向けてばね偏倚されており、各銜接部材の移動を拘束するための掛金手段が設けられ、前記カム軌道に弾性的に係合しており、適宜に作動されて該銜接部材を解放する働きをするカムレバーが設けられていることを特徴とする特許請求の範囲第72項記載の喫煙物品製造装置。

74) 前記各スピンドルと、銜接部材と、キャリアッジは、前記ドラムの周りに縦列に配列され、該スピンドルは、縦列に配置されたキャリアッジとキャリアッジの間に互いに反対向きの背中合わせの対として配列されており、各キャリアッジは、該各キャリアッジにおいて複数の第1及び第2コンポーネントの組立を同時に行うために複数の第1及び第2コンポーネントを受容するように構成されてい

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び銜接部材に対して軸線方向に移動させるための移動手段と、

から成る喫煙物品製造装置。

70) キャリッジを軸線方向に移動させるための前記移動手段は、前記フレームに取付けられたカム円筒体と、該カム円筒体に係合するようにして各キャリアッジに取付けられており、該フレームと前記ドラムとの相対的回転によって作動されて該キャリアッジの往復動を行うカム従節とから成ることを特徴とする特許請求の範囲第69項記載の喫煙物品製造装置。

71) 前記各キャリアッジは、前記第1及び第2コンポーネントをそれぞれ受容するための互いに同心関係をなす第1及び第2凹所を有し、第1コンポーネントを該キャリアッジに装填するための手段と、第1コンポーネントが前記スピンドルに突刺されている間に第2コンポーネントを該キャリアッジに装填するための手段が設けられていることを特徴とする特許請求の範囲第70項記載の喫煙物品製造装置。

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ることを特徴とする特許請求の範囲第69、70、71又は73項に記載の喫煙物品製造装置。

3. 発明の詳細な説明

産業上の利用分野

本発明は、喫煙物品、特にエアゾールを発生する喫煙物品のコンポーネント（構成部材）を組立てて喫煙物品を製造する装置に関する。

従来の技術

ヨーロッパ特許公報第0174645(A2)号及び第0212234(A2)号には、いろいろな形態の喫煙物品が開示されているが、それらの喫煙物品は、通常、(1)エアゾール発生物質（タバコ風味付け剤を包含している場合もある）と、エアゾール発生物質に伝達するために熱を発生する燃料素子とから成るエアゾール発生カートリッジと、(2)エアゾールカートリッジを囲繞するためのものであって、好ましくは、燃料素子を囲包するスリーブとエアゾール発生物質を囲包するタバコ材含有材を有するスリーブ又はジャケ

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ットとから成り、随意選択として、(3)吸口ピース（フィルタ素子を含む場合もある）を備えている。通常、喫煙物品のエアゾール発生カートリッジは、エアゾール発生物質を包含したカプセルから成り、その一端に燃料素子が設けられている。

発明の目的

本発明の目的は、上記のような喫煙物品のコンポーネント、即ち、エアゾール発生カートリッジと、ジャケットを組合せてエアゾール発生モジュールを製造するための高速製造装置を提供することである。

問題点を解決するための手段

本発明は、この目的を達成するためにモジュール、特に、喫煙物品のためのエアゾール発生モジュールを組立製造するための装置を提供する。本発明のエアゾール発生カートリッジ製造装置は、(1)回転組立ドラムと、(2)該ドラムに取付けられており、各々、少なくとも1つのジャケットセグメントを受容し、保持するためのジャケッ

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に整列した鏡像関係をなす対（互いに反対向きとされた背中合わせの対）、又は縦列対として配列し、ドラムの回転に伴って各組立ステーションにおいて並列的に組立作業を行うことができるようにする。各ステーションは、エアゾール発生カートリッジをジャケットセグメント内へ挿入するためのカートリッジ挿入手段を備えたものとするのが好ましい。

ジャケットセグメントがチューブのような支持部材の周りに予備整形された特定材料のスリーブから成るものである場合は、該装置は、好ましくはエアゾール発生カートリッジをジャケットセグメント内へ挿入すると併行してジャケットセグメントから支持部材を吐出させる手段を備えているのが好ましい。

又、他の好ましい実施例では、装置は、ジャケットセグメント内に長手方向の孔を形成する孔形成手段を備えたものとし、エアゾール発生カートリッジをその孔に挿入するようにすることが好ましい。

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ト保持手段と、エアゾール発生カートリッジを受容し、保持するためのカートリッジ保持手段から成る複数の組立ステーションと、(3)該エアゾール発生カートリッジをジャケットセグメント内へ挿入し、それによって喫煙物品のためのエアゾール発生カートリッジを形成するためのカートリッジ挿入手段とから成る。通常、ジャケットセグメントは、タバコ材のロッドから成り、エアゾール発生カートリッジは、エアゾール発生物質を包含している。一般に、この装置には、ジャケットセグメントを各組立ステーションへ供給するためのジャケット供給手段と、エアゾール発生カートリッジを各組立ステーションへ供給するためのカートリッジ供給手段と、各組立ステーションからエアゾール発生モジュールを取出すための取出手段が設けられる。各組立ステーションは、複数のエアゾール発生モジュールを併行して即ち並列的に形成する構成とすることが好ましい。

本発明の好ましい実施例においては、各組立ステーションは、ドラムの外周面の周りに軸線方向

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特に好ましい実施例では、孔形成部材によってジャケットセグメントに前記孔を形成し、エアゾール発生カートリッジをジャケットセグメント内へ挿入すると同時併行的に該孔形成部材を各ジャケットセグメントから引抜くための引抜き挿入手段を備えたものとする。ジャケットセグメントの一部分がチューブのような支持部材の周りに形成されているものである場合は、前記引抜き挿入手段は、エアゾール発生カートリッジをジャケットセグメント内へ挿入すると併行してジャケットセグメント内から支持部材を吐出するための吐出手段をも備えたものであることが好ましい。

好ましいドラム構成においては、支持部材を吐出するための吐出手段、引抜き挿入手段及び孔形成手段を各組立ステーションに配備する。各組立ステーションは、又、ジャケット保持手段及びカートリッジ保持手段を支持する揺動自在の支持手段と、前記孔形成中及び、又はカートリッジの挿入中前記ジャケット保持手段と協同してジャケッ

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トセグメントの移動を拘束するための拘束手段を備えていることが好ましい。前記挿入手段は、カートリッジの挿入中カートリッジ保持手段に近接した位置に位置する銜接部材と、カートリッジをジャケットセグメント内へ少なくとも一部分挿入するために前記摺動自在の支持手段と銜接部材との相対移動を行わせるための手段とから成るものであることが好ましい。

本発明の一実施例においては、ジャケットセグメントへのカートリッジの挿入を行うためにドラムの回転に関連して作動する手段によりジャケットセグメント及びカートリッジをドラム上に装填する。ジャケットセグメントが予備形成された孔を持たない特定材料のロッドである場合、各組立ステーションは、ドラムが回転するにつれてロッドに孔を形成する孔形成手段を備えている。次いで、エアゾール発生カートリッジがジャケットセグメントの孔に挿入され、それによって組立てられたエアゾール発生モジュールは、ドラムが更に回転することによって組立ステーションから排出

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と、喫煙物品の第1コンポーネントと第2コンポーネントを受容し搬送するための搬送手段とから成り、該搬送手段は、第1コンポーネントと第2コンポーネントを受容するための軸線方向に整列した凹所を有する往復動自在の支持手段即ちキャリッジと、前記スピンドル及び銜接部材に対してキャリッジと一緒に移動することができ、かつ、キャリッジに対して移動自在である拘束手段即ちクランプとから成る。各組立ステーションは、各ステーションにおいて同時に複数個の第1コンポーネントと第2コンポーネントを組立てることができるよう、2つ以上のスピンドルと、銜接部材と、第1及び第2コンポーネントを受容する凹所の整列した組合せセットを備えていることが好ましい。

該拘束手段即ちクランプは、キャリッジに対する相対移動によって作動されてキャリッジの凹所内の第1コンポーネントを抱持するようにすることが好ましい。次いで、クランプは、スピンドルに向ってキャリッジと一緒に移動してスピンドル

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され、組立ステーションは、次のジャケットセグメントを受取り、サイクルを繰返す準備が整う。ジャケットセグメントが支持チューブの周りに形成された特定材料のスリーブである場合は、各組立ステーションは、好ましくはカートリッジをジャケットセグメントに挿入するのと併行して支持チューブを吐出するための吐出手段を備えたものとする。

より具体的にいえば、喫煙物品のコンポーネントを組立てるための本発明の好ましい実施例による組立装置は、回転自在のドラムと、該ドラム上に取付けられた複数の組立ステーションとから成る。それらの組立ステーションは、ドラムの周りに軸線方向に整列した対として配列することが好ましい。各組立ステーションは、少なくとも1つのスピンドルと、該スピンドルをその長手軸線の周りに回転自在に支持するためのスピンドル支持手段と、摺動自在の銜接部材と、該銜接部材をスピンドルの軸線に整列させ、銜接部材から軸線方向に離隔させて支持するための銜接部材支持手段

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に係合し、それによって第1コンポーネントにスピンドルを突刺す。次いで、クランプは、キャリッジと共に前記銜接部材に向う反対の方向に移動してスピンドルによって突刺された第1コンポーネントをスピンドルから引抜いて第2コンポーネントに押し嵌めする。次いで、クランプは、キャリッジに対して相対的に移動して第1コンポーネントとその中に挿入された第2コンポーネントから成る複合体を解放する。

前記キャリッジ及びクランプの移動は、先に述べたようにドラムの回転によって行われる。スピンドルは回転させることが望ましく、スピンドルを回転させるために前記支持フレームに対するドラムの回転によって作動される。例えば歯車列のような駆動手段が設けられる。

本発明の装置は、更に、吸口部材を供給するための手段、及び吸口部材をエアゾール発生モジュールに結合して紙巻タバコ型の喫煙物品を製造するための手段を備えたものとするができる。更に別の実施例として、吸口部材を2つのエアゾ

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ール発生モジュールの間に挿入して複合体を形成するための手段を設け、複合体を半分に切断することによって2つの喫煙物品が得られるようにすることもできる。

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バーラップ（包装材）5A、5B、5Cとから成る。

第1図に示されたジャケットセグメントは、予備成形されたスリーブ部分と、繊維質材のロッド部分とから成るが、本発明の装置によって組合せる喫煙物品のためのジャケットセグメントは、（1）支持部材の周りに予備成形されたスリーブ部分だけから成るもの、（2）支持部材なしのスリーブ部分だけから成るもの、（3）ロッド部分だけから成るもの、あるいは（4）予備成形されたスリーブ、又はロッド又はそれらの組合せから成る部分を有するその他の変型であってもよい。そのような場合、本発明の装置は、本発明の教示に従って改変することができる。例えば、ジャケットセグメントがロッド部分だけから成る場合、ジャケットセグメントにエアゾール発生カートリッジを挿入するのに適した孔を形成するのに、通常は、スピンドル又はその他の孔形成手段が用いられるが、別法として、ジャケットセグメントに予め孔をあけずに、カートリッジ自体を適当な形に賦形

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実施例

本発明の装置は、エアゾール発生カートリッジをジャケットセグメント内へ挿入し、第3図に示されるような型式のエアゾール発生モジュールを形成するためのものである。

第1～3図を参照して説明すると、本発明の好ましい実施例による装置は、細長いジャケットセグメントAに長手方向の開口即ち軸線方向の孔1（第3図）を形成するように構成されている。

第1図に示されるように、好ましいジャケットセグメント（エアゾール発生カートリッジBを包被する包被体の所定長の部材）Aは、タバコ材、嵩膨張させたタバコ材、再構成タバコ材、又はそれらの混合物等の繊維質材のロッド2と、ロッド2の一端に突合わせ関係に付設された断熱材、この例ではガラス繊維のような非燃焼性繊維のスリーブ3と、スリーブ3内に配設された例えばプラスチック製のチューブ状支持部材4と、ロッド2とスリーブ3を囲繞し両者を結合した、紙巻タバコのような喫煙物品の製造に慣用されているペー

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しておき、カートリッジをロッド即ちジャケットセグメントに直接挿入することができるようになることもできる。ジャケットセグメントがスリーブ部分だけから成る場合は、本発明の装置は、例えば、スピンドルを省略し、好ましくはエアゾール発生カートリッジがジャケットセグメントに挿入される際にジャケットセグメントの支持部材を吐出させるように改変される。

好ましいエアゾール発生カートリッジBは、第2図に示されるように、エアゾール発生物質を包含し、一端にエアゾール放出のための少なくとも1つの穴8を有する好ましくは断面円形の細長いカプセル5と、カプセル5の他端に挿入された好ましくは炭素プラグの形の熱発生素子即ち燃料素子7とから成る。エアゾール発生カートリッジBは、上記ヨーロッパ特許出願公報に開示されているようなその他のいろいろな形態のエアゾール発生手段であってよい。

ここで用いられる「エアゾール」とは、燃焼する燃料素子からの熱がエアゾール発生カートリッ

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ジ又はカプセル又は当該喫煙物品中の他の部位に存在するエアゾール発生物質に作用することによって創生される蒸気、ガス、粒子等（可視、不可視を問わず）、特に、煙のように見える成分を含む。又、ここでいう「エアゾール発生物質」は、発生するエアゾールが可視であるか否かを問わず、揮発性風味剤及び、又は、薬理学的に活性の（即ち、薬理効果を有する）、又は生理学的に活性の（即ち、生理学的に気分を爽快にするなどの効果を有する）薬剤を含む。

第1図のジャケットセグメントA（喫煙物品のコンポーネント即ち構成部材）と、第2図のエアゾール発生カートリッジB（喫煙物品のコンポーネント）を組立てて第3図のエアゾール発生モジュールMを製造するための本発明の好ましい実施例による装置は、第4図に概略的に示されている回転自在の組立ドラム（以下、単に「ドラム」と称する）27を備えている。第5図を参照して後に詳しく説明するように、この装置は、ドラム上に設けられた複数の組立ステーションS（コンポ

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は、各ステーションは、1組（3個）のエアゾール発生モジュールMを同時に組立てるように設計されている（第10図及び第12A～12O図参照）。

第4図に示されるように、好ましい実施例では、移送ドラムD1、D2、D3が、組立ドラム27の周りに配置され、コンポーネントA及びBを各ステーションの凹所70、72に装填するためにドラム27の回転と同期して、又、それらのコンポーネントを組み立てるために、そして組立てられたエアゾール発生モジュールMをドラム27から取り出すためにキャリッジ60及びクランプ66の移動と同期して回転するように構成される。移送ドラムD1は、コンポーネントA即ちジャケットセグメントを組立ドラム27の凹所70内へ装填するべく組立ドラムの上向き移動側に配置するのが好ましく、移送ドラムD2は、コンポーネントB即ちエアゾール発生カートリッジを組立ドラム27の凹所72内へ装填するべく組立ドラムの頂部近くに配置するのが好ましい。移送ド

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ラメントを組立てるための装置ユニット、以下、単に「ステーション」と称する）から成る。これらのステーションSは、好ましくは、軸線方向に整列し、鏡像関係に（即ち、互いに反対方向に向けられた背中合わせの関係に）配列され、2つの平行なステーション列を構成するようになされている。各ステーションSは、喫煙物品のコンポーネントA、B（以下、単に「コンポーネント」とも称する）を支持し移動させるキャリッジ60の形とした支持手段と、コンポーネントを動かさないように保持するクランプ66の形とした拘束手段と、コンポーネントを突刺してコンポーネントに孔を形成するスピンドル44の形とした孔形成部材と、コンポーネントを受容する凹所70、70の形としたコンポーネント（ジャケットセグメント及びエアゾール発生カートリッジ）保持手段と、組立てられたエアゾール発生モジュールMの移動を拘束する銜接部材68とから成り、2組のエアゾール発生モジュールを併行して組立てることができるようになされている。図示の実施例で

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ラムD3は、組合わされたエアゾール発生モジュールMを組立ドラム27から取出すように組立ドラムの下向き移動側に配置するのが好ましい。これらの移送ドラムは、いずれも、それぞれのコンポーネントを受容するための凹所106、及び移送の前後においてコンポーネントを該移送ドラム上に保持するための真空吸引手段（矢印で示されている）を備えている。

通常、ジャケットセグメントAは、例えば西独のハウニ・ヴェルケ・コルバ・アンド・カンパニ社製のモデルMULFIのような適当に改変された慣用型式のセグメント組立機（図示せず）から直接一連の真空助成送ドラムD1によって供給される。ドラムD1は、2個又は3個のジャケットセグメントを、組立ドラム27の2つの平行なステーション列に整列するように並置させる。あるいは、ジャケットセグメントは、トレー又はホッパーから適当に配置された真空助成式回転器又はそれと同等の手段を用いて供給することもできる。

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通常、エアゾール発生カートリッジBは、組立ドラム27の上方に配置されたトレー又はホッパーから移送ドラムD2又は他の適当に配置された真空助成式回転器又はそれと同等の手段を用いて供給される。

完成したエアゾール発生モジュールMは、第4図に示されるようにベルト上に投下され、包装部署へ搬送される。あるいは、それらのモジュールは、一連の移送ドラム又はそれと同等の手段(図示せず)によってチップ(吸口端)取付け機へ移送され、吸口部材を結合されて紙巻タバコ型喫煙物品として完成される。

再び第5図を参照して説明すると、このドラム装置は、支持構造体10を有する。支持構造体10は、それと一体に固定された、軸線方向の内部開口18を有する水平管状支持体14を含む。支持構造体10には、又、平坦板11と段付板13とから成る垂直取付板12が固定されている。平坦板11の内側面には、段付板13と協同して低圧空気のための通路を画定する半径方向の溝15

5 1

環状の支持体28が水平軸線の周りに回転するようにハブ20に互いに軸線方向に離隔した環状軸受リング30を介して取付けられている。ハブ20を中心とする支持体28の回転は、管状支持体14内に軸受32を介して回転自在に支承された駆動軸31によって行われる。駆動軸31は、その一端に固定された駆動歯車34によって回転される。駆動軸31の他端には、半径方向のフランジ36が固定されており、該フランジにディスク38がボルト止めされ、ディスク38に外側端板39がボルト止めされている。外側端板38は、板138と板139の2部片で構成するのが好便である。板138は、各外側ステーションSに真空及び、又は低圧空気を供給するための溝37を有し、ディスク38に取付けられている。板139は、板139に付設され、溝37と協同して真空及び、又は低圧空気のための通路を画定する。これらの通路は、スリーブ18の導管19に接続し(第8図)、取付板12及び真空又は低圧空気源に連絡する。

5 3

が形成されている。支持構造体10と、取付板12との間に真空室25が画定されている。取付板12の適所に穿設された真空通路又は溝84、86(第13図)は、各ステーションSへ真空を伝える連絡通路を構成する。円筒形スリーブ18が、管状支持体14にそれと同心的に取付けられ、かつ、取付板12の段付板13に固定されている。スリーブ18は、真空又は低圧空気をドラム27の外側端に連通するための導管19を有している。真空室25と導管19とは、板13の適所に穿設された通路又は開口85、87(第13図)によって連絡されている。

スリーブ18の両端間の中間にハブ20が固定されており、ハブ20の両側にカムスリーブ22がボルト止めされている。各カムスリーブ22は、その円筒表面にカム溝24を有し、両端に特定輪郭のカム表面26を有している。ハブ20は、それにボルト止めされる環状の輪歯車48(第8図)を挟持するように2つの部片で構成するのが好都合である。

5 2

内側端板40は、静止取付板12に近接してリング軸受140を介してスリーブ18に回転自在に取付けられている。真空及び低圧空気は、板13に穿設された通路84、85、86、87(第13図)を通して直接各内側ステーションSへ供給される。各内側ステーションの導管76(第5~8図)は、内側端板40を貫通して板13に近接した点、好ましくは約0.1mmにまで近接した点にまで延長している。これによって板13と導管76との間に連通が設定され、ステーションSへ真空又は低圧空気を供給するようになされている。

各ステーションにおいて、2本の軸41が一端を支持体28に連結され、他端をそれぞれ板39及び40に連結されている。これらの軸は、中央駆動軸31によって支持体28が回転される際のドラム27の各回転部材に構造的支持を与える。

環状支持体28は、ステーションの各長手方向の対、即ち縦列対の間で該支持体の周縁に配設さ

5 4

れた3つの回転自在の軸受スリーブ42を有しており、それらの軸受スリーブに互いに反対向きに、背中合わせに配置された回転自在のスピンデル44が支承されている。各スピンデル44は、円錐端46を有する。円錐端46は、ジャケットセグメントAのチューブ状支持部材4（第1図）の端縁に銜接するように寸法づけされた胴部45（第6図）を有することが好ましい。

第5図に明示されるように、環状の輪歯車48が、ステーション対の間で固定ハブ20に取付けられており、該輪歯車48に啮合する3つの平歯車50が円周方向に間隔を置いて配置され、回転自在の支持体28に取付けられている。各平歯車50は、支持体28に回転自在に支承された軸54に固定された駆動歯車52に固定されている。それによって、ハブ20及び輪歯車48を中心とする支持体28の回転により3つの駆動歯車52が回転される。スピンデル44の軸受スリーブ42と一体にスピンデル歯車56が設けられており、各駆動歯車52が、14個のスピンデル歯車

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56から成る搬送手段が2本の水平軸41に摺動自在に装着されている。キャリッジ60は、スピンデル44に対して相対的に軸41に沿って軸線方向に摺動自在である。各キャリッジ60は、その軸線方向の往復動を行うために、該キャリッジ内でスピンデル65に摺動自在に装着された内部連結部材64（第6図）を備えている。連結部材64は、回転スピンデル44の方にばね偏倚（ばね押し）されている。各連結部材64は、カムスリーブ22のカム溝24内に回転自在に配設されたカム従節62を有している。カム溝24は、ドラム27が回転されるのに応答して、連結部材64、従ってキャリッジの軸線方向の往復動を行うように賦形された輪郭を有している。

クランプ66は、スピンデル44の軸線に併行にキャリッジに対して移動しうるように支持腕78を介してキャリッジ80に取付けられている。支持腕78は、ピボット点80でキャリッジ60に、軸82で連結部材64に回転自在に連結されている（第6、7図）。このように、クランプ6

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列中の1つのスピンデル歯車56に啮合し、14個のスピンデル歯車56全部を同時に駆動するようになされている。各スピンデル歯車56は、軸受スリーブ42に取付けられており、それによって1組の背中合わせのスピンデル44を回転させる。14個のスピンデル歯車から成る各歯車列の末端に位置するスピンデル歯車56は、それに隣接するスピンデル歯車列の末端に位置するスピンデル歯車56とは啮合しないようにする。この目的のために、末端のスピンデル歯車56の歯車歯の歯幅を他のスピンデル歯車のその二分の一未満とし、その二分の一未満の歯幅の歯車歯が、それに隣接する末端スピンデル歯車56の二分の一未満の歯幅の歯車歯とは互いに側方にずれるように配置して啮合しないようにする。かくして、固定ハブ20に対する支持体28の回転により、各々14組のスピンデル44から成る3列のスピンデル44をドラム27の回転軸線に平行なそれぞれの水平軸線の周りに回転させる。

各ステーションには、キャリッジ60とクラン

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6の移動も、カム溝24の輪郭によって行われる。各クランプ66は、ジャケットセグメントAをスピンデル44に押し嵌めする際ジャケットセグメントの側方の移動を拘束するために、スピンデル44から離れた所に配置され、好ましくは上下に移動自在の押え部材67を有している。（ここで、「ジャケットセグメントをスピンデルに押し嵌めする」とは、相対的にいえば、「スピンデルをジャケットセグメントに突刺す、即ち、挿入する」ことであり、それによってジャケットセグメントに孔がつけられる。）押え部材67は、その下をキャリッジ60が通る際上方へ移動することができるよう板ばねを介してクランプ66に取付けることができる。それによって、キャリッジと押え部材との間に僅かな不整列（位置づけの誤差）が存在しても、両者の間に結まりや破損が生じるのを回避することができる。

第14及び15図は、エアゾール発生カートリッジBをジャケットセグメントB内へ挿入するために押え部材67を持上げるための好ましい機構

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を示す。この機構は、押え部材67を取付けた支持ブリッジ120と、該支持ブリッジに取付けられたカム従節112を有する。支持ブリッジ120は、ピボット115でクランプ66に枢動自在に取付けられている。押え部材67は、その外側表面からキャリッジ60の凹所70、72と整合する開口71にまで延長したテーパ表面117を有することが好ましい。カートリッジをジャケットセグメントに挿入する工程のためにカム従節112が例えばドラム27のフレーム(図示せず)に取付けられた静止カム表面110に接触すると、カム従節112がカム表面110によって第15図でみて右方へ移動され、支持ブリッジ120をびばと点115で枢動させ、それによって押え部材67を上昇させて、カートリッジBを押え部材67に接触することなく開口71を通して通過させる。

各キャリッジ60は、スピンドル44の軸線と一致する軸線を有する(即ちスピンドル44と同心関係をなす)3つの外向き凹所70(第6、9

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を有する。穴73は、ジャケットセグメントがスピンドル44の方へ移動するのを拘束するが、スピンドル44がジャケットセグメントに孔を形成するために通過するのを可能にし、ジャケットセグメントから吐出される(突き出される)支持部材4の通過を許すように寸法づけされている。各キャリッジ60は、又、凹所70と同心関係をなす3つの外向き凹所72(第6図)によって画定される第2支持区域を有する。凹所72は、エアゾール発生カートリッジB(第2図)をジャケットセグメントAの軸線に整列して受容し支持するように寸法づけされている(第8図参照)。各円筒形の凹所70は、キャリッジ60の長手方向に延長し、端板39、40に取付けられ端板の通路に接続された導管又は通路76に流体連通した複数のオリフィス74を有する。各凹所72も、通路76に流体連通した複数のオリフィス74を有する。これらのオリフィス74は、コンポーネントを凹所70、72内に軸線方向に整列した状態に保持するための真空を供給し、又、それらの

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図)によって画定される第1支持区域を有する。凹所70は、ジャケットセグメントA(第1図)を受容し支持するように寸法づけされている(第8図参照)。各クランプ66は、凹所70と同寸法で、それと補完関係をなし、凹所70と整列し協同してジャケットセグメントAの移動を拘束するクランプ66に取付けられた押え部材67は、凹所70と整列した開口71を有している。開口71は、ジャケットセグメントの側方の移動を拘束するが、エアゾール発生カートリッジBをジャケットセグメント内へ挿入する場合、エアゾール発生カートリッジBの軸線方向の移動を許すように寸法づけされている。

凹所70のスピンドル側の端部のところには、ジャケットセグメントをエアゾール発生カートリッジに押し嵌めする(相対的にいえば、カートリッジをジャケットセグメントに突刺す、即ち挿入する)際ジャケットセグメントの側方の移動を拘束するための押え板75が配設されている。押え板75は、凹所70と整列した穴73(第6図)

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凹所から屑片等の異物を除去するために適宜の時間間隔を置いて低圧空気を噴出させる。

好ましい実施例においては、取付板12の溝84、86が、オリフィス74に真空を供給するように真空室25への流体連通を設定し、取付板12の開口85、87が、オリフィス74に低圧空気を供給するように構成する。取付板12の溝84、86及び開口85、87は、第13図に移送ドラムD1、D2、D3の位置との関連で示されている。低圧空気の圧力は、約4バールとし、真空度は、約70〜80ミリバールとすることが好ましい。

図示の実施例では、各ステーションは、当該ステーションで組立てるべきエアゾール発生モジュールの各々に対して1つつつ、合計3つの衝接部材68を有している。第5、8図に示されるように、衝接部材68は、端板39、40に枢動自在に取付けられたブラケット69にボルト止めされており、スピンドル44に対して軸線方向に移動自在である。各衝接部材68は、ばね96(第8

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図)によってスピンドル44の方に向けてばね偏倚(ばね押し)されており、常態では端部92においてブラケット69の突部93(第7図)に係合する掛金90によって後退位置に掛止され、後述するように適宜に解放されてスピンドル44の方へ押圧される。掛金90は、端板39、40に取付けられた支持部材91に駆動自在に取付けられている(第7図)。掛金90の駆動は、その他端に取付けられたカム従動100がカムスリーブ22の端部の特定輪郭のカム表面26に係合し該カム表面に従って動かされることによって行われる。

作動において、ジャケットセグメントAは、回転する組立ドラム27上のキャリッジ60に形成された凹所70(第5図)に好ましくは移送ドラムD1によって装填される。カム溝24に沿っての連結部材64と、支持腕78の動作によりクランプ6は、キャリッジに対して相対的にスピンドル44の方に向かって動かされ、凹所70内のジャケットセグメントAを抱持する。次いで、カム溝

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されるようにカートリッジBのカプセル5及び燃料素子7をそれぞれジャケットセグメントBのロッド2の孔1及びスリーブ3内へ突刺す。この移動中、スリーブ3内のプラスチック製チューブ状支持部材4は、カプセル5の端縁とスピンドル44の円錐端46の側部45との間に保持され、最終的にスリーブ3からロッド2の孔1を通して吐出される。押え部材67は、ジャケットセグメントAをスピンドル44に押し嵌めるときジャケットセグメントの軸線方向の移動を拘束するが、カートリッジBの通過を許すのに十分な大きさの穴又は開口71を有する。クランプ66及びキャリッジ60がスピンドル44から離れる方向に衝撃部材68に対して更に移動すると、クランプ66は組立てられたエアゾール発生モジュールM(第3図)から離脱し、掛金90を再び衝撃部材68に係合させる。次いで、エアゾール発生モジュールMは、真空作用が解除されることによってキャリッジ60から解放され、移送ドラムD3(第4図)上へ引き渡される。

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24に沿っての連結部材64の動作によりクランプ66とキャリッジ60とが一緒に回転するスピンドル44に向って移動し、押え部材67によって拘束されているジャケットセグメントAをスピンドル44に押し嵌めする。この時点で、エアゾール発生カートリッジB(第2図)が、好ましくは移送ドラムD2(第4図)によってキャリッジ60の凹所72に装填される。次いで、衝撃部材68が、カム表面26の作用により掛金90から解放され、ばね96の作用によってカートリッジBに係合せしめられてそれをジャケットセグメントAに押しつける(第8図)。

カム溝24に沿っての連結部材64の作用によりクランプ66とキャリッジ60と一緒にスピンドル44から離れる方向に移動され、それによって、スピンドル44によって突刺されロッド部分2に孔をあけられたジャケットセグメントAをスピンドル44から引抜き、衝撃部材68の対向押圧力と協力してジャケットセグメントAをエアゾール発生カートリッジB押し嵌めし、第3図に示

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第11A図～11H図及び第12A図～12O図は、組立ドラム27上の各ステーションにおける作動順序を概略的に示す。即ち、第11A～11H図は、キャリッジ60.1とカム表面24.1及び26.1との相互作用、及びキャリッジ60.1と、クランプ66.1と、衝撃部材68.1との間の相対移動を概略的に示す。第12A図～12O図は、各ステーションで3つのエアゾール発生モジュールMを組立てるための好ましい装置のキャリッジ60.1、クランプ66.1及び衝撃部材68.1の作動を概略的に示す。これらの図は、各部品の相対的移動及び相対位置を単に例示するためのものである。

第11A及び第12A図は、クランプ66.1がジャケットセグメントAを装填するためにスピンドル44.1から変位された位置におかれたところを示す。この位置では、キャリッジ60.1上の凹所70.1が露出される。この時点で、好ましくはタバコ材ロッドと、チューブ状支持部材を有する断熱材スリーブとから成るジャケットセグメント

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Aが、第11B、第12B図に示されるようにスピンドル44.1の軸線に整列するようにして凹所70.1内に装填される。次いで、第11C図に示されるように、連結部材64.1がカム溝24.1に追従するカム従節62.1と共に移動され、その結果、支持腕78.1によってクランプ66.1が、ジャケットセグメントAを抱持する位置へ移動される(第12C、12D図参照)。

クランプ66.1がセグメントAを抱持する位置へ移動した後、キャリッジ60.1が、カム溝24.1と協同するカム従節62.1及び連結部材64.1によってスピンドル44.1に向けて移動される。その際、キャリッジ60.1は、クランプ66.1によって抱持されたジャケットセグメントAを連行し、第11D、12E及び12F図に示されるようにジャケットセグメントを回転するスピンドル44.1に押し嵌めする。この位置(第11D、12F図)では、凹所72.1がクランプ66.1と銜接部材68.1との間に露出される。

次に、エアゾール発生カプセルと燃料素子とか

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うにそれらの初期位置へ移動され、複合構造物即ちエアゾール発生モジュールMを解放して取り出し可能な状態とし、掛金90.1を銜接部材68.1に再係合させる。

このような順序作動により上記装置は、プラスチック製チューブ状支持部材に巻かれた断熱材スリーブを一端に有するタバコ材ロッドにスピンドルを突き刺してタバコ材ロッドに断熱材スリーブの内径に相当する縦孔を形成し、次いで、エアゾール発生カートリッジをそれに形成された縦孔及び断熱材スリーブ内へ挿入する。

以上、本発明を実施例に関連して説明したが、本発明は、ここに例示した実施例の構造及び形態に限定されるものではなく、本発明の精神及び範囲から逸脱することなく、いろいろな実施形態が可能であり、いろいろな変更及び改変を加えることができることを理解されたい。又、本発明は、ここに例示の目的で開示した特定の喫煙物品材料に限定されるものではない。例えば、ジャケットセグメントの材料として、タバコ材やガラス繊維

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から成るエアゾール発生カートリッジBが、燃料素子を銜接部材68.1に軸線方向に対面させるようにして(第11E、12G図)クランプ66.1と銜接部材68.1との間に投入される。次いで、銜接部材68.1が、カム表面26.1と協同するカム従節100.1の作用により掛金90.1が引っ込まれる(後退される)ことによって解放される。かくして、ばね押しされた銜接部材68.1がカートリッジBに係合して該カートリッジを押圧しジャケットセグメントAに係合させる(第11F、12H図)。

次いで、キャリッジ60.1及びクランプ66.1がスピンドル44.1から離れる方向に移動され、それによってジャケットセグメントAをスピンドルから引き抜くとともに、ジャケットセグメントAをカートリッジBに押し嵌めし、チューブ状支持部材4をタバコ材ロッドの孔1を通して吐出させる(第11G、第12I〜J図)。最後に、キャリッジ60.1、クランプ66.1及び銜接部材68.1が、第11H及び12K〜O図に示されるよ

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うに、他の繊維質材料又は非繊維質材料を用いることができる。又、断熱材スリーブの素材も、繊維材以外の材料であってもよい。エアゾール発生カートリッジBの形態も、ここに例示した以外の形態とすることもできる。

4. 図面の簡単な説明

第1図は、タバコ材ロッドと、チューブ状支持部材の周りに形成されたスリーブとから成るジャケットセグメントの縦断面図、第2図は、エアゾール発生カートリッジの一部断面による立面図、第3図は、第1図のジャケットセグメントと第2図のエアゾール発生カートリッジを組合せることによって得られたエアゾール発生モジュールの縦断面図、第4図は、回転組立ドラムと、喫煙物品のコンポーネントを回転組立ドラム上へ装填するための回転移送ドラムD1、D2と、複合体Mを取出すための回転移送ドラムD3とから成る本発明の一実施例による装置の概略端面図、第5図は、本発明の好ましい実施例による装置の一部分

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の詳細断面図、第6図は、第5図の装置の1つの組立ステーションの部分拡大断面図、第7図は、第6図のステーションがジャケットセグメントをスピンドルに押し込み、カートリッジ時が装填されたところを示す拡大断面図、第8図は、第6図のステーションの拡大断面図であり、ジャケットセグメントがスピンドルに押し込まれ、衝接部材がカートリッジ時に係合したところを示す。第9図及び第10図は、それぞれ、第6図の線9-9及び線10-10に沿って見た部分断面図、第11A~11H図は、エアゾール発生カートリッジをジャケットセグメントに挿入する諸工程を実施するための第5図の装置の1ステーションの部分概略立面図、第12A~12D図は、第11A~11H図の装置の順次作動を示す部分概略平面図、第13図は、取付板の真空及び低圧空気通路を示す概略平面図、第14図は、カートリッジをジャケットセグメントに挿入する工程のために押入部材を待上げるための機構の立面図、第15図は、第14図の機構の一部断面によ

る側面図である。

- A : ジャケットセグメント
- B : エアゾール発生カートリッジ
- M : エアゾール発生モジュール
- D1、D2、D3 : 移送ドラム
- S : 組立ステーション
- 1 : ジャケットセグメントに形成された長手方向の孔
- 2 : 繊維質材のロッド
- 3 : 断熱材スリーブ
- 4 : チューブ状支持部材
- 5 : カプセル
- 7 : 燃料素子
- 10 : 支持構造体
- 14 : 管状支持体
- 18 : 円筒形スリーブ
- 20 : ハブ
- 22 : カムスリーブ
- 24 : カム溝
- 26 : カム表面

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- 27 : 回転組立ドラム
- 28 : 支持体
- 31 : 駆動軸
- 34 : 駆動歯車
- 39、40 : 端板
- 44 : スピンドル
- 46 : 円錐端
- 48 : 輪歯車
- 50 : 平歯車
- 52 : 駆動歯車
- 56 : スピンドル歯車
- 60 : キャリッジ
- 62 : カム従節
- 64 : 連結部材
- 66 : クランプ
- 67 : 押入部材
- 68 : 衝接部材
- 70、72 : 凹所
- 74 : オリフィス
- 75 : 押入板

- 76 : 導管又は通路
- 78 : 支持腕
- 90 : 掛金
- 98 : ばね
- 100 : カム従節
- 110 : カム表面

代理人の氏名 倉内基弘



代理人の氏名 風間弘志



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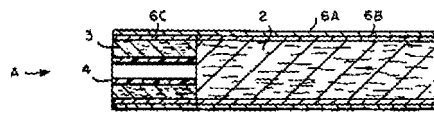


FIG. 1

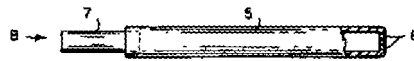


FIG. 2

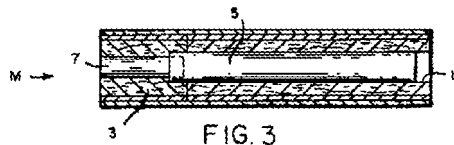


FIG. 3

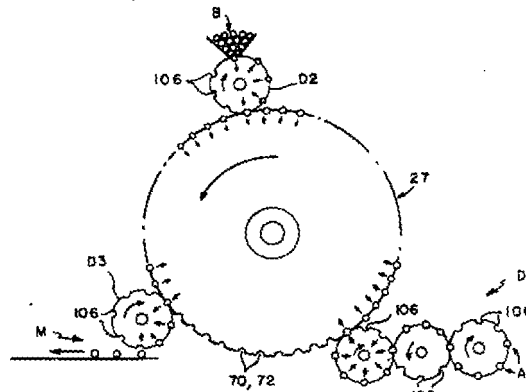


FIG. 4

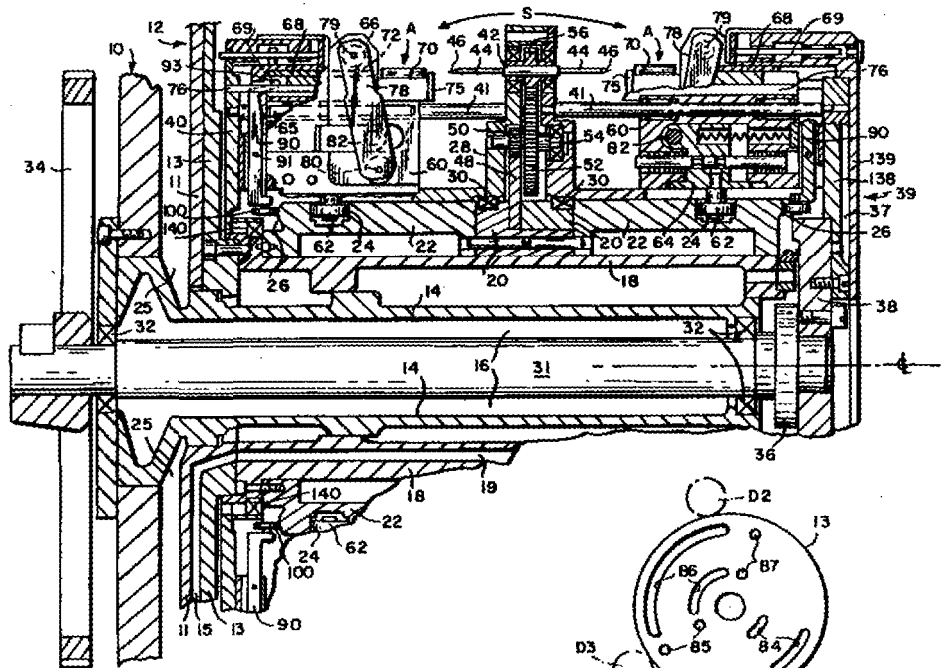


FIG. 5

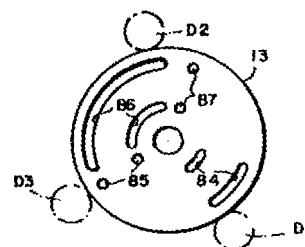


FIG. 13

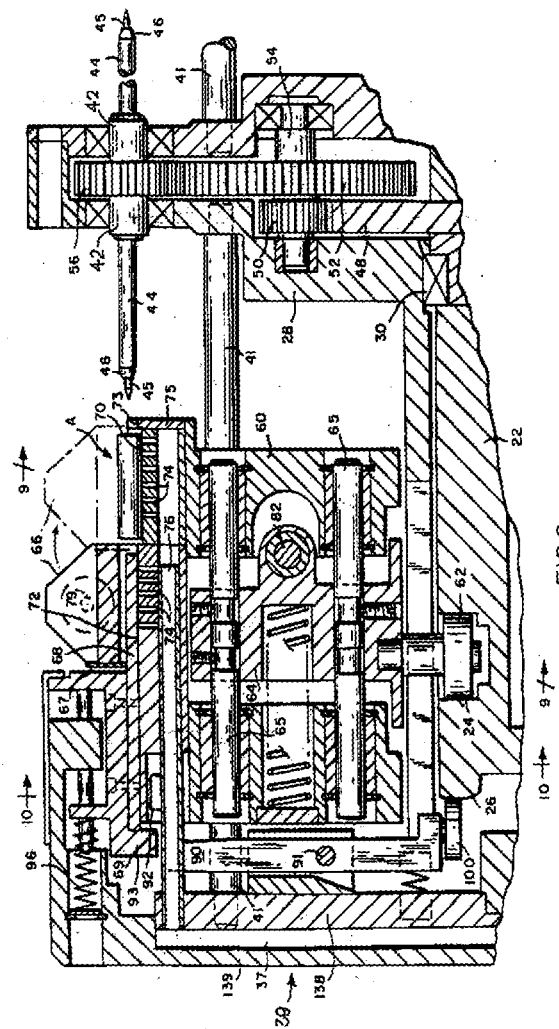


FIG. 6

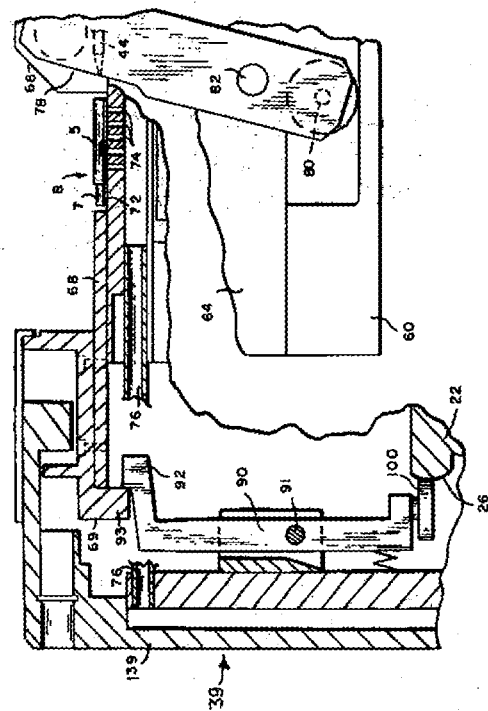
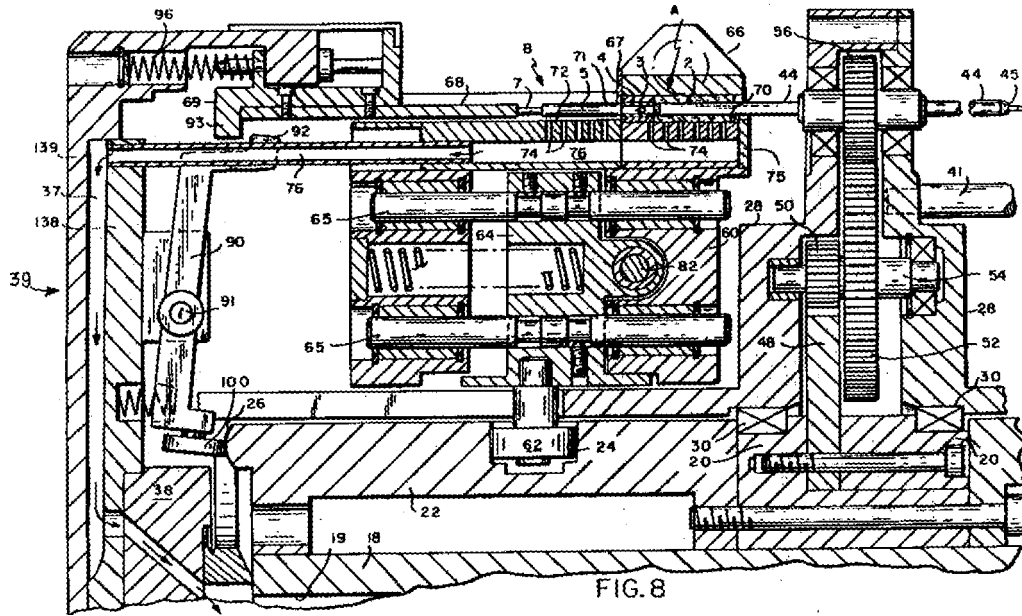
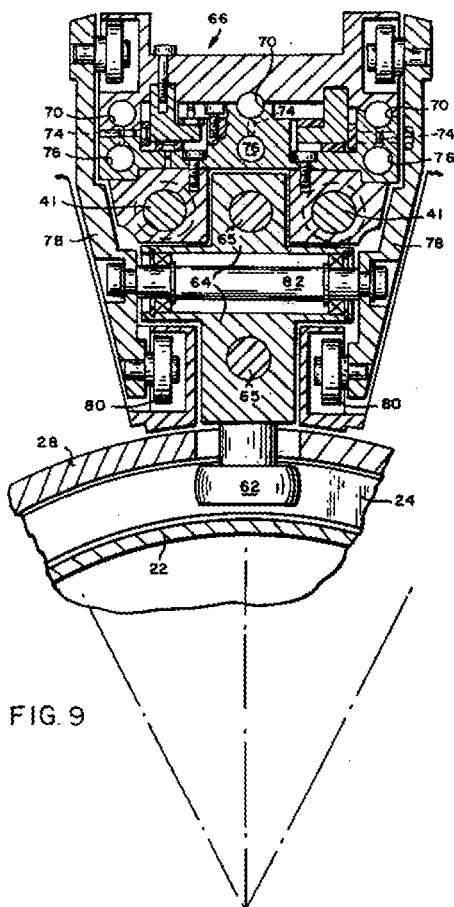
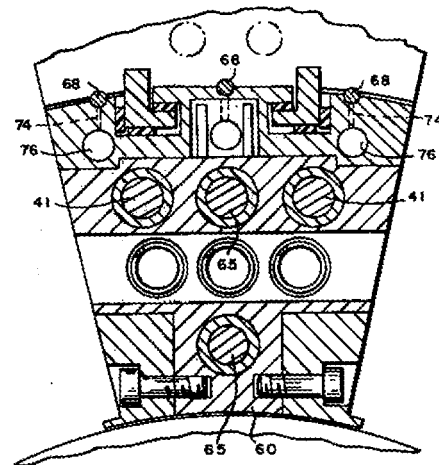
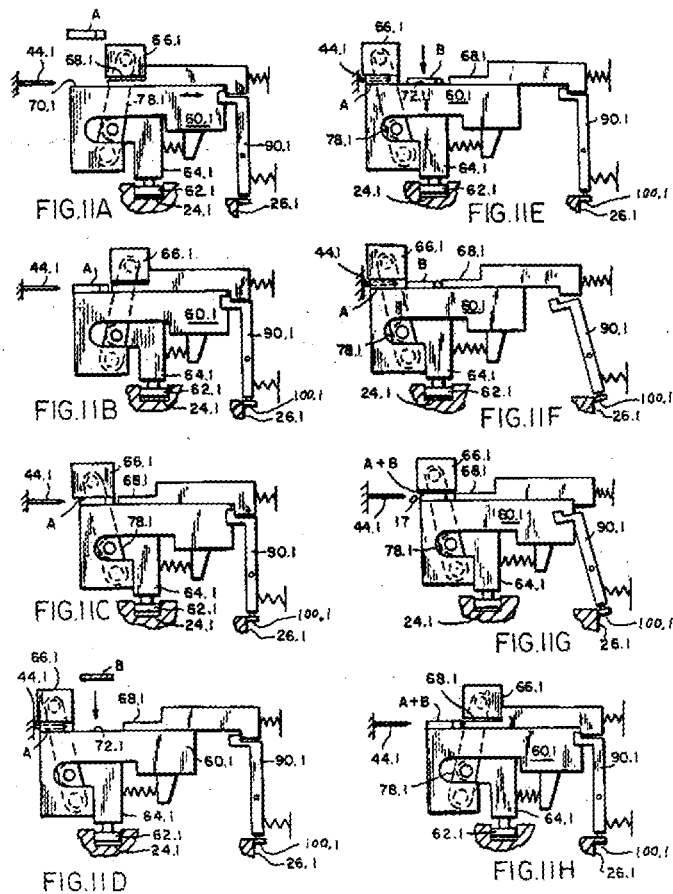
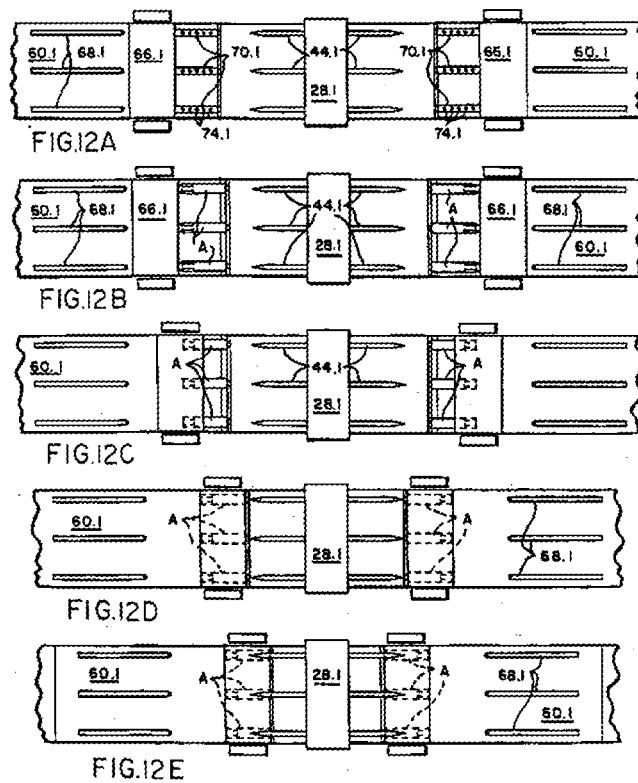


FIG. 7





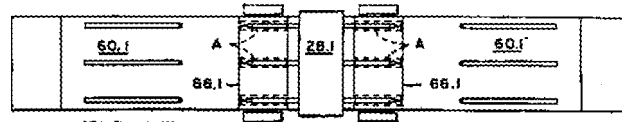


FIG. 12F

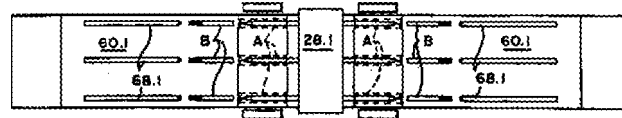


FIG. 12G

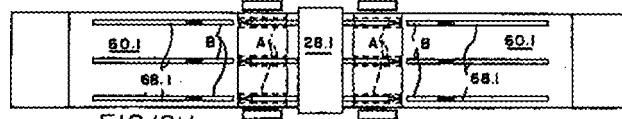


FIG. 12H

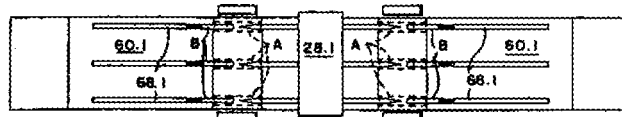


FIG. 12I

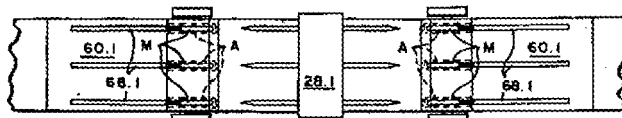


FIG. 12J

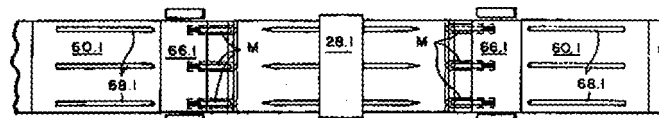


FIG. 12K

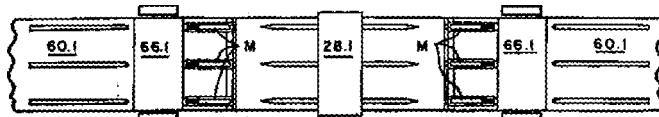


FIG. 12L

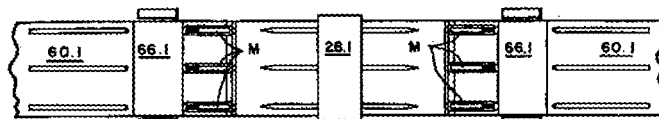


FIG. 12M

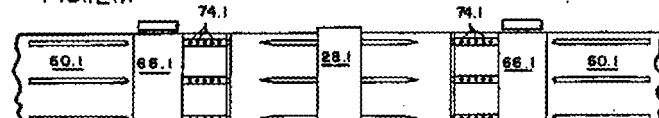


FIG. 12N

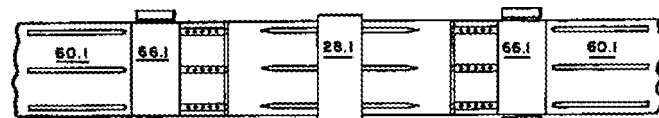


FIG. 12O

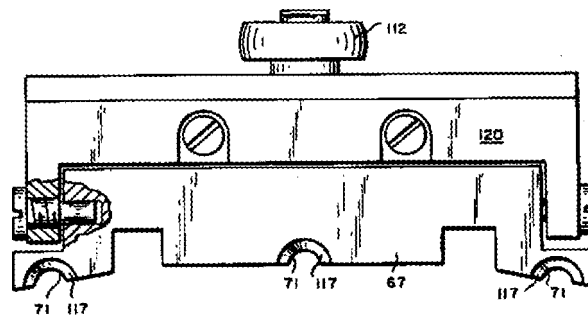


FIG. 14

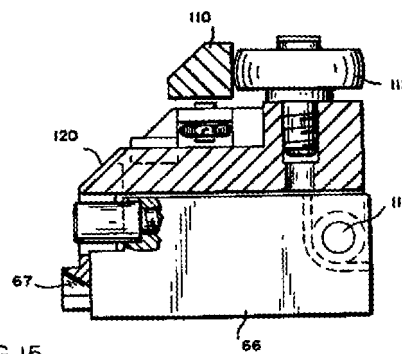


FIG. 15

第1頁の続き

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United States Patent [19]

Hensgen et al.

[11] Patent Number: 4,870,748

[45] Date of Patent: Oct. 3, 1989

[54] APPARATUS FOR ASSEMBLING ELEMENTS OF A SMOKING ARTICLE

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[21] Appl. No.: 74,811

[22] Filed: Jul. 17, 1987

[51] Int. Cl.⁴ A24C 5/18; B23P 21/00

[52] U.S. Cl. 29/773; 131/84.1;
131/94; 131/369

[58] Field of Search 29/776, 773; 53/151;
131/77, 84.1, 94, 108, 369, 273; 198/461

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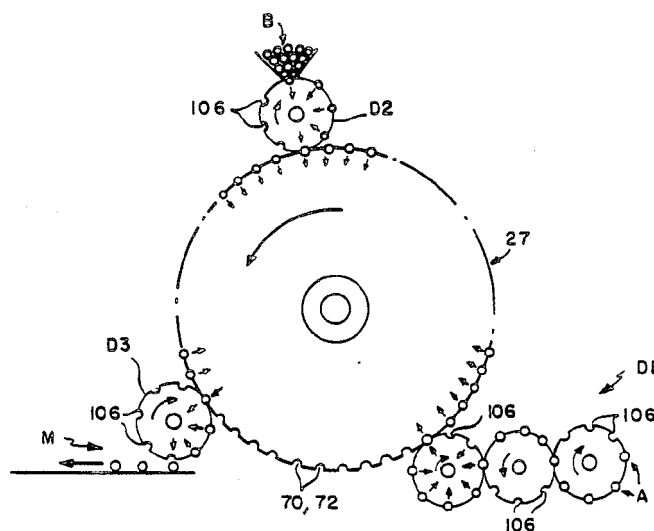
Primary Examiner—Timothy V. Eley

Attorney, Agent, or Firm—Grover M. Myers; David G.
Conlin

[57] ABSTRACT

An apparatus for making smoking articles is described. The preferred apparatus comprises structure to form a passage axially through a jacketed rod of tobacco, at one end of which there is a tubular sleeve of non-combustible material, and to insert an aerosol generating cartridge containing an aerosol forming substance, at one end of which there is a fuel element, into the passage so that the aerosol forming substance is within the passage in the rod of tobacco and the fuel element is within the sleeve of non-combustible material.

74 Claims, 12 Drawing Sheets



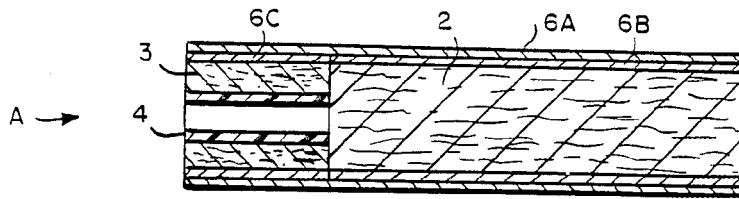


FIG. 1

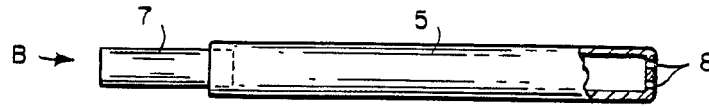


FIG. 2

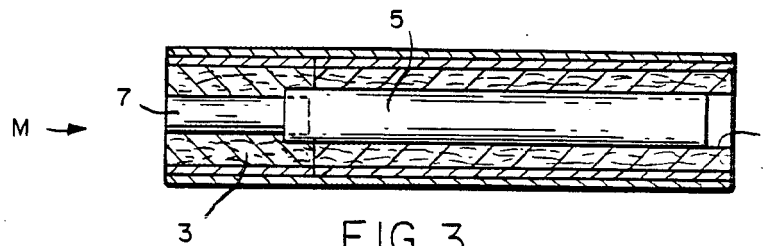


FIG. 3

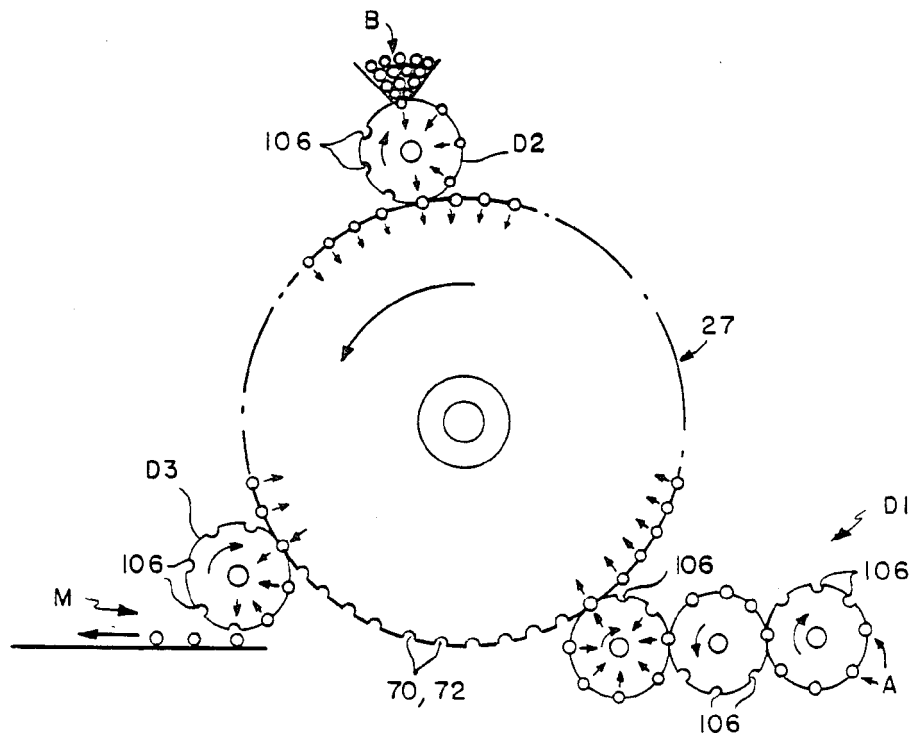
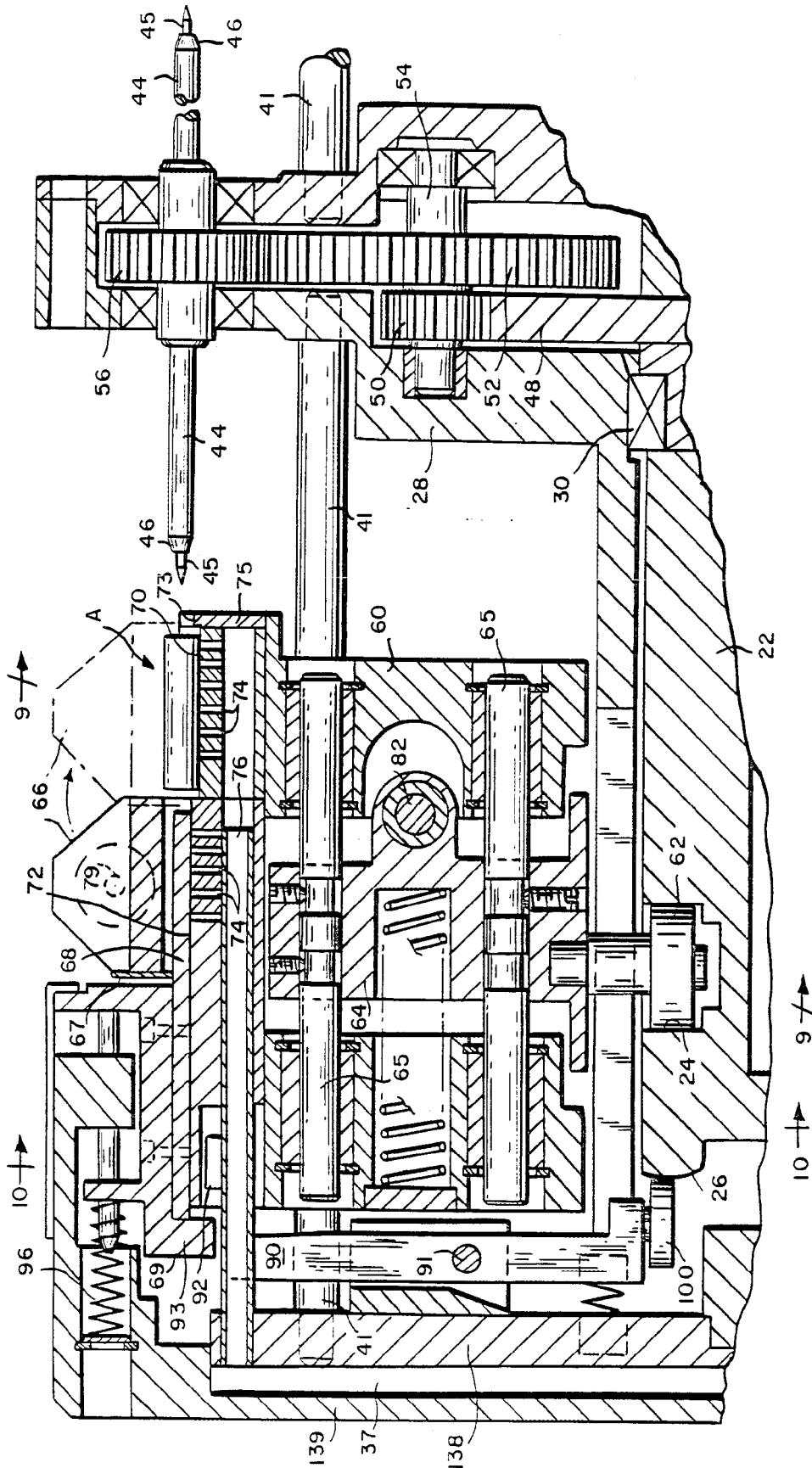


FIG. 4



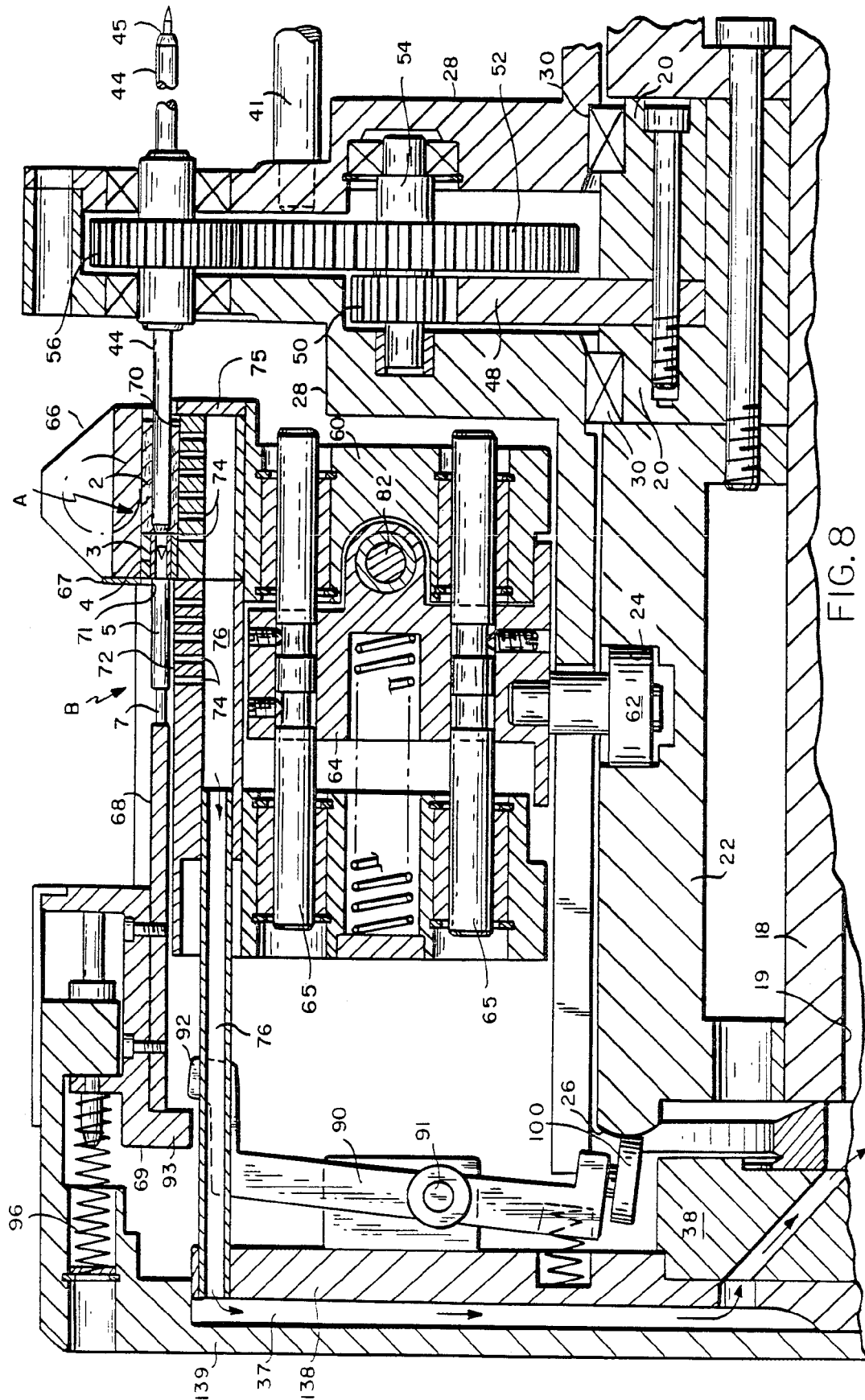


FIG. 8

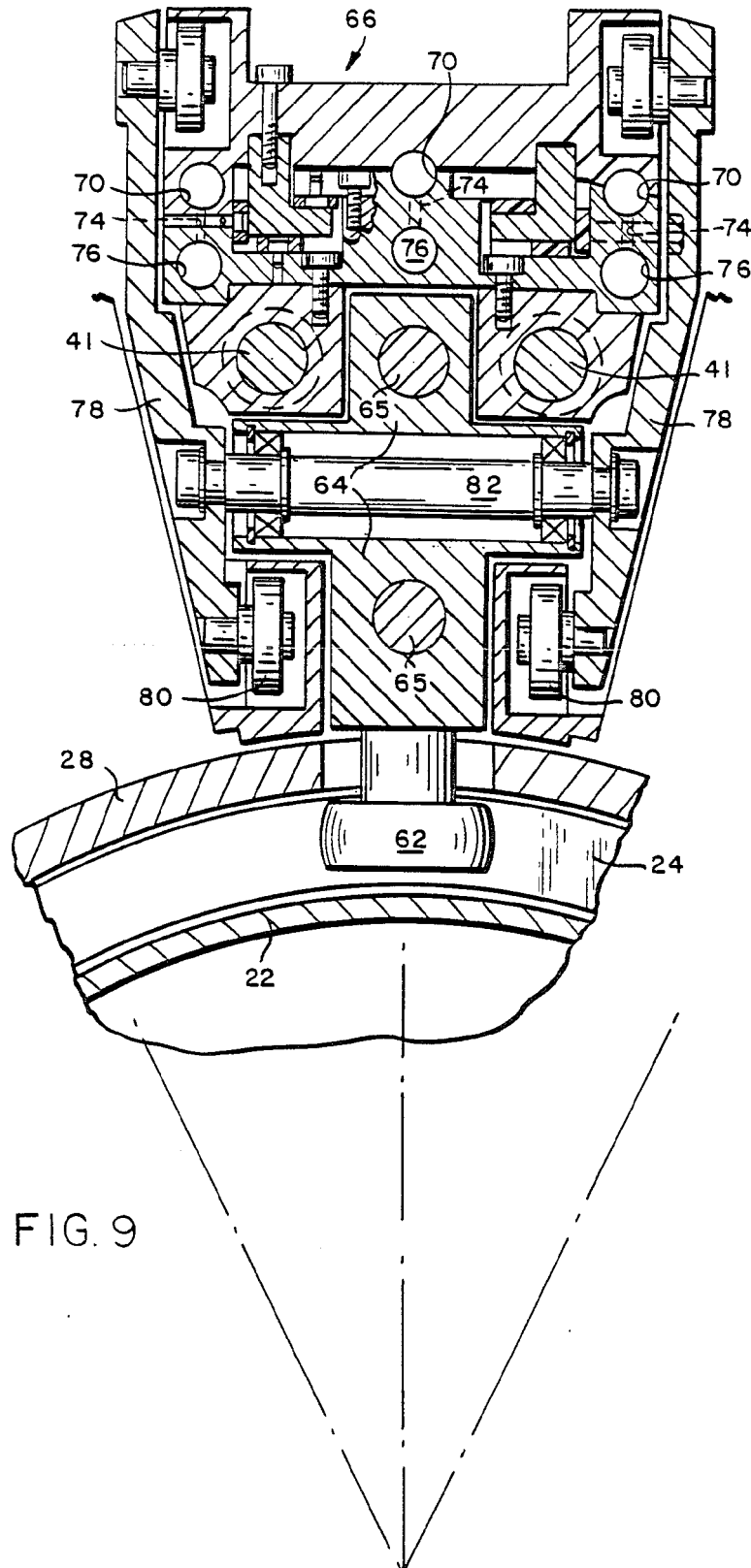


FIG. 9

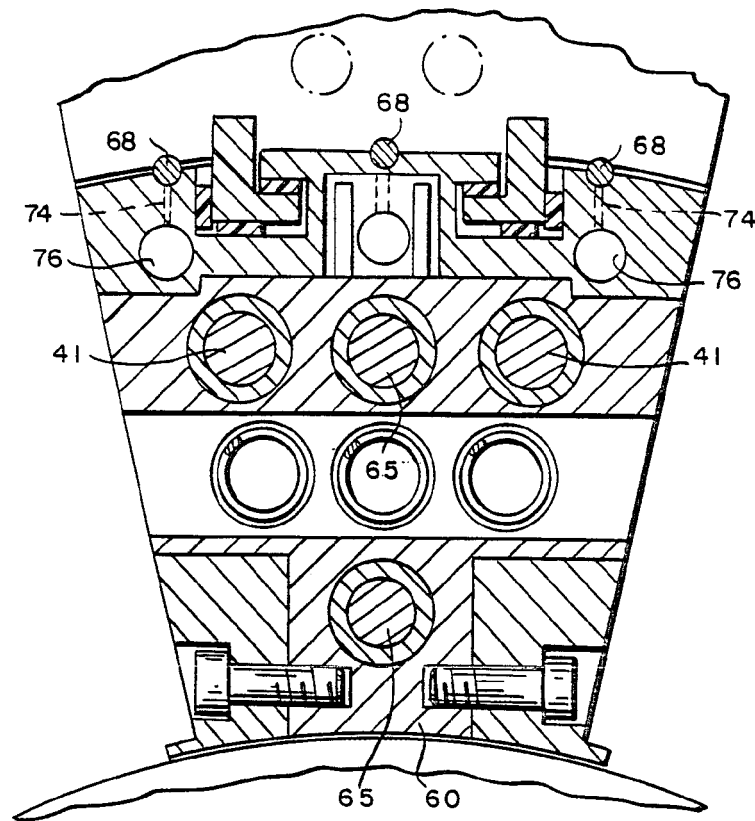
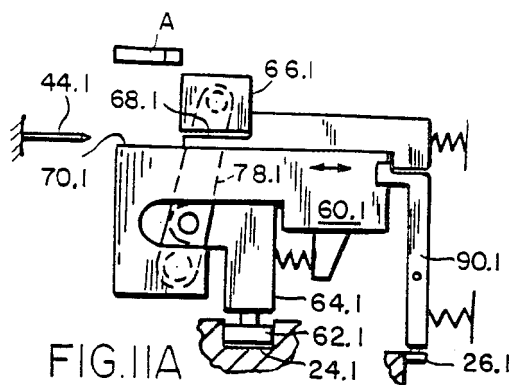
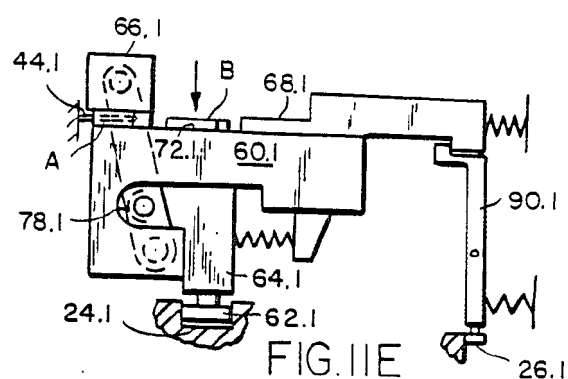
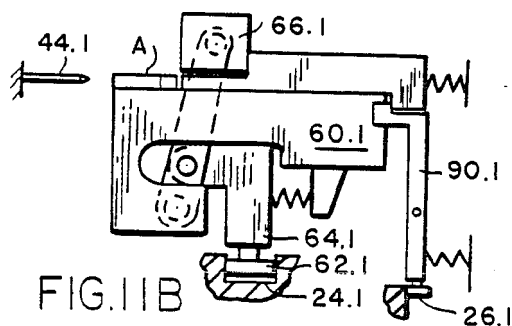
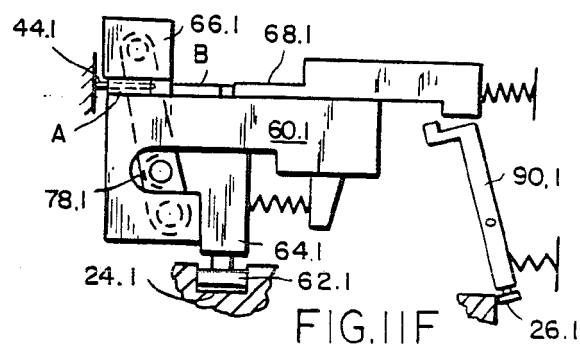
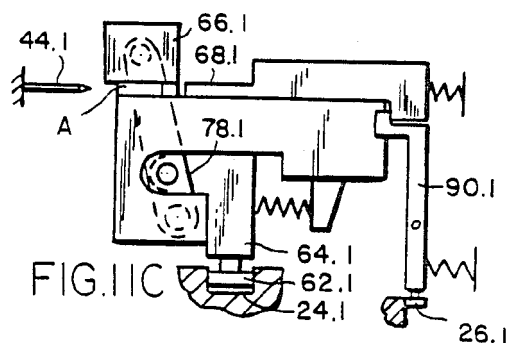
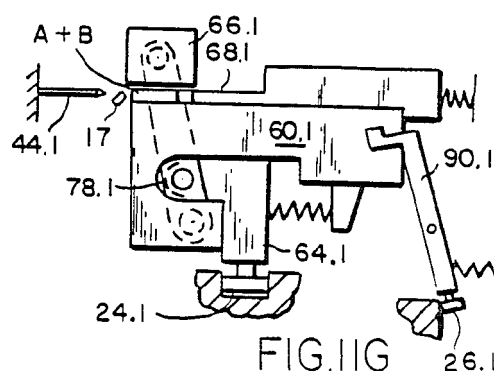
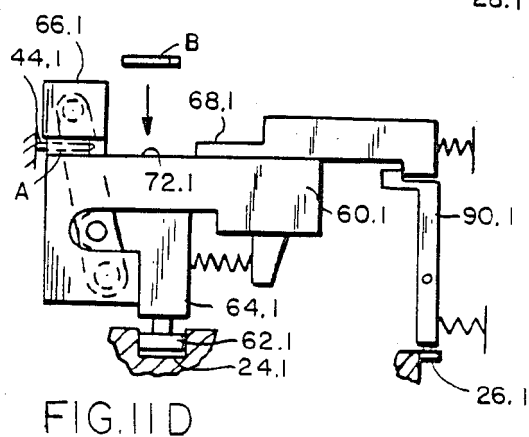
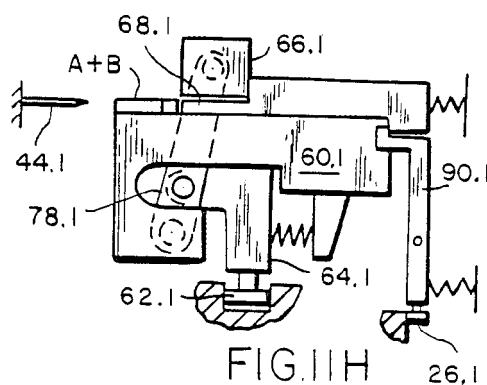
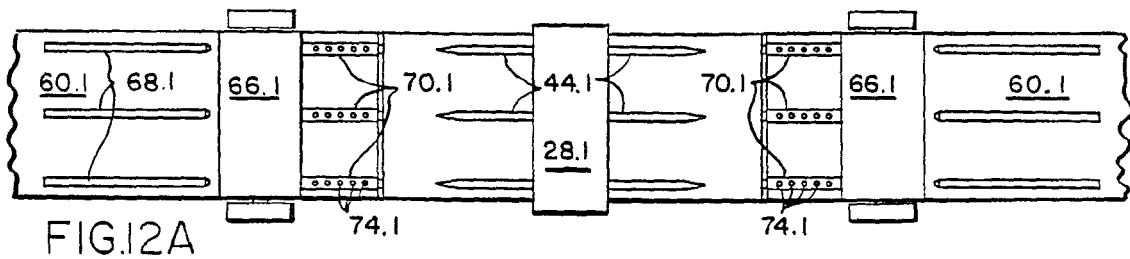
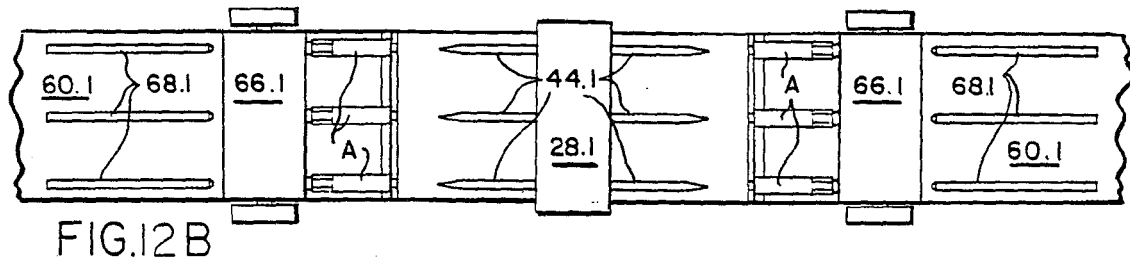
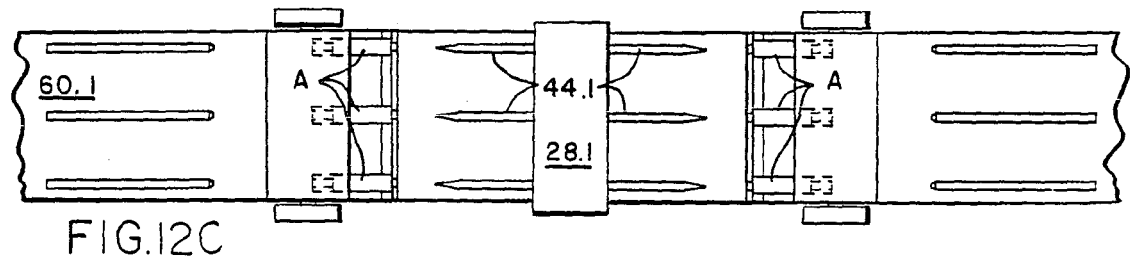
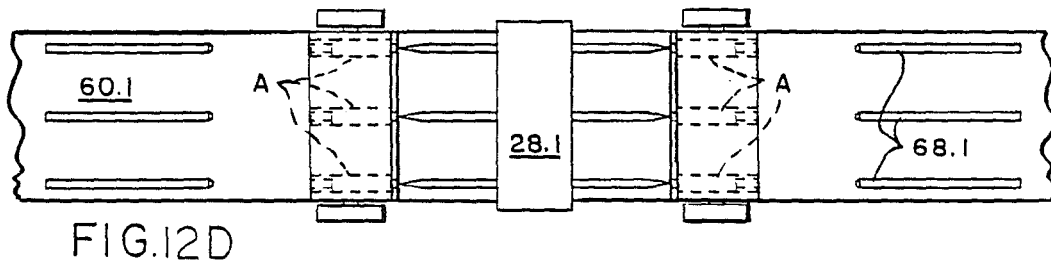
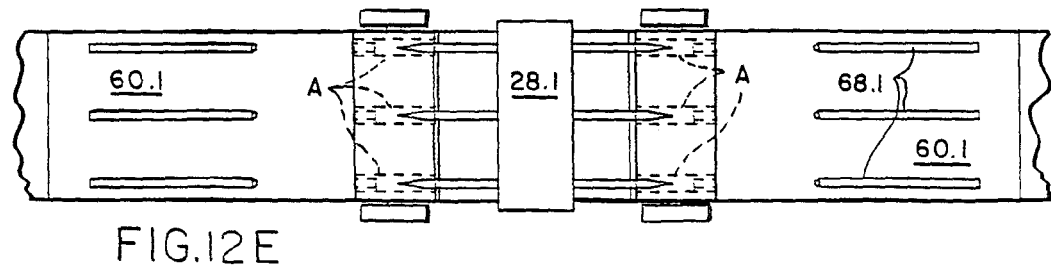


FIG. 10





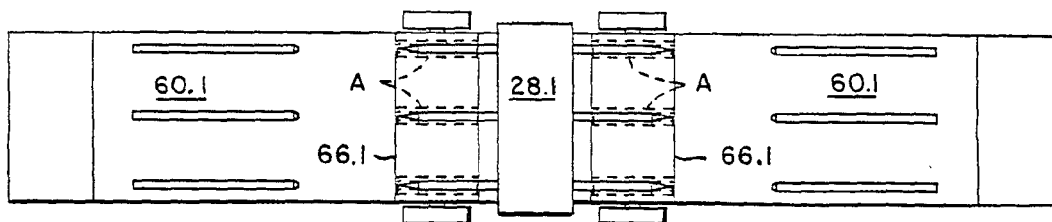


FIG. 12F

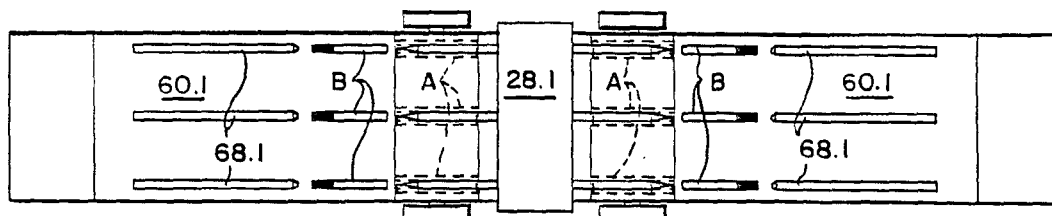


FIG. 12G

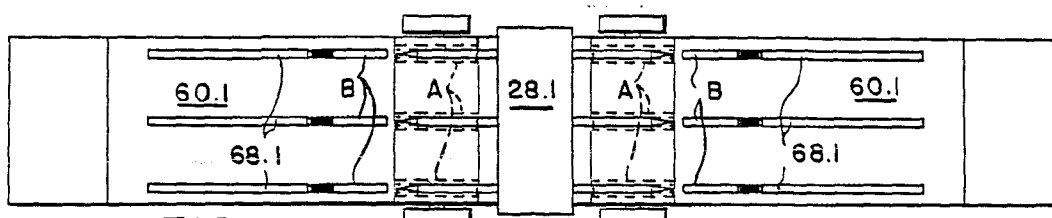


FIG. 12H

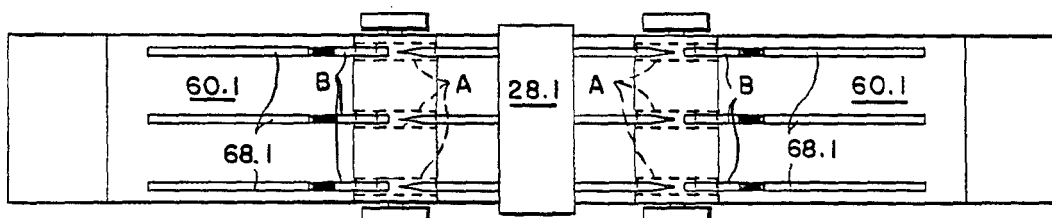


FIG. 12I

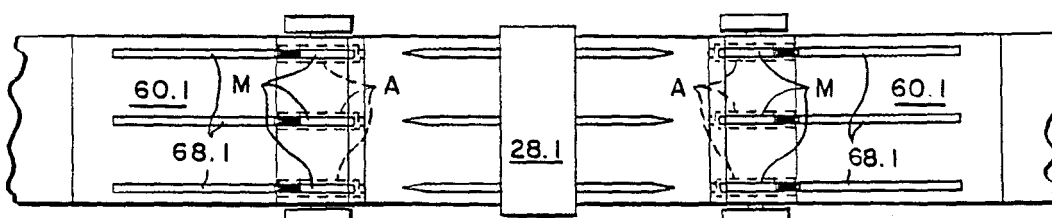
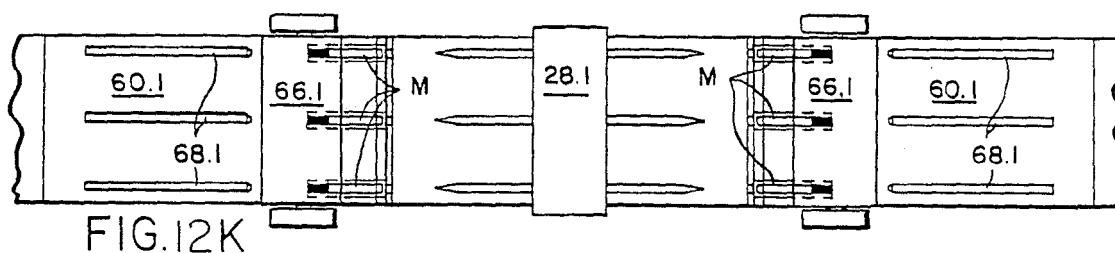
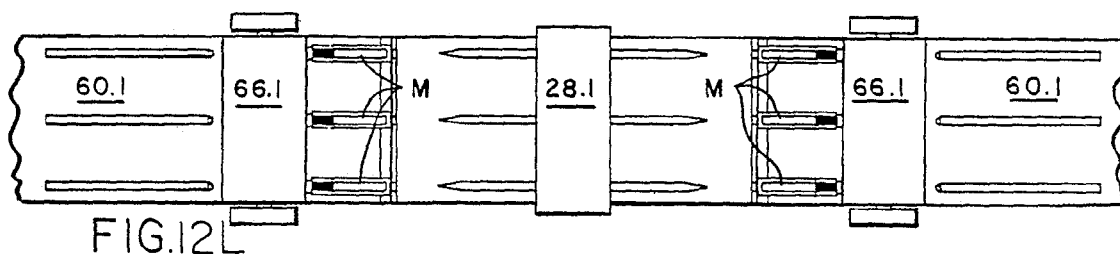
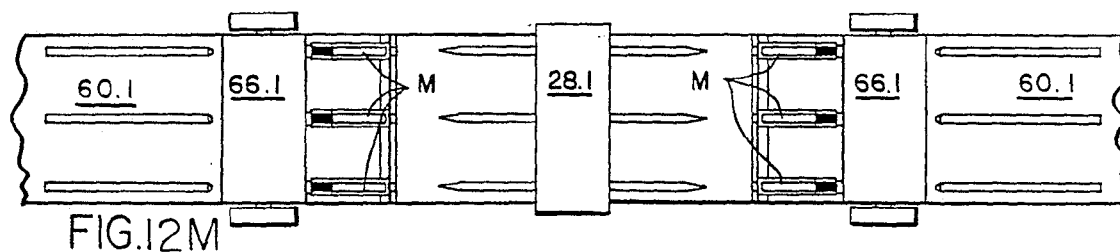
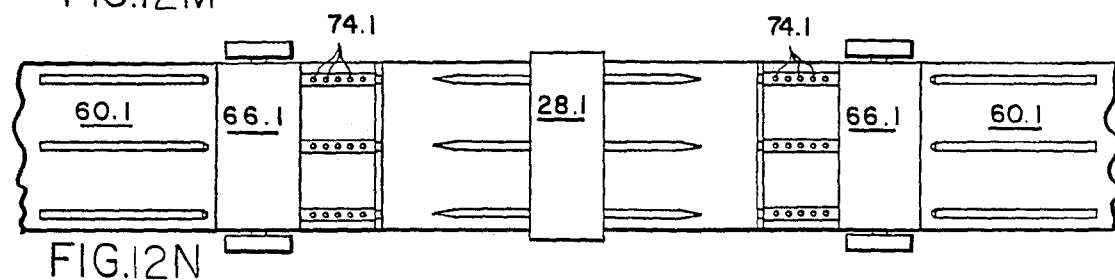
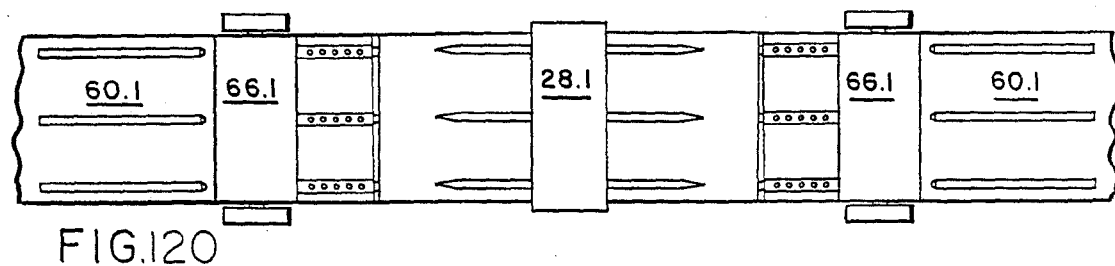


FIG. 12J



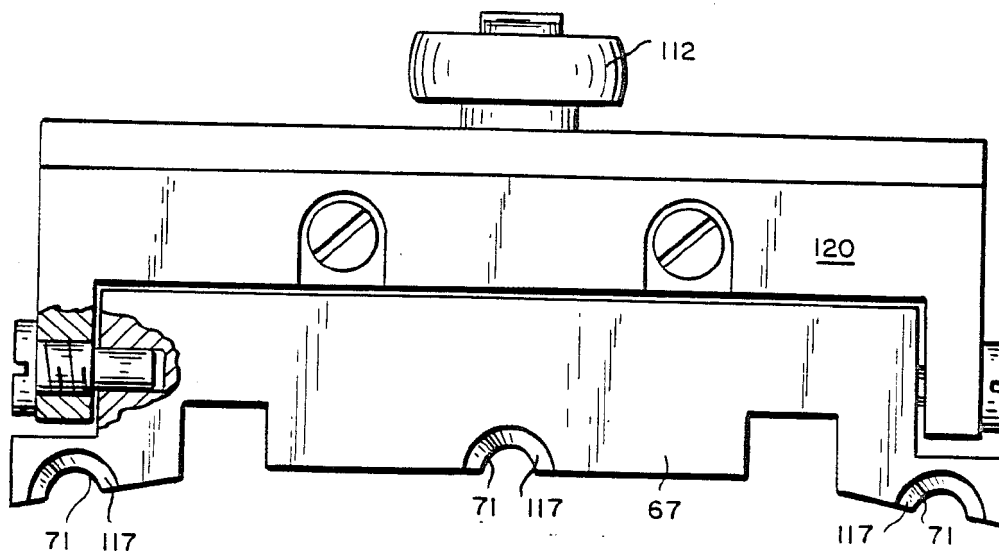


FIG. 14

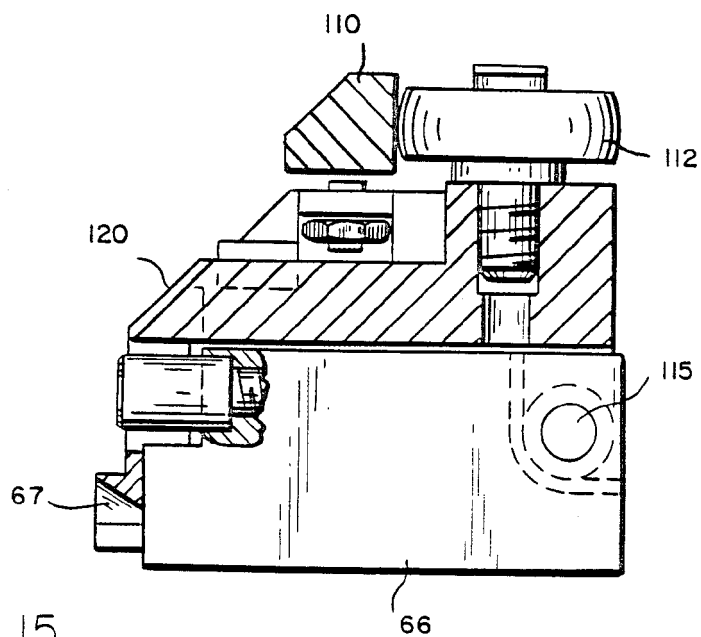


FIG. 15

APPARATUS FOR ASSEMBLING ELEMENTS OF A SMOKING ARTICLE

BACKGROUND OF THE INVENTION

In European Patent Publication Nos. 0174645(A2) and 0212234(A2), the disclosures of which are hereby incorporated by reference, there are disclosed a number of alternative forms of smoking articles which typically embody (1) an aerosol generating cartridge comprising a fuel element for generating heat for transfer to an aerosol forming material which may contain a tobacco flavoring material, (2) a sleeve or jacket circumscribing the cartridge, the sleeve preferably including an insulating material around the fuel element and a tobacco containing material around the aerosol forming material and, optionally, (3) a mouthend piece, which may contain a filter element. Generally, the aerosol generating cartridge of the smoking article comprises a capsule containing an aerosol generating material with a fuel element at one end.

It is a purpose of this invention to provide high speed production apparatus for combining such aerosol generating cartridges and sleeves to form aerosol generating modules.

SUMMARY OF THE INVENTION

In accord with the present invention, an apparatus for making modules, particularly aerosol generating modules for smoking articles is provided. The apparatus comprises (1) a rotatable drum, (2) a plurality of stations mounted around the drum, each station comprising jacket holding means for receiving and holding at least one jacket segment, and cartridge holding means for receiving and holding at least one cartridge or capsule, and (3) means for inserting cartridges into jacket segments, thereby forming modules for smoking articles. Preferably, the jacket segments comprise tobacco and the cartridges contain an aerosol generating material. Typically, the apparatus comprises jacket supply means for supplying jacket segments and cartridge supply means for supplying aerosol generating cartridges to the stations and means for removing the aerosol generating modules from each of the stations, in seriatim. Preferably, each station forms a plurality of aerosol generating modules in parallel.

In one preferred embodiment of the invention, the stations are preferably arranged in axially aligned mirror image pairs or tandem pairs around the periphery of the drum so that operations can take place in parallel at each pair of stations as the drum rotates. The stations preferably each include means for inserting cartridges into jacket segments.

In certain preferred embodiments in which the jacket segments comprise a sleeve of material preformed around a support member, such as a tube, the apparatus includes means for ejecting the support member from the jacket segments, preferably while an aerosol generating cartridge is being inserted into the jacket segment.

In another preferred embodiment, the apparatus further comprises means for forming a passage lengthwise in the jacket segment, and the aerosol generating cartridge is inserted into the passage.

In a particularly preferred embodiment, the passage is formed in the jacket segment by a passage forming member and the apparatus has means for withdrawing the passage forming member and simultaneously inserting the aerosol generating cartridge. In instances where

a portion of the jacket segment is formed around a support member, such as a tube, the withdrawing and inserting means also preferably includes means for ejecting the support member from the jacket segment while the cartridge is being inserted therein.

In the preferred drum configuration, means for ejecting a support member, insertion means and passage forming means, if required, are located at each station. Each station also preferably includes a slidable support means, which supports the jacket holding means and the cartridge holding means, and means cooperating with the jacket holding means for restraining movement of the jacket segment during passage formation and/or insertion of the cartridge. Preferably, the insertion means comprises an abutment member located proximate the cartridge holding means during insertion and means for effecting relative movement between the slidable support means and the abutment member to accomplish insertion of the cartridge at least partially into the jacket segment.

In one embodiment of the invention, means operable in connection with the rotation of the drum position the jacket segment and cartridge on the drum for insertion of the cartridge into the jacket segment and accomplish the insertion. When the jacket segment comprises a rod of material without a preformed passage, each station includes a passage forming means which forms a passage in the rod as the drum rotates. The aerosol generating cartridge is then inserted into the passage, and the completed module is removed from the station upon further rotation of the drum, leaving the station ready to receive another jacket segment and begin the cycle once again. When the jacket segment comprises a tube surrounded by a sleeve of material, each station includes means for rejecting the tube, preferably as the cartridge is inserted.

More specifically, one preferred embodiment of an apparatus for assembling components of a preferred smoking article according to this invention comprises a drum and a plurality of stations mounted on the drum, the stations preferably mounted in axially aligned pairs around the drum. Each of the stations comprises at least one spindle, means supporting the spindle for rotation about its longitudinal axis, a slidable abutment member, means supporting the abutment member in axially-spaced alignment with the axis of the spindle, transport means comprising a reciprocally movable support means or carriage embodying axially aligned recesses for receiving first and second components of the smoking article, and a restraining means or clamp movable in unison with, and relative to, the carriage. Preferably, each station includes two or more spindles, abutment members and sets of aligned recesses for the components, so that a plurality of sets of components may be simultaneously assembled at each station.

The restraining means or clamp is preferably operable, by movement relative to the carriage, to enclose the first components on the carriage. The clamp then moves with the carriage toward the spindle and into engagement with the spindle whereby the spindle pierces the first component. Thereafter, the clamp moves with the first component in an opposite direction, in unison with the carriage toward the abutment member to withdraw the pierced first component from the spindle, and impaling it on the second component. Thereafter, the clamp moves relative to the carriage to release the composite structure comprising the first

component with the second component inserted therein.

Rotation of the drum effects movement of the carriage and clamp as aforesaid. Desirably, the spindle is rotated, and there is means operable by rotation of the drum relative to the supporting frame to effect rotation of the spindle such as, for example, a train of gears.

Apparatus in accord with the present invention may additionally comprise means for supplying a mouthend piece and means for joining the mouthend piece to the aerosol generating module to form a cigarette type smoking article. In another embodiment, the apparatus may include means for inserting mouthend piece modules between two aerosol generating modules to make a composite structure that, when cut in half, forms two smoking articles.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in detail with reference to the accompanying drawings, wherein:

FIG. 1 is a longitudinal section of a jacket segment A comprising a rod of tobacco, at one end of which there is a sleeve of insulating material surrounding a tubular support member;

FIG. 2 is an elevation, partly in section, of an aerosol generating cartridge B comprising a capsule containing an aerosol forming material, at one end of which there is a fuel element;

FIG. 3 is a longitudinal section illustrating an aerosol generating module M consisting of aerosol generating cartridge B of FIG. 2 incorporated in jacket segment A of FIG. 1.

FIG. 4 diagrammatically shows one embodiment of an apparatus in accord with the present invention, comprising a rotating drum, with rotary transfer drums D1 and D2 for depositing smoking article components (e.g., jacket segments A and aerosol generating cartridges B) thereon, and rotary transfer drum D3 for removing the composite structure M therefrom;

FIG. 5 is a fragmentary longitudinal view of an adjacent or tandem pair of stations in a preferred embodiment of the apparatus, having various sectional views rotated about the axis to more clearly illustrate various features of the apparatus, and showing jacket segments A positioned thereon;

FIG. 6 is an enlarged fragmentary section showing one station of the apparatus of FIG. 5 in its initial position and having a jacket segment A positioned thereon;

FIG. 7 is an enlarged fragmentary section showing the station of FIG. 6 in the position having the jacket segment impaled on the spindle and having a cartridge deposited thereon;

FIG. 8 is an enlarged fragmentary section showing the station of FIG. 6 with the jacket segment impaled on the spindle, and with the abutment member engaged with the cartridge, just prior to insertion of the cartridge into the jacket segment;

FIG. 9 is a fragmentary section taken along the line 9-9 of FIG. 6;

FIG. 10 is a fragmentary section taken along the line 10-10 of FIG. 6;

FIGS. 11-A to 11-H are partial elevational views that schematically illustrate the successive operations of one station of the apparatus of FIG. 5 entailed in combining the jacket segment and cartridge; and

FIGS. 12-A to 12-D are partial plan views schematically illustrating the successive operations of one station

of the apparatus of FIG. 5 entailed in combining the jacket segment and the cartridge.

FIG. 13 diagrammatically shows, in relation to the transfer drums, the openings in mounting plate 12 that provide vacuum or low pressure air to the stations.

FIG. 14 is an elevation of a preferred structure for lifting retaining member 67 on clamp 66 for the step of inserting the cartridge "B" into jacket segment "A".

FIG. 15 is a side view, partly in section, of the structure of FIG. 14 illustrating the cam follower in contact with a cam surface to lift the retaining member.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

The apparatus of the present invention is designed to insert an aerosol generating cartridge in a jacket segment, thereby forming an aerosol generating module, of the type as generally illustrated in FIG. 3.

Referring to the drawings, FIGS. 1, 2, and 3, and in accordance with the invention, a preferred apparatus is structured to form a longitudinal opening or axial passage 1 (FIG. 3) in an elongate jacket segment "A" and insert an aerosol generating cartridge "B" into opening 1.

As illustrated in FIG. 1, a preferred jacket segment "A" comprises a rod 2 of fibrous material, such as tobacco, volume expanded tobacco, reconstituted tobacco materials, combinations thereof, or other materials. At one end of rod 2 there is a sleeve 3 of insulating material, in this case non-combustible fibers, such as glass fibers. Within the sleeve, there is a tubular support member 4. The rod 2 and sleeve 3 are circumscribed and joined by means of paper wrappers 6A, 6B, and 6C, such as customarily used in the manufacture of smoking articles such as cigarettes.

Although the jacket segment illustrated in FIG. 1 comprises a preformed sleeve portion and a rod of fibrous material portion, jacket segments for smoking articles that may be combined by apparatus of the present invention may also comprise (1) only a sleeve portion preformed about a support member, (2) a sleeve without a support member, (3) only a rod, or (4) other variations having portions that comprise a sleeve, which may be preformed, a rod, or combinations thereof. In such cases, the apparatus of the present invention can be modified in accord with the teachings herein. For instance, if the jacket segment comprises only a rod portion, a spindle or other passage forming means would normally be used to form a passage suitable for inserting the cartridge therein. Alternatively, the cartridge itself may be suitably shaped to be inserted into the rod without prior forming of a passage. If the jacket segment comprises only a sleeve portion, the apparatus of the invention would be modified accordingly, for instance, to eliminate the spindle and to eject any support member, preferably as the aerosol generating cartridge is inserted into the jacket segment.

The preferred aerosol generating cartridge "B" (FIG. 2) is an elongate capsule 5, advantageously of circular cross section, containing an aerosol forming material and having one or more holes 8 at one end for release of aerosol. A heat generating element 7, preferably in the form of a carbon plug, is inserted in the other end of capsule 5. Other configurations of the aerosol generating cartridge, such as the various aerosol generating means described in the aforesaid European Patent Publications, may also be used.

As used herein, and only for the purposes of this application, "aerosol" is defined to include vapors, gases, particles, and the like, both visible and invisible, and especially those components perceived by the user to be "smoke-like", generated by action of the heat from the burning fuel element upon substances contained within the aerosol generating cartridge or capsule, or elsewhere in the article. As so defined, the term "aerosol" also includes volatile or sublimeable flavoring agents and/or pharmacologically or physiologically active agents, irrespective of whether they produce a visible aerosol.

A preferred apparatus in accord with the invention generally comprises a rotating assembly drum, generally indicated by reference numeral 27 of FIG. 4. Referring specifically to FIG. 5, the apparatus has a plurality of stations "S" typically designed in essentially axially aligned mirror image pairs forming parallel tracks of stations, each station comprising a carriage 60 and a clamp 66, and a plurality of spindles 44, recesses 70, 72, abutment members 68, etc., so that two sets of aerosol generating modules may be assembled in parallel. As shown in the illustrated embodiment, each station is designed to simultaneously assemble three aerosol generating modules. (See FIG. 10 and FIG. 12-A-12-O)

As shown in FIG. 4, preferably there are transfer drums D1, D2 and D3 disposed about the assembly drum 27 for rotation in timed relation to drum 27 for depositing the components "A" and "B" in the recesses 70 and 72 on each station, in timed relation with the movement of the carriage 60 and clamp 66, and for removing the aerosol generating modules M from the drum after assembly. Transfer drum D1 is preferably located on the upgoing side of drum 27 for depositing jacket segments "A" in recesses 70. Transfer drum D2 is preferably located near the top of drum 27 for depositing cartridges "B" in recesses 72. Transfer drum D3 is preferably located on the downgoing side of the drum 27 for removing the combined aerosol generating modules "M." The transfer drums are provided with recesses 106 for receiving the components and vacuum means depicted by the arrows for holding them in place on the transfer drums before or after transfer.

Typically, the jacket segments are fed directly from a suitably modified conventional type segment combining machine (not shown), such as a Hauni MULFI, by a series of vacuum assisted transfer drums D1. Such drums are used to position two or more jacket segments laterally to line up with the parallel tracks of stations on drum 27. The jacket segments can also be fed from trays or hoppers using suitably arranged vacuum assisted rotary devices or equivalent means.

Typically, the cartridges are fed from trays or hoppers positioned above assembly drum 27 using transfer drum D2, or other suitably arranged vacuum assisted rotary devices or equivalent means.

The completed aerosol generating modules "M" may be deposited on a belt as in FIG. 4 and transported for packaging. Alternatively, the modules can be transferred to a tipping machine by a series of rotary transfer drums or other equivalent means (not shown, where they are combined with mouthend pieces to form cigarette-type smoking articles.

Again referring to FIG. 5, the drum apparatus comprises a supporting structure 10 to which is mounted a horizontally-disposed, tubular support 14 defining interiorly thereof an axial opening 16. A vertical mounting plate 12 is mounted on support 14 and attached to sup-

porting structure 10 near the periphery of the drum (not shown). Mounting plate 12 consists of flat plate 11 and stepped plate 13. Flat plate 11 has grooves 15 radially formed in its inner surface, which in combination with stepped plate 13, provide passageways for low pressure air. Between supporting structure 10 and mounting plate 12 is a vacuum chamber 25. Passageways through mounting plate 12 at suitable locations provide vacuum to the stations "S". See 84, 86, in FIG. 13. A cylindrical sleeve 18 is mounted to the tubular support 14 in concentric relation thereto and attached to the stepped plate 13 of the mounting plate 12. Sleeve 18 has conduits 19 for communication of vacuum or low pressure air to the outside end of the drum. Passageways through plate 13 at suitable locations (85, 87) provide communication between chamber 25 and conduits 19. (FIG. 13)

A hub 20 is non-rotatably mounted to the sleeve 18 midway between its opposite ends, and cam sleeves 22 are bolted to opposite sides of the hub. The cam sleeves 22 have on their cylindrical surfaces cam grooves 24 and at their ends profile cam surfaces 26. The hub 20 is conveniently made in two pieces to hold the annular ring gear 48 which is bolted thereto. (FIG. 8)

An annular support 28 is mounted to the hub 20 on axially-spaced annular bearing rings 30 for rotation about a horizontal axis. Rotation of the support 28 about the hub 20 is effected by a drive shaft 31 rotatably supported in bearings 32 within the tubular support 14. The shaft 31 has fixed to one end a drive gear 34 by means of which it can be rotated. At the other end of the shaft 31, there is fixed a radial flange 36. The radial flange 36 has bolted thereto a disk 38 and this, in turn, has bolted to it an outer end plate 39. The end plate 39 is conveniently formed in two sections. Plate 138 is attached to disk 38 and contains grooves 37 for forming passageways for vacuum and/or low pressure air to each outer station. Plate 139 is attached to plate 138 and completes the passageways. The passageways connect with conduit 19 in sleeve 18 for communication with mounting plate 12 and the source of vacuum or low pressure air.

An inner end plate 40 is rotatably mounted on sleeve 18 on ring bearing 140, adjacent to the stationary mounting plate 12. Vacuum and low pressure air are supplied to each of the inner stations directly through passageways 84, 85, 86, 87 in plate 13. See FIG. 13. Conduits 76 at each inner station extend through inner end plate 40 to a point in close proximity, preferably about 0.1 mm, to plate 13. This provides communication between the passageways in plate 13 and conduits 76 for the transmission of vacuum or low pressure air to the stations "S".

At each station, two shafts 41 are connected at one end to an end plate 39 (or 40) and at the other end to the support 28. These shaft 41 aid in providing structural support to the rotating components of the drum as rotation of the central shaft 31 effects rotation of the support 28.

Between each longitudinal or tandem pair of stations, the annular support 28 has peripherally thereof three rotatable bearing sleeves 42, in which there are mounted oppositely-facing rotatable spindles 44 having conical ends 46. Preferably, the conical end 46 of each spindle 44 has a shoulder 45 (as shown in FIG. 6) which is dimensioned to abut the edge of tube 4 in the jacket segment.

As best shown in FIG. 5, an annular ring gear 48 is mounted to the fixed hub 20, and between the station pairs, three annularly spaced spur gears 50 are mounted

to the rotatable support 28 in mesh with the annular ring gear 48. The spur gears 50 are each fixed to a drive gear 52 which, in turn, is fixed to a shaft 54 journaled on the support 28 so that rotation of the support 28 about the hub 20 and ring gear 48 rotates each of the three drive gears 52. Each drive gear 52 meshes with one spindle gear 56 in a train of fourteen spindle gears 56, and thereby drives all fourteen spindle gears simultaneously. Each spindle gear 56 is mounted on a bearing sleeve 42 and thereby rotates a set of opposite-facing spindles 44. The spindle gears 56 at the end of each train of fourteen gears do not mesh with the end gear in the adjacent train of gears. To accomplish this, the gear teeth on these end gears are less than half the width of the gear and the partial width teeth on one end gear are on one side of the gear while the partial width teeth on the adjacent end gear are on the other side so that they do not mesh. Thus, rotation of the support 28 relative to the fixed hub 20, by way of the aforesaid gears, effects rotation of three trains of fourteen sets of spindles 44 about their horizontal axes which, as illustrated, are parallel to the axis of rotation of the drum.

At each station, a transport comprising a carriage 60 and a clamp 66 is slidably mounted on two horizontally-disposed shafts 41. The carriages 60 are movable axially along the shafts 41 relative to the spindles 44. To effect reciprocal movement, the carriages 60 are each provided with an internal coupling member 64, which is slidably mounted in carriage 60 on spindles 65 and spring biased toward rotating spindles 44. Each coupling member 64 has a cam follower 62 journaled in the cam groove 24 in cam sleeve 22. The cam grooves 24 are contoured so as to effect axial reciprocal movement of the coupling members 64 and, thus, carriages 60 when the assembly drum is rotated.

The clamps 66 are mounted to carriages 60 on support arms 78 which are pivotally coupled to the clamp at 79, to the carriages at 80, and to the coupling members 64 at shaft 82, FIGS. 6 and 7, for movement relative to the carriages 60 parallel to the axis of the spindles 44. Thus clamp movement also is effected by the contour of cam grooves 24. Each clamp 66 has a retaining member 67, preferably vertically movable, located distally from the spindles to restrain lateral movement of the jacket segment as it is impaled on a spindle. The retaining member 67 can be mounted to clamp 66 on a leaf spring to permit movement in the upward direction when the cartridge moves under the retaining member, thereby avoiding jamming and breakage if there exists slight misalignment.

FIGS. 14 and 15 illustrate a preferred structure for lifting retaining member 67 for the step of inserting cartridge "B" into jacket segment "A". The structure has a support bridge 120 to which is mounted retaining member 67 and a cam follower 112. The support bridge 120 is pivotally mounted at 115 to clamp 66. Preferably, the retaining member 67 has tapered surfaces 117 from its outward face to the openings 71 that align with the recesses 70, 72 on carriage 60. When the cam follower 112 contacts cam surface 110 (which is stationary, mounted (not shown) e.g. to the frame for drum 27) for the insertion step, cam surface 110 moves cam follower 112 (to the right in FIG. 15) to cause support bridge 120 to pivot at 115 thereby lifting retaining member 67 to permit cartridge "B" to pass through opening 71 without hitting the retaining member.

Each carriage 60 includes a first support area, defined by three outwardly-facing recesses 70 (FIGS. 6, 9 and

10), the axes of which coincide with the axes of the spindles 44. Recesses 70 are dimensioned to receive and support jacket segments "A" (FIG. 1), each preferably comprising a jacketed rod 2 of tobacco, at one end of which is the sleeve 3 of insulating fibers surrounding a plastic tube 4. See FIG. 8. Each clamp 66 also has complementary recesses of the same dimensions as recesses 70 which are aligned with and cooperate with recesses 70 to restrain movement of the jacket segment. The retaining member 67 on clamp 66 has openings 71 aligned with the recesses. Openings 71 are dimensioned to restrain lateral movement of the jacket segment but to permit the aerosol generating cartridges to pass through to be inserted into the jacket segments.

At the spindle end of recesses 70 is a retaining plate 75 to restrain lateral movement of the jacket segment when it is impaled onto the cartridge. Retaining plate 75 has holes 73 aligned with recesses 70 and dimensioned to permit the spindle 44 to pass through to make a passage in jacket segment and to permit tube 4 to pass through to be ejected from the jacket segment while restraining movement of the jacket segment toward the spindle.

Each carriage 60 also includes a second support area defined by three outwardly-facing recesses 72 which are concentric with recesses 70, and which are dimensioned to receive and support the aerosol generating cartridges "B" (FIG. 2), each preferably comprising capsule 5, at one end of which is the heat-generating element 7, in alignment with the axes of the jacket segments. See FIG. 8.

Each cylindrical recess 70 contains a plurality of orifices 74 which are in communication with a passage 76 extending lengthwise of the carriage, and mounted in end plate 39, 40 in flow communication with the passageways therein. Each recess 72 is also provided with a plurality of orifices 74 in communication with the passage 76. Orifices 74 provide vacuum for holding the components in the recesses 70 and 72 in axial alignment and also provide bursts of low pressure air at suitable intervals to remove any debris from the recesses.

In the preferred embodiment, grooves 84 and 86 in mounting plate 12 provide communication to vacuum chamber 25 to provide vacuum to orifices 74 and openings 85 and 87 in mounting plate 12 provide low pressure air to orifices 74, as illustrated in FIG. 13 with reference to the position of the transfer drums. Preferably, low pressure air is provided at about 4 barr and vacuum is provided at about 70 to 80 mbarr.

In the illustrated embodiment, each station also includes three abutment members 68, one for each of the modules to be assembled at that station. The abutment members 68, FIGS. 5 and 8, are bolted to brackets 69 slidably mounted to an end plate 39, 40, and are movable axially relative to the spindles 44. Each abutment member 68 is spring-biased by spring 300 (FIG. 8), and is held retracted by a latch 90 engaged at 92 with extension 93 of bracket 69 (FIG. 7), and is released at appropriate times as will appear hereinafter. Latch 90 is pivotally mounted on a support member 91, which is mounted on the end plate 39, 40. See FIG. 7. Movement of the latch 90 is effected by engagement of a cam follower 100 mounted thereon with the profile cam surface 26 at the end of the cam sleeve 22.

In operation, as the assembly drum 27 rotates, a jacket segment "A" is placed in a recess 70 (FIG. 5), preferably by transfer drum D1. Due to the action of coupling member 64, following cam groove 24, and support arms 78, the clamp 66 is moved relative to the

carriage 60 toward the spindle 44 to enclose the jacket segment A in recess 70. Thereafter, the clamp and carriage move in unison toward the rotating spindle due to the action of coupling member 64 following cam groove 24, to impale the jacket segment A, restrained by retaining member 67, on the spindle 44. At this position, an aerosol generating cartridge "B" (FIG. 2) is placed on the carriage in the recess 72, preferably by transfer drum D2 (FIG. 4). Following deposit of the cartridge "B" on the carriage, the abutment member 68 is released by the latch 90, due to the contour of cam surface 26, so that the abutment member is moved into engagement with the cartridge "B" and pushes it against jacket module A. See FIG. 8.

Movement of the clamp 66, together with the carriage 60, away from the spindle 44, as effected by coupling member 64 in combination with cam groove 24, withdraws jacket segment A and the pierced rod of tobacco 2 from the spindle and, with the aid of abutment member 68, impales the jacket segment A on the cartridge "B" disposing the capsule 5 within rod 2 and the fuel element 7 within sleeve 3 as shown in FIG. 3. During this movement, the plastic tube support member for sleeve 3 is held between capsule 5 and the shoulder 45 on the conical tip 46 of spindle 44, and is eventually ejected from sleeve 3 by passage through the pierced tobacco rod 2. Retaining member 67 has a hole 71 of sufficient size to permit the cartridge "B" to pass through and to restrain axial movement of jacket segment A when it is impaled on the spindle. Further movement of the clamp 66 and carriage 60 relative to the abutment member 68 removes clamp 66 from the resulting aerosol generating module "M" (FIG. 3) and reengages the latch 90 with the abutment member 68. The aerosol generating module "M" is then removed from the carriage by disengagement of the vacuum and transfer to transfer drum D3 (FIG. 4).

FIGS. 11-A to 11-H and 12-A through 12-O schematically depict the sequence of operation of the stations on assembly drum 27. FIGS. 11-A to 11-H diagrammatically show the interaction of carriages 60.1 with cam surfaces 24.1 and 26.1 and the relative movements of the carriages 60.1, the clamps 66.1 and the abutment members 68.1. FIGS. 12-A through 12-O diagrammatically show the movements of clamps 66.1, carriages 60.1 and abutment members 68.1 for the illustrated preferred embodiment which makes three aerosol generating modules at each station. These figures are presented solely for the purpose of illustrating relative movements and relative positions of the various parts of the carriages as shown.

FIGS. 11-A and 12-A show the clamp 66.1 displaced away from the spindles, for loading jacket segments A. At this position, the recesses 70.1 on the carriage 60.1 are exposed. Jacket segments A, preferably comprising a rod of tobacco, the sleeve of insulating fibers and the support tube, are now deposited in the recesses 70.1, as shown in FIGS. 11-B and 12-B, in alignment with the axis of the spindles 44.1. The clamp 66.1 is now moved by the are 78.1, by movement of coupling member 64.1 in conjunction with cam follower 62.1 following cam groove 24.1, as shown in FIG. 11-C, to a position to enclose the jacket segments A in recesses 70.1. See FIGS. 12-C and D.

Following movement of the clamp relative to enclosing segments A, the carriage 60.1 is moved toward the spindles, by means of coupling member 64.1 and cam follower 62.1 in conjunction with cam groove 24.1. Carriage 60.1 carries with it jacket segments A, en-

closed by the clamp 66.1, to a position to impale the jacket segments on the rotating spindles 44.1, as shown in FIGS. 11-D, 12-E and 12-F. At this position (FIGS. 11-D and 12-F), the recesses 72.1 are exposed between the clamp 66.1 and the abutment members 68.1.

The cartridges B, comprising the capsule and fuel element, are now deposited between the clamp 66.1 and the abutment members 68.1 (FIG. 11-E and 12-G) with the fuel elements facing abutment members 68.1. The abutment members are then released by retraction of the latch 90.1 through the action of cam follower 100.1. Thus the spring biased abutment members move into engagement with the cartridges "B" and press the latter into engagement with jacket segments A (FIG. 11-F and 12-H).

Now the carriage 60.1 and clamp 66.1 are moved away from the spindles, which withdraws the jacket segments A from the spindles, expels the tubes 4 after passing through the openings in the tobacco rods, and impales the jacket segments A on the cartridges "B" (FIG. 11-G, 12-I to J). Finally, the carriage 60.1, clamp 66.1 and abutment members 68.1 are moved to their initial positions, as shown in FIGS. 11-H and 12-K to O, to free the composite structures "M" for pickoff, and to reengage latch 90.1.

Thus, in sequence, the aforesaid apparatus operates to pierce a rod of tobacco, one end of which has been attached to a sleeve of insulating fibers disposed about a plastic tube, to form a longitudinal passage through the rod of tobacco corresponding to the inside diameter of the sleeve, and thereafter insert an aerosol generating cartridge into the formed passage and the sleeve.

It should be understood that the present disclosure is for the purpose of illustration only and the invention includes all modifications or improvements which are within the scope of the appended claims. The invention is not limited by particular materials, which are described only for purposes of illustration. For example, other materials may be used to form the jacket segment in place of tobacco and glass fibers, such as other fibrous materials and/or non-fibrous materials. Materials other than fibrous materials may also be used to form the sleeve. Other configurations of the aerosol generating cartridge may be employed.

It should also be understood that those skilled in the art, upon considering the present disclosure including the drawings, can readily modify the apparatus to insert cartridges in a sleeve (i.e. without a spindle), to make more or less aerosol generating modules simultaneously at each station, etc.

What is claimed is:

1. Apparatus for making aerosol generating modules for smoking articles, the apparatus comprising: a rotatable drum; a plurality of stations mounted on the drum, each station comprising jacket holding means for receiving and holding at least one jacket segment and cartridge holding means for receiving and holding at least one aerosol generating cartridge; and means for inserting the cartridges into the jacket segments.

2. The apparatus of claim 1 wherein the stations are arranged in axially aligned pairs.

3. The apparatus of claim 1 or 2 wherein each station includes means for inserting.

4. The apparatus of claim 1 or 2 wherein each station comprises passage forming means for forming a passage lengthwise through at least a portion of each jacket segment.

5. The apparatus of claim 4, wherein each station further comprises means for ejecting a support member from within the jacket segment.

6. The apparatus of claim 4 wherein the passage forming means comprises a passage forming member, each station further comprising means for withdrawing the passage forming member from each jacket segment and simultaneously inserting an aerosol generating cartridge into the jacket segment.

7. The apparatus of claim 6, each station further comprising means for ejecting a support member from within the jacket segment.

8. The apparatus of claim 7, wherein the means for simultaneously withdrawing the passage forming member and inserting the cartridge includes the means for ejecting the support member.

9. The apparatus of claim 1 or 2 wherein each station further comprises means for ejecting a support member from within the jacket segment.

10. The apparatus of claim 9 wherein each station further comprises means for simultaneously inserting an aerosol generating cartridge into the jacket segment while the support member is being ejected.

11. The apparatus of claim 1 or 2 wherein at each station the jacket holding means is in axial alignment with the cartridge holding means.

12. The apparatus of claims 1 or 2 wherein each station further comprises: a slidable support means having thereon the jacket holding means and the cartridge holding means; and means cooperating with the jacket holding means for restraining movement of the jacket segment during insertion.

13. The apparatus of claim 12 wherein the insertion means comprises: an abutment member proximate the cartridge holding means; and means for effecting relative movement between the slidable support means and the abutment member to insert the cartridge into the jacket segment.

14. The apparatus of claim 12 wherein the insertion means comprises an abutment member proximate the cartridge holding means and means for moving the slidable support means toward the abutment member to effect the insertion of the cartridge into the jacket segment.

15. The apparatus of claim 12 further comprising means for restraining movement of the abutment member while the support means is moving toward the abutment member to effect insertion of the cartridge into the jacket.

16. The apparatus of claim 12, wherein each station comprises passage forming means for forming a passage lengthwise through at least a portion of each jacket segment.

17. The apparatus of claim 1 or 2 wherein each station further comprises: a support means having fixed thereto the jacket holding means and the cartridge holding means; and means cooperating with the jacket holding means for restraining movement of the jacket segment during insertion; and wherein the insertion means comprises: an abutment member proximate the cartridge holding means; and means for effecting relative movement between the support means and the abutment member to insert the cartridge into the jacket segment.

18. The apparatus of claim 17, wherein each station comprises passage forming means for forming a passage lengthwise through at least a portion of each jacket segment.

19. The apparatus of claim 1 or 2 wherein each station comprises a plurality of corresponding jacket holding and cartridge holding means.

20. The apparatus of claim 1 or 2 wherein each station comprises

passage forming means for forming a passage lengthwise through at least a portion of each jacket segment;

a slidable support means which carries the jacket holding means and cartridge holding means, the jacket holding means being mounted proximate to the passage forming means; the jacket holding means comprises a first recess shaped to receive a jacket segment, and the cartridge holding means comprises a second recess adjacent to the first recess and shaped to receive a cartridge, the recesses being in axial alignment for insertion of the cartridge into the jacket segment; the jacket holding means further including means for restraining movement of the jacket segment during passage formation and insertion; the passage forming means comprising a spindle in axial alignment with the recesses; the insertion means comprises an abutment member proximate the cartridge holding means;

means for moving the slidable support means toward the spindle to effect formation of the passage in the jacket segment; and

means for moving the support means away from the spindle, cooperating with means for restraining movement of the abutment member while the support means is moving away from the spindle, to withdraw the jacket segment from the spindle, engage the cartridge with the abutment member, and insert the cartridge into the jacket segment.

21. The apparatus of claim 20 wherein each station comprises a plurality of corresponding pairs of first and second recesses.

22. The apparatus of claim 20 wherein the spindle, the means for moving the support means away from the spindle, and the means for restraining movement of the abutment member comprise a means for ejecting a support member from within the jacket segment.

23. The apparatus of claim 1 or 3, wherein the jacket holding means and cartridge holding means are mounted adjacent each other on a support means, the jacket holding means includes a means for restraining movement of the jacket segment during insertion, the insertion means comprises an abutment member adjacent the cartridge holding means, and the apparatus further comprises means for effecting relative motion between the abutment member and the support means to effect insertion of the cartridge into the jacket segment.

24. The apparatus of claim 23 wherein the apparatus comprises passage forming means for forming a passage lengthwise through at least a portion of the jacket segment.

25. The apparatus of claim 24 wherein the passage forming means comprises a passage forming member and each station comprises means for withdrawing the passage forming member from the jacket segment and simultaneously inserting the aerosol generating cartridge.

26. The apparatus of claim 1 or 2 wherein the jacket segment comprises a sleeve of insulating material preformed about a tubular member and wherein the inser-

tion means includes means for ejecting the tubular member from the sleeve.

27. The apparatus of claim 1 or 2 wherein the jacket segment comprises a rod of tobacco material and each station comprises passage forming means for forming a passage lengthwise in the rod.

28. Apparatus for making aerosol generating segments for smoking articles, said apparatus comprising: a rotatable drum;

a plurality of stations located on the drum, each station comprising: jacket holding means for receiving and holding jacket segments; cartridge holding means for receiving and holding aerosol generating cartridges; and means for inserting the cartridges into the jacket segments, thereby forming aerosol generating modules;

jacket supply means for supplying jacket segments and cartridge supply means for supplying aerosol generating cartridges to each of the stations in seriatim; and

means for removing the aerosol generating modules from each station, in seriatim.

29. The apparatus of claim 28 wherein the jacket supply means comprises a rotatable member.

30. The apparatus of claim 28 wherein the cartridge supply means comprises a rotatable member.

31. The apparatus of claim 28 wherein the stations are arranged in axially aligned pairs around the periphery of the drum.

32. The apparatus of claim 28 wherein each station comprises passage forming means for forming a passage lengthwise through at least a portion of each jacket segment.

33. The apparatus of claim 32 wherein each station further comprises means for ejecting a support member from within the jacket segment.

34. The apparatus of claim 32 wherein the passage forming means comprises a passage forming member, each station further comprising means for withdrawing the passage forming member from each jacket segment and simultaneously inserting an aerosol generating cartridge into the jacket segment.

35. Apparatus for assembling components of a smoking article, the apparatus comprising a rotatable drum containing a plurality of peripheral movably mounted supports for receiving first and second components in alignment; means associated with the drum and operable as the drum is rotated to form an axial passage in one component and impale the first component on the second component to produce a composite structure.

36. Apparatus according to claim 35 wherein there are peripherally-spaced spindles on the drum aligned with the supports and movable clamps associated with the supports for enclosing the first components on the supports and moving them onto the spindles and thereafter removing pierced first components from the spindles and impaling them on the second components.

37. Apparatus according to claim 35 wherein the means for forming the axial passage includes spindles in alignment with the supports and the supports comprise recesses for receiving the components and are movable in a first direction to impale the first components on the spindles and thereafter in a second direction to withdraw the first components from the spindles and impale them on the second components.

38. Apparatus according to claim 37 wherein there are abutment means for constraining axial movement of

the second components as the first components are being impaled thereon.

39. Apparatus according to claim 35 wherein the supports on the drum are arranged in a series of adjacent axial pairs, and the drum further comprises a pair of opposite-facing spindles located between each pair of supports.

40. The apparatus of claim 39 wherein the supports are mounted in sets on slidably mounted carriages and each carriage has a slidably mounted clamp associated with it for enclosing first components on the support.

41. The apparatus of claim 35 wherein the means for forming the axial passages in the first components comprises pairs of opposite-facing spindles on the drum and wherein the supports are arranged in pairs on both sides of the spindles and comprise sets of axially aligned, corresponding recesses for first and second components.

42. The apparatus of claim 41 wherein the sets of recesses are located in groups on slidably mounted carriages and each carriage has a slidably mounted clamp associated with it for enclosing first components on the support.

43. The apparatus of claim 40 or 42 wherein the drum is mounted on a support member having a contoured cam groove and wherein the carriages and the clamps move in response to the contour of the cam groove.

44. The apparatus of claim 40 or 42 further comprising a releasable, slidable abutment member for constraining movement of the second components while the first components are being impaled on the second components.

45. The apparatus of claim 44 wherein the abutment member is released and latched in response to the contour of a cam surface on a support member for the rotatable drum.

46. The apparatus of claim 39, 40, 41 or 42, further comprising means for rotating the spindles.

47. The apparatus of claim 46 wherein the spindles are rotated by the rotation of the drum.

48. The apparatus of claim 47 wherein the means for rotating the spindles comprise gear means mounted between the pair of supports.

49. Apparatus for assembling components of a smoking article, the apparatus comprising a support member having contoured cam surfaces; and a rotatable drum mounted on the support member and having a plurality of movably mounted assembly stations arranged in tandem around the periphery of the drum, each station comprising a slidably mounted carriage having aligned sets of recesses for receiving a plurality of first and second components of the smoking article, a slidably mounted clamp associated with the carriage for enclosing the first components on the carriage, a slidable abutment member aligned with each set of recesses for constraining axial movement of a second component, and means responsive to cam surfaces on the support member to move the clamp relative to the carriage and abutment members to enclose the first components on the carriage, to move the abutment members from a retracted position to an engaged position for constraining axial movement of the second components on the carriage, to move the carriage and clamp toward the abutment members to insert the second components in the first components, to move the carriage relative to the clamp to release the assembled first and second components, and to move the abutment members from their engaged position to their retracted position.

50. Apparatus for assembling components of a smoking article, comprising a rotatable drum, a plurality of assembly stations mounted on the drum, each station comprising a spindle, means supporting the spindle for rotation about its longitudinal axis, a slidable abutment member, means supporting the abutment member in axially-spaced alignment with the axis of the spindle, a transport means comprising a reciprocal carriage having aligned recesses for receiving first and second components of the smoking article and a clamp movable in unison with the carriage relative to the spindle and the abutment member and movable relative to the carriage, the clamp being operable by movement relative to the carriage and abutment member to enclose a first component in the recess on the carriage for movement with the carriage in a direction toward the spindle into engagement with the spindle to pierce the first component and thereafter in an opposite direction toward the abutment member, initially in unison with the carriage to withdraw the pierced first component, from the spindle and impale it on the second component, and then relative to the carriage to release the composite structure comprising the first component with the second component contained therein, the abutment member being movable from a retracted position while the carriage is moving toward the spindle to an engaged position to restrain the second component while the carriage is moving away from the spindle and the first component is being impaled on the second component.

51. The apparatus of claim 50 wherein each station comprises an equal number of spindles, abutment members, and sets of aligned recesses for receiving first and second components, for the assembly of a plurality of corresponding components simultaneously at each station.

52. The apparatus of claim 50 wherein the stations are mounted in tandem pairs around the rotatable drum and wherein each station comprises an equal number of spindles, abutment members, and sets of aligned recesses for receiving first and second components, for the assembly of a plurality of corresponding components simultaneously at each station.

53. The apparatus of claim 52 wherein the spindles are rotatably mounted in opposite-facing pairs between the carriages of each tandem pair of stations and wherein the means for rotating the spindles comprise gear means mounted between the carriages of each tandem pair of stations.

54. Apparatus according to claim 50 wherein there are orifices in communication with the recesses and means connecting the orifices to a vacuum.

55. Apparatus according to claim 50 wherein there is cam-actuated means for effecting movement of the carriage relative to the spindle and for effecting movement of the clamp relative to the carriage.

56. Apparatus according to claim 50 wherein the abutment member is slidably mounted and is spring-biased toward the spindle and wherein the apparatus further comprises latch means to constrain movement of the abutment member prior to deposit of the second component on the carriage and means operable for releasing the latch means following deposit of the second component on the carriage, to permit the abutment member to engage the second component.

57. Apparatus according to claim 50 further comprising first supply means for depositing the first component on the carriage in its recess prior to movement of the clamp to the enclosing position and second supply

means for depositing the second component on the carriage in its recess following movement of the carriage and clamp to the position of impalement of the first component on the spindle.

58. Apparatus for the manufacture of a smoking article, the apparatus comprising a rotatable drum, a plurality of stations mounted on the drum, each station comprising a spindle; an abutment member disposed in spaced alignment with the spindle; a carriage structured to support a first component comprising a jacketed rod of tobacco, at one end of which there is a sleeve of non-combustible material formed around a support member, in alignment with the spindle and the abutment member; and means for effecting movement of the carriage in a direction toward the spindle to pierce the jacketed rod of tobacco; means for supporting a second component comprising an aerosol generating cartridge, at one end of which there is a fuel element, on the carriage between the first component and the abutment members, for constraining movement of the second component relative to the carriage; and means for moving the carriage in a direction away from the spindle to withdraw the first components from the spindle, impale it on the second component and expel the support member.

59. Apparatus for making smoking articles, the apparatus comprising a drum rotatable about a horizontal axis, a series of spindles mounted on the drum for rotation about horizontal axes parallel to the axis of rotation of the drum, a drive shaft supported by the drum for rotation about a horizontal axis parallel with the axes of the spindles; a train of gears operable by rotation of the drive shaft to effect rotation of the spindles; means for effecting rotation of the drive shaft by rotation of the drum; an abutment member mounted on the drum in axially-spaced alignment with each spindle; a carriage structured to support first and second components positioned between and in alignment with a corresponding number of spindles and abutment members, the carriage being mounted on the drum for reciprocal movement relative to and parallel to the axes of the spindle and the abutment member; and means operable by rotation of the drum to effect reciprocal movement of the carriage to move the carriage in a direction to impale first components on the spindles and in the opposite direction toward the abutment member to withdraw the first components from the spindles and move them toward the abutment members to impale the pierced first components on second components supported by the carriage and constrained by abutment members.

60. Apparatus according to claim 59 wherein there is a clamp mounted on the carriage for movement therewith and relative thereto, to enclose and release the first component on the carriage, and cam-actuated means for effecting movement of the clamp.

61. Apparatus according to claim 59 or 60 wherein the carriage embodies recesses for receiving the first and second components and vacuum means for restraining movement of the components within the recesses.

62. Apparatus according to claim 61 wherein there are a plurality of sets of recesses on the drum and a spindle and abutment member mounted to the drum in peripherally-spaced relation about the axis of rotation of the drum corresponding to each set of recesses.

63. Apparatus according to claim 59 comprising means yieldably biasing the abutment member in a direction toward the spindle, a latch constraining movement of the abutment relative to the carriage and means

for releasing the latch following deposit of the second component on the carriage.

64. Apparatus according to claim 59 comprising means for retracting the abutment member relative the carriage to facilitate placing the second component on the carriage between the abutment member and the first component.

65. Apparatus for making smoking articles, the apparatus comprising a support frame; a drum disposed on the frame for rotation about a horizontal axis; a spindle mounted to the drum for rotation therewith about a horizontal axis spaced from and parallel to the axis of rotation of the drum; spindle rotating means operable by rotation of the drum relative to the frame to effect rotation of the spindle; an abutment member mounted to the drum in axially-spaced alignment with the spindle; a carriage movably mounted to the drum between the spindle and the abutment member and in alignment therewith; carriage movement means on the frame and drum cooperable by rotation of the drum relative to the frame to effect movement of the carriage to move a component supported by the carriage onto the spindle to pierce the same and to withdraw the pierced component from the spindle and impale it on a second component supported by the carriage between the first component and the abutment member.

66. Apparatus according to claim 65 wherein the spindle rotating means for effecting rotation of the spindle comprises a ring gear mounted to the frame, a spur gear mounted to the drum in mesh with the ring gear and meshing gears, one of which is engaged with the spur gear and another of which is mounted to the spindle.

67. Apparatus according to claim 66 wherein the carriage movement means comprise a cam cylinder containing a cam groove mounted to the frame and a cam follower mounted on the carriage for engagement with the cam groove.

68. Apparatus according to claim 67 wherein the cam cylinder is provided with a profile cam at one end and a lever is pivotally mounted to the frame with one end engaged with the profile cam and the other end engageable at times with the abutment member to effect retraction and release of the abutment member and there is spring means for yieldably holding the abutment member in contact with the profile cam.

69. Apparatus for making smoking articles comprising a first component comprising a rod of tobacco, at one end of which there is a sleeve of non-combustible material and a second component comprising an aerosol

generating cartridge, the apparatus comprising a frame; a drum disposed on the frame for rotation about a horizontal axis; circumferentially-spaced spindles mounted to the drum about the axis of rotation of the drum; means operable by rotation of the drum relative to the frame to effect rotation of the spindles; an abutment member mounted to the drum in axial alignment with each spindle; carriages slidably mounted to the drum between the spindles and abutment members structured to receive the components in alignment with a spindle and an abutment member; and means for effecting axial movement of each carriage relative to the aligned spindle and abutment member to move the first component onto the spindle to pierce the same and then from the spindle and onto the second component to dispose the first component on the second component.

70. Apparatus according to claim 69 wherein the means for effecting axial movement of the carriages comprise a cam cylinder mounted to the frame and a cam follower mounted to each carriage in engagement with the cam cylinder, operable by relative rotation of the frame and drum to effect reciprocal movement of the carriages.

71. Apparatus according to claim 70 wherein each carriage embodies first and second concentric recesses for receiving, respectively, the first and second components, the apparatus having means for depositing the first components on the carriage; and means for depositing the second component on the carriage while the first component is on the spindle.

72. Apparatus according to claim 70 wherein the cam cylinder embodies a cam groove and the cam follower is in the groove.

73. Apparatus according to claim 72 wherein the cam cylinder further comprises a cam track, wherein the abutment members are spring-biased toward the spindles, wherein there are latch means constraining movement of the abutment members, and wherein there are cam levers yieldably engaged with the cam track operable at times to release the abutment members.

74. The apparatus of claim 69, 70, 71 or 73 wherein the spindles, abutment members, and carriages are arranged in tandem around the drum, the spindles are arranged in opposite-facing pairs located between tandem carriages, and each carriage is structured to receive a plurality of first and second components, for the assembly of a plurality of corresponding components of smoking articles simultaneously on each carriage.

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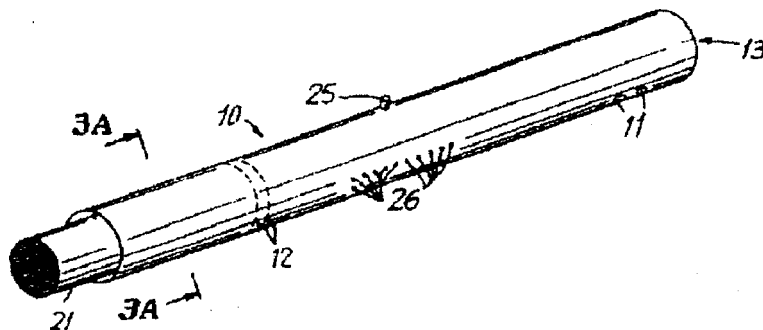
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요약

본 발명에 따른 물품은 대체 가능한 풍미발생매체(27)가 영구 재사용이 가능한 일련의 가열기(23)에 의해 전기적으로 가열되어 흡입 가능한 풍미제나 기타 성분을 증기 또는 에어로졸태로 방출시키게 된다. 각각의 가열기는 필요한 풍미발생매체부위만을 가열하며, 여러번의 퍼프시풍미포함물질이 지속적으로 소비자에게 전달 될 수 있다. 풍미발생 매체는 물품의 캐비티(30)에 설치되어 있는 가열부재와 인접하고 있는 압축성의 발포재이며 삽입시 부재를 세정하게된다.

도면도



명세서

[발명의 명칭]

풍미발생물품

[도면의 간단한 설명]

제1도는 본 발명을 구체화하는 풍미발생물품의 사시도이며,

제2도는 제1도의 부분절개전개 사시도이고,

제3도는 제2도에서 3-3선으로 표시된 부분의 횡단면도이며,

제3a도는 제1도에서 3A-3A선으로 표시된 부분의 횡단면도이고,

제4도는 제3도에서 4-4선으로 표시된, 풍미발생물품에서 풍미카트리지가 수용된 캐비티의 종단면도이며,

제5도는 또다른 가열기 구현예를 나타낸 것으로 제3도와 유사한 횡단면도이고,

제6도는 제15도에서 6·6선으로 표시된, 음미형생물품에서 음미카트리치가 수용된 캐비티의 종단면도이며, 제7도는 또 다른 가형 기구현예를 나타낸 것으로서 제3도 및 제5도와 유사한 횡단면도이고, 제8도는 제7도에서 8·8선으로 표시된 제7도의 음미형생물품에서 음미카트리치가 수용되는 캐비티의 종단면도이며, 제9도는 본 발명을 구체화한 음미카트리치 구현예의 사시도이고, 제10도는 제9도에서 10·10선으로 표시된 제9도의 종단면도이다.

* 도면의 주요부분에 대한 부호의 설명

10, 50, 70, 90 : 음미형생물품

11 : 종전충부

12 : 구멍

20 : 재형가늘/영구부

21 : 카트리치

22 : 전원

23, 51, 71 : 가형부재

24 : 제어회로

25 : 누름단추

26 : 표시기

27 : 음미부품

28 : 플터부품

30 : 캐비티

31 : 음배포장지역

32 : 음미부품의 영역

33 : 음배형표지역

140, 42, 52, 53 : 가형부재의 전단

41 : 표면처리부

43 : 캐비티의 전단면

54, 72 : 전단

73 : 주름

80 : 간격판

90 : 음미부품

91 : 음용다발

92 : 금속포일층

93 : 플러리

[발명의 상세한 설명]

본 발명은 음배중미기를 유리하게 하기 위해 음미형생물품이 가형되지 않은 음미형생물품에 관한 것이다. 특히, 본 발명은 전가적으로 가형된 물품에 관한 것이다.

전가적으로 가형된 음미형생물품은 1989년 12월 1일 출원된 미합중국 특허 출원 제 07/444,746호의 전체 내용을 구체적으로 언급되어 있으며, 이로부터 수정된 제1항을 주청한 제1항을 제외하고 있는 제 0430566호에 기재되어 있다. 이 출원서에는 전가적으로 가형되는 음미형생물품에 관한 기재가 있는데, 이 물품에 사용되는 전가형부재는 소모될 수 있으며 양배 또는 음배부품을 포함하는 음미형생물품이 배설되어 있다. 소모될 수 있는 가형가/음미 장치는 수동스위치의 임박 또는, 물연료물품을 소비자가 파괴함으로써 작동케 하는 제어회로에 의한, 하지, 축전지 등 전가에너지원을 포함하는 약간 의 영구장치라도 언급되어 있다. 적어도 하나 이상, 하지만 한편의 파괴에 사용되는 가형부재의 전체 또는 적어도 고안된 제어회로는 예컨대 음미포장물품을 포함하는 예컨대 파프수를 소비자에게 전달한 다.

또한, 바람직하게는 제어회로는 음미형생물품의 파괴와 그 결과 중미를 저장하는 원치않는 화합물이 생성되는 것을 방지하기 위하여 특정 가형가/음미 장치를 작동시키는 것을 막아준다.

이러한 물품에서는 음미형생물품이 소모되는 것에 비해서 가형부재가 소모되며, 이는 결과적으로 음미형생물품을 모호하면서 새로운 가형부재를 구입해야 하므로 소비자의 비용을 증가시켰다.

가형부재가 소모되는 경우, 소모되는 재료의 양이 더욱 많아진다.

더우기, 가형부재가 물품에 영구히 장착되지 않은 경우, 전가에너지원과 전가적으로 연결된 물리가능한 가형가에서 때로 과도한 전류 저항을 나타낼 수 있으며, 그 결과 전류소모를 증가시킬 수 있었다.

또한, 가형부재가 소모되는 경우, 가형가/음미 장치가 음미형생물품의 특성을 결정하는 것이 가형된 음미형생물품에 의해 소모되는 전류소모의 다변화를 경험한다. 음미포장물품의 특성을 결정하는 것이 가형된 음미형생물품에 의해 소모되는 전류소모, 이러한 특성이 변화하게 된다.

본 발명의 목적은 제 EP-A-0430566호에 기재된 물품의 상가한 불리점을 극복하고, 캐비티(30)에 배열된 전가 가형부재, 예컨대 한 면에서 가형원(22)에 의한 전가/음미수단의 가형을 조형하기 위한 조형수단(24)(적어도 하나 그러나 모든 전가/음미수단의 수 또는 적게 존재), 전가/음미수단에 고정해 있는 캐비티(30)에 장착된 음미형생물품(21)의 물리부위(예컨대 음미포장물품을 소비자에게 전달하기 위해서 전가/음미수단(23, 51, 71)의 어느 한면의 작용으로 인하여 그와 접촉된 음미형생물품에 의해 물리부위의 각 부분이 가형된다)를 포함하며, 음미포장물품을 소비자에게 제공할 수 있는 물품을 제공하는 것이 다.

본 발명에 따른 물품은 가형부재를 재사용할 수 있으며, 더우기 모든 소모부위가 미생물 분해성이 있다.

본 발명에 따른 물품은 또한, 가형가와 전가에너지원 사이의 전기적 접속 저항성이 최소화되며, 사용항에

따른 가열부재의 온도 변화가 최소화 된다.

바람직하며, 유리한 특성들은 종속항에 기재되어 있으며, 본 발명의 구현예를 실시예와 첨부한 도면을 참조하여 다음에 기재한다.

예를들면, 본 발명에 따른 풍미발생 물품은 담배 대응품으로 사용될 수 있다. 그러므로 풍미발생매체는 담배유도물을 포함하는 물질이어야 한다. 본 발명에 따른 풍미발생 물품은 원한다면 풍미발생 매체, 필터 등의 분리가능한 소모부위와 전기에너지원을 포함하는 재생가능한 영구 부위, 재생가능한 가열부재, 수동스위치작동이나 펄스 유도작용에 의해 적당한 순서로 가열기를 에너지화 하기 위한 제어회로 등을 포함한다.

적당한 제어회로는 상기한 제EP-A-043566호에 기재되어 있다.

재생가능하거나 영구적인 부분은 소모부위가 삽입될 수 있게하기 위해 그의 입구선단에 캐비티를 포함하고 있다. 캐비티에 배열된 재생 가능한 가열기는 캐비티로 삽입되는 소모부위가 캐비티로 삽입될때 소모 부위와 열접촉한다.

이것은 가열기를 캐비티의 측면에서 돌출되게 하고 소모부위를 압축성이 있게 하여 가열기가 그 물질을 압축하게 함으로써 이루어진다.

대신에 가열기들은 캐비티의 선단으로부터 돌출될 수 있으므로 사실상 소모부위를 통과 할 수 있다. 재생 가능한 가열기를 사용할 때는 각기 사용전에 가열기를 세척해주는 것이 중요하다. 그렇지 않으면 부분 적으로 산화, 피로화되거나 또는 열적으로 분해된 풍미발생매체의 구성분의 먼저 사용된 잔류물이 재가 열 될 수 있으므로 원하지 않는 화합물과 저하된 풍미를 소비자에게 전달할 수 있다.

이러한 잔류물은 가열기가 소모부위의 일부분인 경우 문제되지 않는다. 왜냐하면 재가열되지 않기 때문이다. 그러나 재생가능한 가열기가 사용되는 경우 잔류물은 문제가 된다.

본 발명에서는 가열기에 소모부위가 삽입될때 가열기에 대한 소모부위의 세정 작용에 의해 가열기의 세 척이 이루어진다.

따라서 소모부위의 삽입선단은 가열기 표면상의 잔류물을 캐비티입구의 선단으로 밀어내며, 가열기의 후 위선단으로 밀어낸다. 이러한 이유로 압축되는 소모부위는 견고해야 하며, 효과적으로 세정작용을 보장 하기 위하여 가열기는 매끄럽게 표면처리되어야 한다.

유효량의 풍미포함물질(예를 들면 담배풍미에어졸)을 소비자에게 전달할 수 있도록 고려하여 가열기의 매개변수를 선택한다.

예를 들어 2초간 35㎖의 펄스시 2mg의 에어졸을 소비자에 전달하는 것이 바람직하다.

이러한 전달이 이루어지기 위한 가열기의 온도는 풍미발생매체와 접촉시 약 150 내지 500℃ 사이에 이를 수 있어야 한다. 더우기, 가열기는 약 1칼로리(4.19줄) 내지 6칼로리(25.12줄)의 전원을 소비하여야 한다.

이러한 특성을 갖는 가열기는 양에 대한 활성표면적(풍미발생 매체와 접촉된 표면적)의 비율이 약 3mm²/mg 내지 6mm²/mg, 활성표면적은 약 3mm² 내지 50mm², 양은 약 1mg 내지 30mg, 그리고 저항은 약 0.5Ω 내지 3.0Ω이 바람직하다.

더욱 바람직하게는, 가열기의 활성표면적은 약 3mm²내지 20mm², 저항은 약 1.0Ω 내지 1.6Ω이어야 한다.

가열기의 전력소모는 저항성에 의해 결정되며, 저항성은 비저항과 크기에 의해 결정되기 때문에 상기조 건들은 서로 연관되어 있다. 가열기를 고장 없이 3,600회 이상 반복 사용할 수 있도록 재료를 선택하여 야한다. 또한 가열기 재료는 원하지 않는 화합물을 형성할 수 있는 어떠한 온도범위에서도 풍미발생 매 체와 반응하지 않는 반응성에 기초하여 선택되어진다. 풍미발생 매체가 없는 상태에서 가열되는 경우에 도, 마찬가지로 원하지 않는 화합물을 발생시키지 말아야 한다. 원하지 않는 화합물을 발생시킬 수 있는 가열기 재료는 적당한 세라믹 물질 등 불활성열전도 물질로 캡슐화 되어야 한다.

이러한 기준에 기초하여, 본 바람의 전기가열수단에 사용되는 바람직한 재료는 탄소, 흑연, 스텐레스 강, 탄탈륨, 금속세라믹기재, 알루미늄합금, 철합금, 그리고 크로뮴합금 등의 금속합금 등을 포함한다.

상기의 적당한 금속세라믹 기체는 실리콘 탄화 알루미늄, 실리콘 탄화 티타늄을 포함한다.

상기 재료중 스텐레스강과 알루미늄, 철 또는 크로뮴합금은 그의 반응성 때문에 적당한 세라믹 재료로 캡슐화 되어야 한다.

상기에서 캡슐화를 위한 적당한 세라믹물질은 실리카, 알루미늄 및 졸겔이다.

본 발명의 전기가열 수단에 사용되는 특히 바람직한 물질은 탄탈륨이다.

풍미발생물품(10)의 첫번째 바람직한 구현예는 제1도 내지 제4도와 같다. 이 물품(10)은 재생가능 또는 영구부위(20)와 부위(20) 입구선단의 캐비티(30)에 장착되는 소모가능한 필터/풍미부위 또는 카트리지(21)로 구성된다.

재생가능부위(20)에는 입구로부터 멀리 떨어진 선단에 전지, 축전지 또는 둘 모두인 전원(22)을 포함한 다. 상기 전지는 대체 가능하거나 충전가능하며 만일 전지를 재충전하거나 또는 전원(22)을 축전지로만 할 경우, 이 물품(10)의 외부표면에는 전원(22)의 충전을 위해 외부전력 공급기(도시하지 않음)와 연결 되는 충전접촉부위(11)를 갖게 된다. 이 전원(22)은 누름단추(25)나 펄스-작동센서(도시하지 않음)에 의 해 차례로 작동하는 제어회로(24)의 조절하에서 에너지화 되는 가열부재(23)에 전력을 제공하게 된다.

발광 다이오드나 가시형지시기일 수 있는 지시기(26)는 각종 가열기(23)의 상태를 반영하게된다.

전원(22), 제어회로(24), 누름단추(25)(또는 퍼프-작동센서)와 지시기(26)의 기능은 상기한 EP-A-0430566에 더욱 상세히 기재되어 있다.

상기 부위(20)는 기존 담배의 외양과 동일하게 하기 위해 담배포장지(31)로 의해 둘러싸는 것이 바람직하다. 부위(20)의 측면에는 퍼프시 외부공기구를 끌어 들이는 구멍을 제공할 수 있으며, 또는 외부공기를 한쪽 선단(13)에 있는 개구부를 통해서 부위(20)전체로 끌어들일 수 있다.

본 구현예에서, 가열부재(23)는 선행이며, 캐비티(30)의 입구선단에서 약간 떨어진 지점으로부터 캐비티(30)의 로드 선단에서 조금 떨어진 지점까지 확장되어 있다.

제4도에 나타난 바와 같이, 가열부재(23)는 아래의 이유 때문에 캐비티(30)의 벽면에서 떨어져서 약간 구부러져 있다. 두 선단 중 하나에서, 가열부재(23) 모두는 공통적으로 전기적으로 연결되어 있으며, 다른 한쪽 선단에서의 가열부재(23)는 각각 전원(22)과 연결되어 있어 가열부재(23)를 각각 작동시키게 된다.

캐비티(30)의 입구선단에서의 가열부재(23)의 굴곡진 선단부(40)에는 소모부위(21)가 삽입될 수 있는 인입부가 있다. 가열부재(23)는 캐비티(30)의 원주를 따라 실질적으로 균일하게 분포하는 것이 바람직하며, 인접하는 가열부재(23)에 의해 가열된 소모부위(21)의 영역이 중첩되지 않도록 충분히 떨어져 있는 것이 바람직하다. 중첩되는 경우 재가열해야 하며, 원하지 않는 화합물과 용미저하물질이 생산될 수 있기 때문이다.

바람직하게는, 소모부위(21)는 폴리그램이나 다른 고정수단(도시하지 않음)에 의해 부착된 통미부분(27)과 필터부분(28)으로 구성된다.

필터부분(28)으로는 통상의 셀룰로오스 아세테이트 필터 부분이 바람직하며, 대개 외관을 위해서 제공되는 매우 얇은 것과, 물품(10)이 종래의 담배와 유사한 무는 느낌을 갖도록 하는 것이 바람직하다.

통미부분(27)은 또꺼운 공기가 통과하거나 관통을 할때 통미를 유리하는 어떤 물질이어야 할 것이다. 여기서, 통미부분(27)은 미합중국 특허 제 4,510,950호에 기재된 압축된 오피셀 발포성 담배 생성물의 실린더형 부위가 바람직하다. 즉, 글리세린 등의 에어를 전구물전 약 10% 정도를 첨가하는 것이 외에는 전체적으로 상기 공보에 설명되어 있다. 에어졸과 같은 용미포함물질이 방출되도록 하기 위해 에어를 전구 물질을 첨가하는 것이 바람직하며, 따라서 소비자가 용미포함물질을 내뿜는 경우에 눈에 보이는 응축된 에어졸이 담배연기의 외형과 유사하게 보이게 될 것이다.

필터/통미부위(21)의 직경은 캐비티(30)의 내부직경과 거의 동일하고, 심한 캐비티(30)의 벽으로부터 바깥쪽으로 공여진 가열부재(23) 사이의 실린더형 공간의 직경 보다는 다소 커야 하며, 그래서, 가열부재(23)가 친밀한 열접촉을 위해 통미부분(27)을 압박하게 된다. 통미부분(27)은 견고하여야 하지만 압축성이 있어야 한다. 상기한 특허 제 4,510,950호에 기재된 오피셀 발포구조는 본 목적에 적합하지만 압축가능한 구조가 사용되어야 할 것이다.

소모부위(21)가 삽입된 물품(10)의 횡단면도를 보여주는 제 3a도에서는 가열부재(23)에 의해 압착된 통미부분(27)을 자세히 보여주고 있다.

또한, 제3a도에서는 가열기(23)와 인접하고 있는 통미부분(27)의 영역(32)을 보여주고 있으며, 통미부분(27)의 일부밖에 상응하는 각각의 영역(32)은 각각의 가열기(23)에 의해 가열되어 제각기 용미포함 물질이 총진되게 된다.

부위(21)의 길이는 소모된 부위(21)를 제거하는데 도움이 되도록 필터부분(28)의 일부가 캐비티(30)에서 돌출되게 하는 것이 바람직하다.

그러나, 부위(21)는 캐비티(30)에 정확히 삽입되어 있으며, 분리 방출 매카니즘도 제공되어 있다.

제조된 부위(21)의 길이가 어떨든지, 부위(27, 28)길이는 필터부분(28) 모두가 가열부재(23)의 선단(40) 보다는 캐비티(30)의 입구선단에 더 가깝게 되도록 하여야 필터부분(28)의 가열시 낭비되는 에너지가 없게 된다.

상술한 바와 같이, 새로운 소모부위(21)를 삽입할 때는 먼저 사용된 가열부재의 잔류물을 세척하는 세정작업을 해야 하는데, 바람직하게는 가열부재(23)의 표면을 매끄럽게 표면처리(41)하게 되면 세척하는데 도움이 준다. (비록 부재(23)로 부터 분리될지라도, 표면처리(41)는 분리출일 필요는 없으며, 분리출이 아닌 것이 바람직하다.) 견고하지만 압축성이 있는 부위(21)는 탄성이 있으므로 세정 작용시 견고하게 정복될 수 있다. 또한, 입구선단과 거리를 두고 있는 가열부재(23)의 선단(42)은 캐비티(30)의 선단벽면(43)과 인접해 있지만 떨어져 있는 캐비티(30)의 측면벽에 접촉되어 있다. 이것은 세정된 가열부재(23)의 잔류물들이 재가열되지 않게 하기 위하여 잔류물을 가열부재(23)의 후방선단(42)으로 밀어내게 된다.

상기에서 언급한 바와 같이, 제1도 내지 제4도의 구현예에서 가열 부재(23)의 전기적인 접속부가 그의 양쪽선단(40, 42)에 있으며 캐비티(30)의 입구선단까지 전선을 확장하거나 다른 도전체를 필요로 하게 된다.

그러나, 상기 요구조건은 더욱 바람직한 구현예에서는 필요하지 않으며, 이것은 제5도와 제6도에 나타난 바와같이 가열부재(52)를 배열한 것을 제외하고는 상기 제1도 내지 제4도 구현예와 동일하다.

즉, 가열부재(51)들은 신장된 U자 형태로, 첫번째 다리(leg)와 두번째 다리를 가지며, 첫번째 다리 및 두번째 다리 각각의 선단(52, 53)은 캐비티(30)의 선단 벽면(43)에 인접해 있는 캐비티(30)의 측면벽에 정속되어 있다. 선단(52)은 공통적으로 전기적으로 연결되어 있으며, 선단(53)은 전기적인 에너지원(22)에 연결되어 있다. 캐비티(30)의 입구 선단에 인접한 선단(54)은 전기적으로 연결되어 있지는 않으며, 그래서 캐비티(30)의 측면벽에 접촉시킬 필요가 없고, 제5도와 제6도에 나타난 바와 같이 상기한

소모부위(21)의 안입선을 제공하기 위하여 캐비티(30)의 측면벽쪽을 향하고 있다.

제6도에서는, 최상부위의 최하부의 부재(51)는 U자형 틈을 따라 치물면을 보여준다.

제7도와 제8도에서 나타낸 다른 구현예(70)에서, 가열부재(71)는 캐비티의 벽으로부터 다소 더 떨어져 있으며, 가열부재(71) 각각은 다소 더 날카로운 V자 형 틈(72)과 강도를 증가하기 위한 주물(73)을 포함하고 있으며, 첫번째 다리와의 두번째 다리를 갖는다. 이 경우에, 가열부재(71)는 친밀한 열접촉을 제공하기 위하여 소모부위(21)쪽으로 관통하여 확장되게 된다. 상기 기재한 오픈-셀 발포 구조는 본 구현예에 특히 적합하다. 이러한 구현예에서, 가열부재(71)는 캐비티(30)의 측면벽으로부터 떨어져 있기 때문에 각각의 선단(52, 53)은 캐비티(30)의 측면벽에 정착되어 있지는 않지만 선단벽면(43)에는 정착되어 있다. 바람직하게는 선단(52, 53)과 선단벽면(43)은 열과 전기의 도전성이 없는 간격판(80)에 의해 연결되는 것이 좋다. 이 경우에, 상기한 제정 작용은 전류하는 후위선단(52, 53)을 세정하고 간격판(80)위를 세정하여 잔류물이 제거되지 않게 한다.

소모부위(21)에 있는 소비부분(27)의 다른 구현예를 제9도와 제10도에 나타낸다. 소비부분(90)은 소비발생매체의 솔라리(93)로 위가 구획된 알루미늄 또는 금속포일층(92)으로 주위가 둘러싸인 섬유다발층을 포함한다. 섬유다발(91)은 부분(90)에 필요한 압축성을 준다. 이것은 부분(27)에서 발생하는 담배의 불충분한 시동을 피하며, 부분(27)의 중심에 있는 담배발포영역(33)(제 3a도)에 공간과 압축성을 제공한다. 소비자에게 풍미를 전달하기 위해서 가열되지는 않는다. 구현예(10)가 사용된다면, 더우기 섬유다발(91)은 셀룰로오스 아세타이드 또는 다른 필러물질로 만들어질 수 있으며, 필터 부분(28)형으로 되어 소모부위(21)가 단일체로 제공될 수 있다. 그러므로 가열부재는 재생가능하며, 소모부위는 미생물 분해성이 있는 전기적으로 가열된 소비발생물품이 제공된다는 것을 보여준다. 더우기, 가열기는 영구히 정착되므로 가열기와 전기에너지 간의 전기적 접촉 저항성이 제거된다.

(57) 청구의 범위

청구항 1

캐비티에 배열된 다수의 전기가열수단(23, 51, 71), 상기 전기가열수단에 전력을 공급하기 위한 전기에너지원(22), 모든전기 가열수단의 갯수보다는 적되 적어도 하나이상의 정해진 횟수중 어느 한번에 가열되도록 열원(22)에 의한 전기 가열수단의 가열을 조절하기 위한 제어수단(24) 및 다수의 전기가열수단과 근접되게 캐비티(30)에 수용된 제가가능한 부위인 소비발생매체(21)로 이루어져 있는 전기가열수단(23, 51, 71)중 어느하나의 작동으로 인하여 그와 접촉하고 있는 제가가능한 부위인 소비발생매체의 정해진 양의 소비포함물질을 소비자에게 전달하도록 된 출임가능한 소비포함물질을 소비자에게 전달하기 위한 소비발생물품.

청구항 2

제1항에 있어서, 제가가능한 부위인 소비발생매체는 제가가능한 부위를 소모하고 소비자에 의해 대체된 후에 각각의 전기가열수단의 한번의 작동에 의해 소비자에게 정해진 양의 소비포함물질을 전달하기 위하여 충분한 양의 소비발생매체를 포함하는 물품.

청구항 3

제1항 또는 제2항에 있어서, 캐비티(30)와 제가가능한 부위(21)는 실질적으로 실린더형이고, 직경이 동 일한 물품.

청구항 4

제3항에 있어서, 제가가능한 부위(21)는 캐비티(30)보다 길고, 삽입 및 제거를 위한 그림을 소비자에게 제공하기 위하여 선단에 돌출된 부위를 갖는 물품.

청구항 5

제1항에 있어서, 각각의 전기가열수단(23, 51)은 캐비티 내부로 돌출되어 있고, 제가가능한 부위는 압축성을 갖고 있되 전기가열수단은 캐비티내부에서 제가가능한 부위와 인접하고, 그사이에서 친밀한 열적접촉이 제공되도록 제가가능한 부위를 압박하고 있는 물품.

청구항 6

제1항에 있어서, 각각의 전기가열수단(71)은 캐비티 내부로 돌출 되어 있고, 제가가능한 부위는 압축성을 갖고 있되 그 사이에서 친밀한 열적접촉이 제공되도록 전기가열수단이 제가가능한 부위측으로 확장되어 있는 물품.

청구항 7

제1항에 있어서, 캐비티(30)는 이를 통해서 제가가능한 부위(21)가 삽입되는 삽입선단과 이 삽입선단과 어긋되어 있는 원선단을 가지고 있고, 캐비티 내부로의 제가가능한 부위의 삽입은 이전에 가열된 제가가 능한 부위로부터 남겨진 잔류물을 전기가열수단(23, 51, 71)으로부터 세정되는 물품.

청구항 8

제1항에 있어서, 각각의 전기 가열수단(23, 51, 71)은 원선단과 공간을 이루고 있되, 캐비티 내부로 제가가능한 부위의 삽입으로 인해 잔류물이 전기가열수단을 지나서 원선단쪽으로 세정되는 물품.

청구항 9

제1항에 있어서, 풍미발생매체는 압출된 담배 재료로 이루어지는 물품.

청구항 10

제9항에 있어서, 압출된 담배재료는 담배 발포성 재료인 물품.

청구항 11

제10항에 있어서, 담배발포성 재료는 오픈-셀 발포성인 물품.

청구항 12

제1항에 있어서, 풍미발생매체는 가열시 에어로졸을 형성하는 에어로졸 형성재료인 물품.

청구항 13

제12항에 있어서, 에어로졸-형성재료는 글리세린으로 이루어진 물품.

청구항 14

제12항 또는 제13항에 있어서, 에어로졸-형성재료는 물로 이루어진 물품.

청구항 15

제9항에 있어서, 상기 풍미발생매체는 담배와 에어로졸-형성재료로 이루어져 있고, 풍미발생매체의 가열 시 담배성분으로 이루어진 에어로졸이 형성되는 물품.

청구항 16

제15항에 있어서, 풍미발생매체는 추가로 담배 가용물로 이루어진 물품.

청구항 17

제1항에 있어서, 전기가열수단은 약 0.5Ω과 3.0Ω사이의 저항을 가지는 물품.

청구항 18

제17항에 있어서, 전기가열수단은 약 1.0Ω과 1.6Ω사이의 저항을 가지는 물품.

청구항 19

제1항에 있어서, 전기가열수단은 풍미발생매체와 접촉할 때 약 150℃ 내지 500℃ 사이의 온도를 발생시키는 물품.

청구항 20

제1항에 있어서, 전기가열수단은 가열될 때마다 약 1칼로리 (4.10줄)와 6칼로리(25.12줄)사이의 열량을 소모하는 물품.

청구항 21

제1항에 있어서, 전기가열수단은 총량에 대한 활성표면적의 비가 약 3mm²/mg과 6mm²/mg사이인 물품.

청구항 22

제21항에 있어서, 전기가열수단은 약 3mm²와 20mm²사이의 활성표면적을 가지며, 약 1mg와 30mg사이의 중량을 가지는 물품.

청구항 23

제22항에 있어서, 전기가열수단은 약3mm²와 20mm²사이의 활성표면적을 가지는 물품.

청구항 24

제1항에 있어서, 전기가열수단은 탄소, 흑연, 스텐레스강, 탄탈륨, 금속세라믹기재 및 금속합금으로 구성된 군에서 선택된 재료로 이루어진 물품.

청구항 25

제24항에 있어서, 금속합금은 알루미늄합금, 철합금, 크롬합금으로 구성된 군에서 선택된 물품.

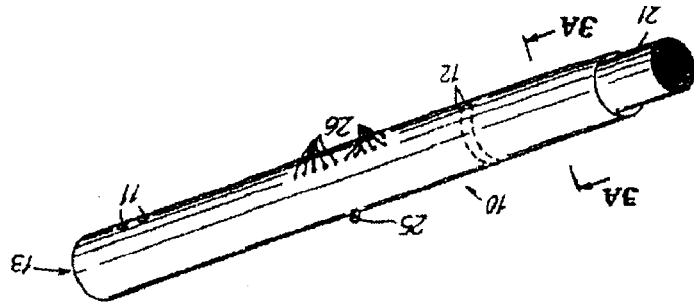
청구항 26

제24항에 있어서, 금속 세라믹기재는 실리콘 탄화알루미늄, 실리콘 탄화티타늄 및 이들의 혼합물로 이루어진 군에서 선택된 물품.

청구항 27

제24항에 있어서, 재료는 탄탈륨인 물품.

청구항 28



도 5

도 5

도 5는 종단면도를 나타내며, 도 5a는 도 5의 선단부를 확대하여 나타낸 것이다. 도 5a에 도시된 바와 같이, 선단부(21)는 원통형으로 형성되어 있으며, 그 상면(22)에는 원형의 홈(23)이 형성되어 있다. 이 홈(23)의 내경(24)은 선단부(21)의 외경(25)보다 작다. 또한, 선단부(21)의 외경(25)은 선단부(21)의 길이(26)에 따라 변한다. 도 5a에 도시된 바와 같이, 선단부(21)의 외경(25)은 선단부(21)의 길이(26)에 따라 변한다. 도 5a에 도시된 바와 같이, 선단부(21)의 외경(25)은 선단부(21)의 길이(26)에 따라 변한다.

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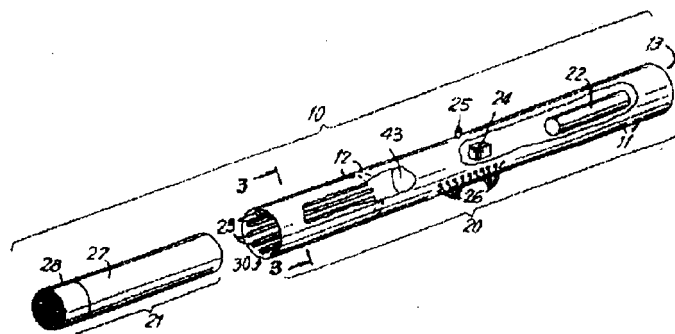
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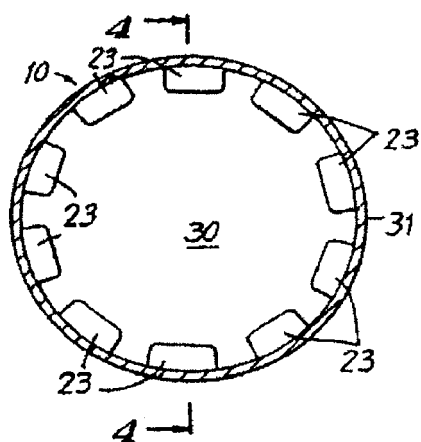
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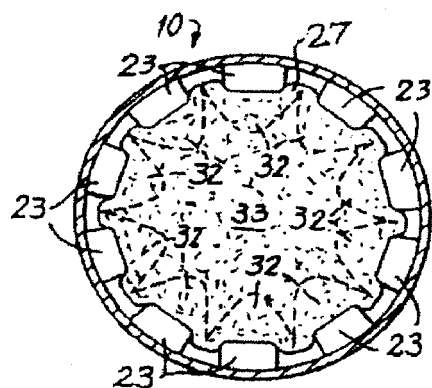
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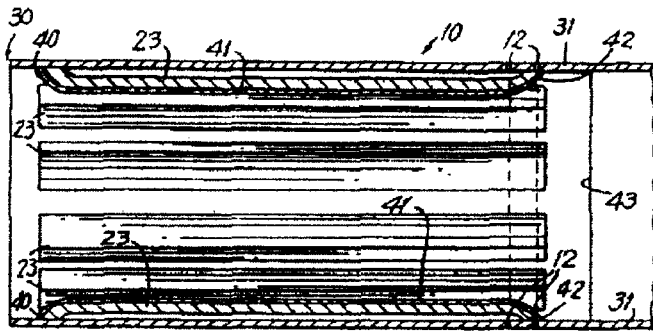
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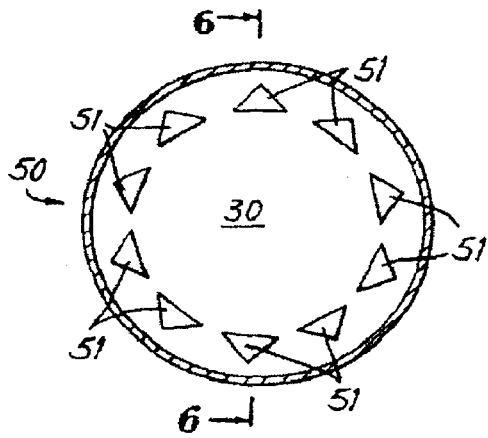
도면 3a



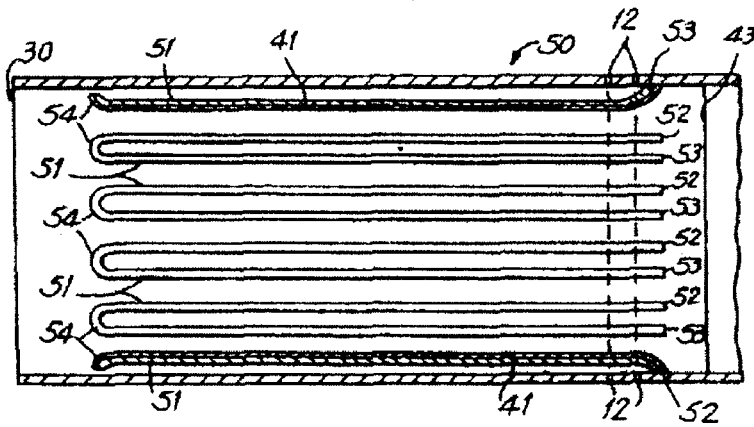
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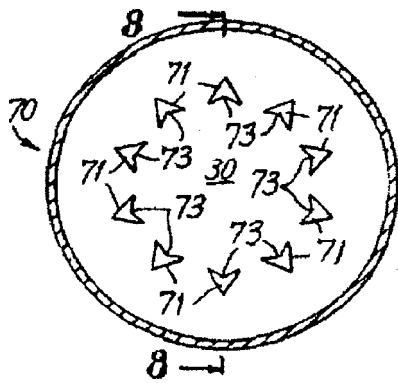
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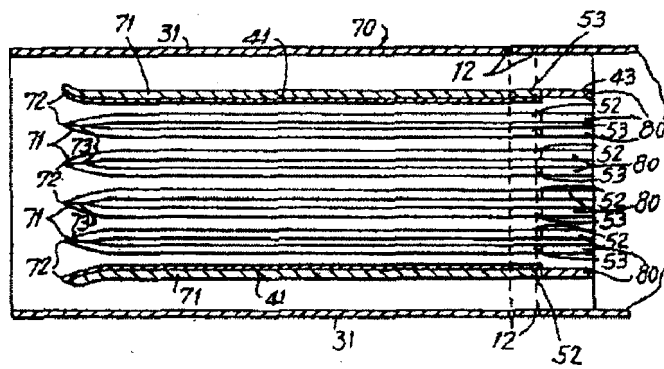
도면6



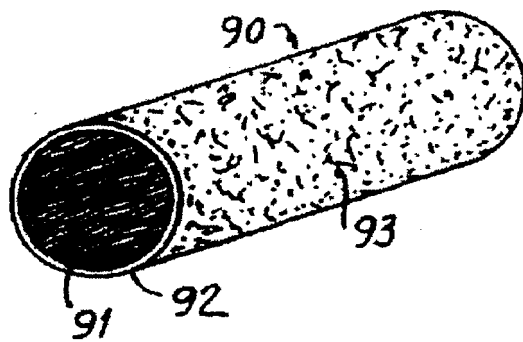
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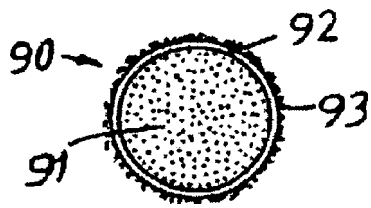
도면8



도면9



도면 10





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Description

This invention relates to articles in which flavor generating media are heated but not burned to release tobacco flavors. More particularly, this invention relates to electrically heated articles, as disclosed in the first part of claim 1 relating to the prior art of WO 86/02528.

An electrically heated flavor generating article is described in copending European Patent Application EP-A-0430566 claiming priority from commonly-assigned United States patent application Serial No: 07/444,746, filed December 1, 1989, which is hereby incorporated by reference of art, 54(3) and (4) EPC. That application describes an electrically heated flavor generating article which is provided with a disposable set of electrical heating elements on each of which is deposited an individual charge of flavor generating medium containing, for example, tobacco or tobacco-derived material. The disposable heater/flavor unit is mated to a more or less permanent unit containing a source of electrical energy such as a battery or capacitor, as well as control circuitry to actuate the heating elements in response to a puff by a consumer on the article or the depression of a manual switch. The circuitry is designed so that at least one but less than all of the heating elements are actuated for any one puff, so that a pre-determined number of puffs, each containing a premeasured amount of flavor-containing substance, is delivered to the consumer. The circuitry also preferably prevents the actuation of any particular heater more than once, to prevent overheating of the flavor generating medium thereon and consequent production or undesired compounds yielding off tastes.

In such an article, the heating elements are disposed of along with the spent flavor generating medium. This results in increased costs to the consumer, who must buy new heating elements with each refill of flavor generating medium. The volume of material disposed of is also greater when the heating elements must be disposed of.

In addition, when the heating elements are not permanently attached to the article, there is sometimes excessive contact resistance where the removable heaters are electrically connected to the source of electrical energy, resulting in increased power consumption.

Also, when the heating elements are disposable, the resistance may vary from heater to heater, resulting in variations in power consumption which in turn lead to variations in temperature. As it is the temperature to which the flavor generating medium is heated that determines the characteristics of the flavor containing substance, those characteristics will also vary.

The present invention aims to overcome the above mentioned disadvantages with the article described in EP-A-0430566 and accordingly provides an article for delivering to a consumer an inhalable flavor-containing substance, comprising a plurality of electrical heating means disposed in a cavity, a source of electrical energy for powering the electrical heating means, control means for controlling the heating of the electrical heating means by the source to heat at any one of a pre-determined number of times, at least one but fewer than all of the electrical heating means, and a removable portion of flavor generating medium received in the cavity in proximity to the plurality of electrical heating means, whereby on activation of any one of the electrical heating means a respective fraction of the removable portion of flavor generating medium in contact therewith is heated, delivering a predetermined quantity of flavor-containing substance to the consumer.

An article embodying the invention has the advantage of reusable heating elements and the further advantage that all disposable portions are biodegradable.

An article embodying the invention may have the further advantage that electrical contact resistance between the heaters and the source of electrical energy is minimized, and the advantage that variations from use to use in the temperature of the heating elements is minimized.

Preferred and advantageous features are defined in the sub-claims to which reference should be made.

Embodiments of the invention will now be described, by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a flavor generating article embodying the invention;

Figure 2 is a partially fragmentary, exploded perspective view of the flavor generating article of Figure 1;

Figure 3 is a radial cross-sectional view of the flavor generating articles of FIGS. 1 and 2, taken from line 3-3 of Figure 2;

Figure 3A is radial cross-sectional view of the flavor generating article of Figures 1-3, taken from line 3A-3A of Figure 1;

Figure 4 is a longitudinal cross-sectional view of the flavor cartridges received cavity of the flavor generating article of Figures 1-3A, taken from line 4-4 of Figure 3;

Figure 5 is a radial cross-sectional view similar to Figure 3 showing an alternative heater embodiment;

Figure 6 is a longitudinal cross-sectional view of the flavor cartridge receiving cavity of the flavor generating article of Figure 5, taken from line 6-6 of Figure 5;

Figure 7 is a radial crosssectional view similar to Figures 3 and 5 showing another alternative heater embodiment;

FIG. 8 is a longitudinal cross-sectional view of the flavor cartridge receiving cavity of the flavor generating article of FIG. 7, taken from line 8-8 of FIG. 7;

FIG. 9 is a perspective view of an alternative embodiment of a flavor cartridge embodying the invention; and

FIG. 10 is an end elevational view of the flavor cartridge of FIG. 9, taken from line 10-10 of FIG. 9.

A flavor generating article according to the present invention can be used, for example, to simulate a cigarette. In such a case, the flavor generating medium would be a material containing tobacco or tobacco derivatives. In accordance with the invention, the flavor generating article would include a removable disposable portion which included the flavor generating medium and, if desired, a filter, and a reusable "permanent" portion including a source of electrical energy, a set of reusable heating elements, and control circuitry for energizing the heaters in an appropriate sequence, in response to manual actuation or puff-induced actuation. Suitable control circuitry is described in EP-A-0430566 referred to above.

The reusable or permanent portion includes a cavity at the mouth end thereof for insertion of the disposable portion. The reusable heaters are disposed in the cavity in such a way that they make thermal contact with the disposable portion when the disposable portion is inserted into the cavity. This can be accomplished by having the heaters protrude from the sides of the cavity and making the disposable portion compressible, so that the heaters press into the material. Alternatively, the heaters can protrude from the end of the cavity, so that they actually pierce and extend into the disposable portion.

When reusable heaters are used, it is important that they be cleaned before each use. Otherwise, residues from the previous use, which might include partially oxidized, pyrolyzed or thermally decomposed constituents of the flavor generating medium, might be reheated, possibly giving rise to undesired compounds and off tastes being delivered to the consumer. Such residues are not of concern when the heaters are part of the disposable portion because they are never reheated, but may be of concern where reusable heaters are provided. In the present invention, the cleaning of the heaters is accomplished by the wiping action of the disposable portion against the heaters as the disposable portion is inserted. Thus the insertion end of the disposable portion pushes any residues on the heater surfaces toward the mouth end of the

cavity, to, and preferably past, the ends of the heaters. For this reason, the disposable portion, while compressible, should be relatively firm, and the heaters should preferably have a smooth surface finish to assure that the wiping action is effective.

The parameters of the heaters are chosen to allow delivery of an effective amount of flavor-containing substance -- e.g., an aerosol containing tobacco flavors -- to the consumer under standard conditions of use. For example, it may be desirable to deliver 2 mg of aerosol to a consumer during a 35 ml puff having a two-second duration.

It has been found that in order to achieve such delivery, the heaters should be able to reach a temperature of between about 150°C and about 500°C when in contact with the flavor generating medium. Further, the heaters should consume between about 1 calorie (4.19 Joules) and about 6 calories (25.12 Joules) given the limitations of power sources.

Heaters having such characteristics preferably have a ratio of active surface area (surface area in contact with the flavor generating medium) to mass of between about 3 mm²/mg and about 6 mm²/mg, an active surface area of between about 3 mm² and about 50 mm², a mass of between about 1 mg and about 30 mg, and a resistance of between about 0.5 ohm and 3.0 ohms. More preferably, the heaters should have an active surface area of between about 3 mm² and about 20 mm² and a resistance of between about 1.0 ohm and 1.6 ohms. These requirements are interrelated, because heater power consumption is determined by resistance, which in turn is determined by resistivity and size.

The materials of which the heaters are made are chosen to assure reliable repeated uses of up to 3,600 on/off cycles without failure. The heater materials are also chosen based on their reactivities, to assure that they will not react with the flavor generating medium at any temperature likely to be encountered to form any undesired compounds. Similarly, the heaters themselves should not evolve any undesired compounds when heated out of the presence of the flavor generating medium. Alternatively, heater materials that might otherwise give rise to undesired compounds could be encapsulated in an inert heat-conducting material such as a suitable ceramic material.

Based on these criteria, preferred materials for the electric heating means of the present invention include carbon, graphite, stainless steel, tantalum, metal ceramic matrices, and metal alloys, such as aluminum alloys, iron alloys, and chromium alloys. Suitable metal-ceramic matrices include silicon carbide aluminum and silicon carbide titanium. Of the listed materials, stainless steel and the aluminum,

iron or chromium alloys should be encapsulated in a suitable ceramic material because of their reactivity. Suitable ceramic materials for encapsulation include silica, alumina, and sol gels.

A particularly preferred material for use in the electrical heating means of this invention is tantalum.

A first preferred embodiment of a flavor generating article 10 is shown in FIGS. 1-4. Article 10 includes reusable or "permanent" portion 20 and disposable filter/flavor portion or cartridge 21 which is received in a cavity 30 at the mouth end of portion 20.

Reusable portion 20 includes, at the end remote from the mouth end, a power source 22, which could include a battery, a capacitor or both. The battery could be replaceable, rechargeable or both. If the battery is rechargeable, or if power source 22 is a capacitor alone, then article 10 is provided with charging contacts 11 on its outer surface, for connection to an external power supply (not shown) for charging power source 22. Power source 22 provides power for heating elements 23, which are energized under the control of control circuit 24, which is in turn actuated by pushbutton 25 or by a puff-actuated sensor (not shown). Indicators 26, which could be light-emitting diodes or other visual indicators, reflect the status of the various heaters 23. The functions of power source 22, control circuit 24, pushbutton 25 (or a puff-actuated sensor), and indicators 26 are described in more detail in EP-A-0430566 referred to above.

Portion 20 is preferably covered by cigarette wrapping paper 31, to give it the appearance of a conventional cigarette. Perforations 12 may be provided in the wall of portion 20 to allow outside air to be drawn in during puffing, or outside air may be drawn through all of portion 20 via openings (not shown) at its far end 13.

In this embodiment, heating elements 23 are linear, extending from a point slightly spaced away from the mouth end of cavity 30 to a point slightly spaced away from the rod end of cavity 30. As seen in FIG. 4, heating elements 23 are bowed slightly away from the wall of cavity 30, for reasons to be discussed below. At one of the two ends, all of heating elements 23 are connected in common to ground, while at the other end each element 23 is connected separately to control circuitry 24 for individual actuation of heating elements 23. The curvature of ends 40 of heating elements 23 at the mouth end of cavity 30 provides a lead-in for the insertion of disposable portion 21. Heating elements 23 are preferably distributed substantially uniformly around the circumference of cavity 30, and should preferably be spaced apart sufficiently that the regions of disposable portion 21 heated by neighboring heating elements 23 do not overlap,

which could lead to reheating and the production of undesired compounds and off tastes.

Disposable portion 21 preferably includes a flavor segment 27 and a filter segment 28, attached by a plug wrap or other fastening means (not shown). Filter segment 28 is preferably a conventional cellulose acetate filter segment, and preferably is very short, being provided mostly for the sake of appearance and to give article 10 a "mouth feel" similar to a conventional cigarette.

Flavor segment 27 can be any material that liberates flavors when hot air passes over or through it. Preferably, flavor segment 27 is a cylindrical portion of an extruded open-cell foamed tobacco product of the kind described in commonly-assigned United States Patent No. 4,510,950, which is hereby incorporated by reference in its entirety, except that approximately 10% of an aerosol precursor such as glycerine is added to the composition. It is desirable to add an aerosol precursor to deliver the flavor-containing substance as an aerosol, so that when the consumer exhales the flavor-containing substance, the visible condensed aerosol may mimic the appearance of cigarette smoke.

The diameter of filter/flavor portion 21 is at most equal to the inner diameter of cavity 30, and should be at least somewhat greater than the diameter of the cylindrical space between heating elements 23, which are bowed out from the wall of cavity 30 as discussed above, so that elements 23 press into flavor segment 27 for intimate thermal contact. To that end, flavor segment 27 should be firm but compressible. The open-cell foamed structure described in above-incorporated Patent No. 4,510,950 is particularly well-suited for that purpose, but other compressible structures may be used.

The compression of flavor segment 27 by heating elements 23 is illustrated in FIG. 3A, which shows a radial cross-sectional view of article 10 with disposable portion 21 inserted. FIG. 3A also shows regions 32 of flavor segment 27 adjacent heaters 23, each region 32 representing that fraction of segment 27 that is heated by each respective heater 23 to provide an individual charge of flavor-containing substance.

The length of portion 21 is preferably such that some part of filter segment 28 protrudes from cavity 30 to aid removal of spent portions 21. However, portion 21 could be inserted flush into cavity 30, and a separate ejection mechanism (not shown) could be provided. Whatever length portion 21 is made, the relative lengths of segments 27, 28 preferably should be such that all of filter segment 28 is closer to the mouth end of cavity 30 than the ends 40 of heating elements 23, so that no energy is wasted heating filter segment 28.

As discussed above, a wiping action cleans residue from previous uses off heating elements 23 as each new disposable portion 21 is inserted, and that preferably is aided by smooth surface finish 41 on the surface of heating elements 23. (Although drawn separately from elements 23, surface finish 41 need not be, and preferably is not, a separate layer.) The resilience of firm but compressible portion 21 assures firm contact for the wiping action. Preferably also, the ends 42 of heating elements 23 remote from the mouth end are connected to the side wall of cavity 30 adjacent to, but spaced away from, end wall 43 of cavity 30. That allows the residue that is wiped off heating elements 23 to be pushed past ends 42 of heating elements 23 so that residue is not reheated.

As discussed above, in embodiment 10 of FIGS. 1-4, the electrical connections to heating elements 23 are made at both ends 40, 42 thereof, requiring the extension of wires or other conductors to the mouth end of cavity 30. That requirement is eliminated in a more particularly preferred embodiment 50, which is identical to embodiment 10 except for the arrangement of heating elements 51 as illustrated in FIGS. 5 and 6.

Each heating element 51 is in the shape of an elongated "U", each having both of its ends 52, 53 connected to the side wall of cavity 30 adjacent end wall 43 of cavity 30. Each respective end 52 is individually connected to control circuitry 24 for individual actuation of heating elements 51, while ends 53 are connected in common to ground. While ends 54 adjacent the mouth end of cavity 30 are not electrically connected, and thus need not touch the side wall of cavity 30, they are nonetheless turned toward the side wall of cavity 30, as shown in both FIGS. 5 and 6, to provide a lead-in for disposable portion 21 as discussed above. It should be noted that in FIG. 6, the uppermost and lowermost elements 51 are shown cut through their U-shaped tips 54.

In another embodiment 70 shown in FIGS. 7 and 8, heating elements 71 are spaced somewhat further from the wall of cavity 30, and each is provided with a somewhat sharper "V" tip 72, as well as with fold 73 to increase their rigidity. In this way, heating elements 71 actually pierce and extend into disposable portion 21 to provide the desired intimate thermal contact. The open-cell foam structure described above is particularly well-suited for such an embodiment. In this embodiment, because heating elements 71 are spaced further from the side wall of cavity 30, ends 52, 53 are not attached to the side wall of cavity 30, but to its end wall 43. Preferably, the connections of ends 52, 53 to end wall 43 are made through spacers 80 which are not conductive of either heat or electricity. In this way, the wiping action referred to above wipes

residue past ends 52, 53 and onto spacers 80, where the residues are not reheated.

An alternative embodiment of flavor segment 27 of disposable portion 21 is shown in FIGS. 9 and 10. Flavor segment 90 includes a fiber bundle 91 around which is wrapped a layer 92 of metallic foil, such as aluminum foil, onto which has been coated a slurry 93 of flavor generating medium. Fiber bundle 91 gives segment 90 the necessary compressibility. This alternative avoids the inefficient use of tobacco that occurs in segment 27, where the tobacco foam region 33 (FIG. 3A) in the center of segment 27 provides bulk and compressibility but is never heated to deliver flavor to the consumer. Furthermore, if this embodiment 90 is used, fiber bundle 91 could be made of cellulose acetate or other suitable filter material, and could be extended to form filter segment 28, thereby providing disposable portion 21 as a unitary body.

Thus it is seen that an electrically heated flavor generating article is provided in which the heating elements are reusable, and of which all disposable portions can be biodegradable. In addition, electrical contact resistance between the heaters and the source of electrical energy is eliminated, as the heaters are permanently attached.

Claims

1. An article for delivering to a consumer an inhalable flavor-containing substance, comprising electrical heating means (23;51;71) disposed in a cavity (30), a source of electrical energy (22) for powering the electrical heating means, control means (24) for controlling the heating of the electrical heating means by the source (22), and a removable portion of flavor generating medium (21) received in the cavity (30) in proximity to the electrical heating means, characterised by a plurality of electrical heating means controlled by the control means to heat at any one of a pre-determined number of times, at least one but fewer than all of the electrical heating means, and in that on activation of any one of the electrical heating means (23;51;71) a respective fraction of the removable portion of flavor generating medium in contact therewith is heated, delivering a pre-determined quantity of flavor-containing substance to the consumer.
2. An article according to Claim 1, wherein the removable portion of flavor generating medium contains a sufficient quantity of flavor generating medium for delivery of the predetermined quantity of flavor containing substance to the consumer by a single activation of each electrical heating means after which the removable

portion is spent and is replaceable by the consumer.

3. An article according to Claim 1 or 2, wherein the cavity (30) and the removable portion (21) are substantially cylindrical and of substantially equal diameter. 5
4. An article according to Claim 3, wherein the removable portion (21) is longer than the cavity (30) and, in position has an end protruding there from providing a grip for the consumer for insertion and removal. 10
5. An article according any of claims 1 to 4, wherein each electrical heating means (23;51) protrudes into the cavity, and the removable portion is compressible, whereby the electrical heating means are adjacent the removable portion in the cavity and compress the removable portion to provide intimate thermal contact therebetween. 15 20
6. An article according to any of Claims 1 to 4, wherein each electrical heating means protrudes (71) into the cavity, and the removable portion is compressible whereby the electrical heating means extend into said removable portion, providing intimate thermal contact therebetween. 25 30
7. An article according to any preceding claim, wherein the cavity (30) has an insertion end through which the removable portion (21) is inserted and a far end remote from said insertion end, and insertion of the removable portion into the cavity, wipes from the electrical heating means (23;51;71) any residue remaining from a previously heated removable portion. 35 40
8. An article according to Claim 7, wherein each of the electrical heating means (23;51;71) is spaced from the far end, whereby on insertion of the removable portion into the cavity, the residue is wiped beyond the electrical heating means in the direction of the far end. 45
9. An article according to any preceding claim, wherein the flavor generating medium comprises an extruded tobacco material. 50
10. An article according to Claim 9, wherein the extruded tobacco material is a tobacco foam material. 55
11. An article according to Claim 10, wherein the tobacco foam material is an open-cell foam.

12. The article of any preceding claim, wherein the flavor generating medium comprises an aerosol-forming material, which on heating forms an aerosol.
13. The article of Claim 12, wherein the aerosol-forming material comprises glycerine.
14. The article of Claim 12 or 13, wherein said aerosol-forming material comprises water.
15. An article according to any of Claims 9 to 14, wherein said flavor generating medium comprises tobacco and an aerosol-forming material, and on heating the flavor generating medium an aerosol comprising tobacco components is formed.
16. An article according to Claim 15, wherein the flavor generating medium further comprises tobacco solubles.
17. An article according to any preceding claim, wherein the electrical heating means has a resistance of between about 0.5 ohms and about 3.0 ohms.
18. An article according to Claim 17, wherein the electrical heating means has a resistance of between about 1.0 ohms and 1.6 ohms.
19. An article according to any preceding claim, wherein the electrical heating means produces a temperature of between about 150 °C and about 500 °C when in contact with the flavor generating medium.
20. An article according to any preceding claim, wherein the electrical heating means consumes between about 1 calorie (4.10 Joules) and about 6 calories (25.12 Joules) each time it is heated.
21. An article according to any preceding claim, wherein the electrical heating means has a ratio of active surface area to mass of between about 3 mm²/mg and about 6 mm²/mg.
22. An article according to Claim 21, wherein the electrical heating means has an active surface area of between 3mm² and about 50 mm², and a mass of between 1 mg and about 30 mg.
23. An article according to Claim 22, wherein the electrical heating means has an active surface area of between about 3 mm² and about 20 mm².

24. An article according to any preceding claim, wherein the electrical heating means comprises a material selected from the group consisting of carbon, graphite, stainless steel, tantalum, metal ceramic matrices, and metal alloys. 5
25. An article according to Claim 24, wherein the metal alloys are selected from the group consisting of aluminium alloys, iron alloys, and chromium alloys. 10
26. An article according to Claim 24, wherein the metal ceramic matrices are selected from the group consisting of silicon carbide aluminium, silicon carbide titanium, and mixtures thereof. 15
27. An article according to Claim 24, wherein the material comprises tantalum. 20
28. An article according to Claim 25, wherein the material is encapsulated in a ceramic coating. 25
29. An article according to any preceding claim, wherein the removable portion has a mouth end and a rod end, the removable portion (21) further comprising a filter at the mouth end. 30
30. An article for delivering to a consumer an inhalable flavor containing substance, comprising a plurality of electrical heating elements (23;51;71) disposed in a cavity (30) in the article, an electrical energy source (22) for powering the heating elements, control means (24) for controlling the heating of the heating elements by the power source to heat at least one, but not all the elements a predetermined number of times, and a flavor generating medium removably received in the cavity and arranged proximate the heating elements, whereby heating of the elements by the power source releases a predetermined quantity of flavor containing substance from the portion of the flavor generating medium in contact with the one or more elements heated, to the consumer. 35 40 45

Patentansprüche

1. Artikel zur Abgabe einer von einem Verbraucher inhalierbaren, ein Aroma enthaltenden Substanz, mit einer elektrischen Heizeinrichtung (23; 51; 71), die in einem Hohlraum (30) angeordnet ist, einer elektrischen Energiequelle (22) zur Stromversorgung der elektrischen Heizeinrichtung, einer Steuereinrichtung (24) zur Steuerung des Heizvorganges der elektrischen Heizeinrichtung durch die Quelle (22) 50 55

und mit einem entfernbaren Abschnitt eines das Aroma erzeugenden Mediums (21), der in dem Hohlraum (30) in der Nähe der elektrischen Heizeinrichtung aufgenommen ist, gekennzeichnet durch eine Vielzahl von elektrischen Heizvorrichtungen, die durch die Steuereinrichtung gesteuert werden, um irgendeine der elektrischen Heizvorrichtungen eine vorbestimmte Anzahl von Malen und zwar wenigstens eine, jedoch weniger als alle der elektrischen Heizvorrichtungen aufzuheizen, wobei bei Aktivierung irgendeiner der elektrischen Heizvorrichtungen (23; 51; 71) einjeweiliger Bruchteil des entfernbaren Abschnitts des das Aroma erzeugenden Mediums, welcher damit in Berührung stet, erhitzt wird und eine vorbestimmte Menge der das Aroma enthaltenden Substanz an den Verbraucher abgibt.

2. Artikel nach Anspruch 1, bei dem der entfernbare Abschnitt des das Aroma erzeugenden Mediums eine ausreichende Menge des das Aroma erzeugenden Mediums enthält, um die vorbestimmte Menge der das Aroma enthaltenden Substanz an den Verbraucher durch eine einzelne Aktivierung jeder elektrischen Heizvorrichtung abzugeben, wonach der entfernbare Abschnitt verworfen wird und von dem Verbraucher ersetzbar ist.
3. Artikel nach Anspruch 1 oder 2, bei dem der Hohlraum (30) und der entfernbare Abschnitt (21) im wesentlichen zylindrisch gestaltet sind und im wesentlichen gleichen Durchmesser haben.
4. Artikel nach Anspruch 3, bei dem der entfernbare Abschnitt (21) länger ausgebildet ist als der Hohlraum (30) und in Lage gebracht ein Ende aufweist, welches daraus hervorragt und einen Handgriff zum Einschieben und Entfernen für den Verbraucher bildet.
5. Artikel nach irgendeinem der Ansprüche 1 bis 4, bei dem jede elektrische Heizvorrichtung (23; 51) in den Hohlraum hineinragt und bei dem der entfernbare Abschnitt zusammendrückbar ist, wobei die elektrischen Heizvorrichtungen benachbart dem entfernbaren Abschnitt in dem Hohlraum angeordnet sind und den entfernbaren Abschnitt zusammendrücken, um dadurch dazwischen einen ausgeprägten thermischen Kontakt herzustellen.
6. Artikel nach irgendeinem der Ansprüche 1 bis 4, bei dem jede elektrische Heizvorrichtung (71) in den Hohlraum hineinragt und der entfernbare Abschnitt zusammendrückbar ist, wo-

bei sich die elektrische Heizvorrichtung in den entfernbaren Abschnitt hinein erstreckt, um dadurch einen ausgeprägten thermischen Kontakt dazwischen herzustellen.

7. Artikel nach irgendeinem der vorhergehenden Ansprüche, bei dem der Hohlraum (30) ein Einschubende aufweist, über welches der entfernbare Abschnitt (21) einschiebbar ist, und ein ablegendes Ende, welches von dem Einschubende entfernt gelegen ist, besitzt und wobei das Einschieben des entfernbaren Abschnitts in den Hohlraum von den elektrischen Heizvorrichtungen (23; 51; 71) jeglichen Rückstand abwischt, der von einem früher erhitzten entfernbaren Abschnitt zurückgeblieben ist.
8. Artikel nach Anspruch 7, bei dem jede der elektrischen Heizvorrichtungen (23; 51; 71) von dem abliegenden Ende beabstandet ist, wobei bei Einschieben des entfernbaren Abschnitts in den Hohlraum der Rückstand über die elektrischen Heizvorrichtungen in Richtung des abliegenden Endes abgewischt wird.
9. Artikel nach irgendeinem der vorhergehenden Ansprüche, bei dem das das Aroma erzeugende Medium ein extrudiertes Tabakmaterial aufweist.
10. Artikel nach Anspruch 9, bei dem das extrudierte Tabakmaterial aus einem Tabakschaummaterial besteht.
11. Artikel nach Anspruch 10, bei dem das Tabakschaummaterial aus einem Schaum mit offenen Zellen besteht.
12. Artikel nach irgendeinem der vorhergehenden Ansprüche, bei dem das das Aroma erzeugende Medium ein Aerosol bildendes Material enthält, welches bei Erhitzung ein Aerosol erzeugt.
13. Artikel nach Anspruch 12, bei dem das das Aerosol erzeugende Material Glyzerin aufweist.
14. Artikel nach Anspruch 12 oder 13, bei dem das das Aerosol erzeugende Material Wasser enthält.
15. Artikel nach irgendeinem der Ansprüche 9 bis 14, bei dem das das Aroma erzeugende Medium Tabak und ein Aerosol erzeugendes Material aufweist und bei Erhitzen des das Aroma erzeugenden Mediums ein Aerosol gebildet wird, welches Tabakkomponenten enthält.

16. Artikel nach Anspruch 15, bei dem das das Aroma erzeugende Medium ferner Tabak-Lösungsmittel enthält.

- 5 17. Artikel nach irgendeinem der vorgehenden Ansprüche, bei dem die elektrische Heizvorrichtung einen Widerstand zwischen ca 0,5 Ohm und ca 3,0 Ohm aufweist.
- 10 18. Artikel nach Anspruch 17, bei dem die elektrische Heizvorrichtung einen Widerstand zwischen ca 1,0 Ohm und 1,6 Ohm aufweist.
- 15 19. Artikel nach irgendeinem der vorhergehenden Ansprüche, bei dem die elektrische Heizvorrichtung eine Temperatur zwischen ca 150 °C und ca 500 °C erzeugt, wenn sie in Kontakt mit dem das Aroma erzeugenden Medium steht.
- 20 20. Artikel nach irgendeinem der vorhergehenden Ansprüche, bei dem die elektrische Heizvorrichtung zwischen ca 1 Kalorie (4 .10 Joules) und ca 6 Kalorien (25:12 Joules) jedesmal verbraucht, wenn sie erhitzt wird.
- 25 21. Artikel nach irgendeinem der vorhergehenden Ansprüche, bei dem die elektrische Heizvorrichtung ein Verhältnis des aktiven Oberflächenbereiches zur Masse zwischen ca 3 mm²/mg und ca 6 mm²/mg aufweist.
- 30 22. Artikel nach Anspruch 21, bei dem die elektrische Heizvorrichtung einen aktiven Oberflächenbereich zwischen 3 mm² und ca 50 mm² besitzt und eine Masse zwischen 1mg und ca 30 mg aufweist.
- 35 23. Artikel nach Anspruch 22, bei dem die elektrische Heizvorrichtung einen aktiven Oberflächenbereich zwischen ca 3 mm² und ca 20 mm² besitzt.
- 40 24. Artikel nach irgendeinem der vorhergehenden Ansprüche, bei dem die elektrische Heizvorrichtung ein Material enthält, welches aus der Gruppe, bestehend aus Kohlenstoff, Graphit, rostfreiem Stahl, Tantal, Metallkeramik-Matrizen und Metall-Legierungen, ausgewählt ist.
- 45 25. Artikel nach Anspruch 24, bei dem die Metall-Legierungen aus der Gruppe ausgewählt sind, die aus Aluminium-Legierungen, Eisen-Legierungen und Chrom-Legierungen bestehen.
- 50 26. Artikel nach Anspruch 24, bei dem die Metallkeramik-Matrizen aus der Gruppe ausgewählt sind, die aus Siliziumkarbid-Aluminium, Siliziumkarbid-Titan und Mischungen davon be-
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steht.

27. Artikel nach Anspruch 24, bei dem das Material Tantal enthält.

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28. Artikel nach Anspruch 25, bei dem das Material in einen Keramiküberzug eingekapselt ist.

29. Artikel nach irgendeinem der vorhergehenden Ansprüche, bei dem der entfernbare Abschnitt ein Mundende und ein Stabende aufweist, wobei der entfernbare Abschnitt (21) ferner ein Filter an dem Mundende aufweist.

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30. Artikel zum Abgeben einer inhalierbaren, ein Aroma enthaltenden Substanz an einen Verbraucher, mit einer Vielzahl von elektrischen Heizelementen (23; 51; 71), die in einem Hohlraum (30) in dem Artikel angeordnet sind, einer elektrischen Energiequelle (22) für die Stromversorgung der Heizelemente, einer Steuereinrichtung (24) zum Steuern des Heizvorganges der Heizelemente durch die Energiequelle, um wenigstens eines, jedoch nicht alle der Elemente eine bestimmte Anzahl von Malen zu erhitzen, und mit einem ein Aroma erzeugenden Medium, welches in dem Hohlraum entferntbar aufgenommen ist und dicht bei den Heizelementen angeordnet ist, wodurch das Aufheizen der Elemente durch die Energiequelle eine vorbestimmte Menge der das Aroma enthaltenden Substanz aus dem Abschnitt des das Aroma erzeugenden Mediums für den Verbraucher freisetzt, der in Berührung mit dem einen oder mehreren erhitzten Elementen steht.

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Revendications

1. Article destiné à délivrer à un consommateur une substance comportant un arôme inhalable, comportant des moyens de chauffage électrique (23; 51; 71) agencés dans une cavité (30), une source (22) d'énergie électrique destinée à alimenter les moyens de chauffage électrique, des moyens de commande (24) destinés à commander le chauffage des moyens de chauffage électrique par la source (22), et une partie amovible constituant un support délivrant un arôme (21) reçu dans la cavité (30) à proximité des moyens de chauffage électrique, caractérise en ce qu'il comporte plusieurs moyens de chauffage électrique commandés par les moyens de commande pour chauffer à chaque fois d'un nombre prédéterminé de fois, au moins un moyen de chauffage électrique mais pas tous les moyens de chauffage électrique, et en ce que, lors de l'activation de l'un

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quelconque des moyens de chauffage électrique (23; 51; 71), un fragment respectif de la partie amovible du support délivrant un arôme en contact avec celui-ci est chauffé en délivrant au consommateur une quantité prédéterminée de substance comportant un arôme.

2. Article selon la revendication 1, dans lequel la partie amovible du support délivrant un arôme comporte une quantité suffisante de support délivrant un arôme pour délivrer la quantité prédéterminée de substance comportant un arôme au consommateur par activation unique de chaque moyen de chauffage électrique après quoi la partie amovible est usée et peut être remplacée par le consommateur.

3. Article selon la revendication 1 ou 2, dans lequel la cavité (30) et la partie amovible (21) sont à peu près cylindriques et de diamètre à peu près égal.

4. Article selon la revendication 3, dans lequel la partie amovible (21) est plus longue que la cavité (30) et, en position, a une extrémité faisant saillie à partir de celle-ci pour fournir au consommateur une préhension pour l'insertion et l'enlèvement.

5. Article selon l'une quelconque des revendications 1 à 4, dans lequel chaque moyen de chauffage électrique (23; 51) fait saillie à l'intérieur de la cavité, et la partie amovible est compressible, de sorte que les moyens de chauffage électrique sont adjacents à la partie amovible dans la cavité et compriment la partie amovible pour fournir un très bon contact thermique entre ceux-ci.

6. Article selon l'une quelconque des revendications 1 à 4, dans lequel chaque moyen de chauffage électrique fait saillie (71) à l'intérieur de la cavité, et la partie amovible est compressible de sorte que les moyens de chauffage électrique s'étendent à l'intérieur de ladite partie amovible, fournissant un très bon contact thermique entre ceux-ci.

7. Article selon l'une quelconque des revendications précédentes, dans lequel la cavité (30) a une extrémité d'insertion à travers laquelle la partie amovible (21) est insérée et une extrémité éloignée de ladite extrémité d'insertion, et l'insertion de la partie amovible à l'intérieur de la cavité balaye des moyens de chauffage électrique (23; 51; 71) tout résidu restant de la partie amovible chauffée antérieurement.

8. Article selon la revendication 7, dans lequel chacun des moyens de chauffage électrique (23; 51; 71) est espacé de l'extrémité éloignée, de sorte que lors de l'insertion de la partie amovible à l'intérieur de la cavité, les résidus sont balayés au-delà des moyens de chauffage électrique dans la direction de l'extrémité éloignée. 5
9. Article selon l'une quelconque des revendications précédentes, dans lequel le support délivrant un arôme comporte un matériau extrudé de tabac. 10
10. Article selon la revendication 9, dans lequel le matériau extrudé de tabac est un matériau en mousse de tabac. 15
11. Article selon la revendication 10, dans lequel le matériau en mousse de tabac est une mousse à cellules ouvertes. 20
12. Article selon l'une quelconque des revendications précédentes, dans lequel le support délivrant un arôme comporte un matériau de formation d'aérosol, qui, lorsqu'il est chauffé, forme un aérosol. 25
13. Article selon la revendication 12, dans lequel le matériau de formation d'aérosol est constitué de glycérine. 30
14. Article selon la revendication 12 ou 13, dans lequel ledit matériau de formation d'aérosol est constitué d'eau. 35
15. Article selon l'une quelconque des revendications 9 à 14, dans lequel ledit support délivrant un arôme est constitué de tabac et d'un matériau de formation d'aérosol, et, lors du chauffage du support délivrant un arôme, est formé un aérosol comportant des composants de tabac. 40
16. Article selon la revendication 15, dans lequel le support délivrant un arôme comporte en outre des solutions de tabac. 45
17. Article selon l'une quelconque des revendications précédentes, dans lequel les moyens de chauffage électrique ont une résistance comprise entre environ 0,5 ohm et environ 3,0 ohms. 50
18. Article selon la revendication 17, dans lequel les moyens de chauffage électrique ont une résistance comprise entre environ 1,0 ohm et 1,6 ohms. 55
19. Article selon l'une quelconque des revendications précédentes, dans lequel les moyens de chauffage électrique fournissent une température comprise entre environ 150 °C et environ 500 °C lorsqu'ils sont en contact avec le support délivrant un arôme.
20. Article selon l'une quelconque des revendications précédentes, dans lequel les moyens de chauffage électrique consomment entre environ 1 calorie (4,10 Joules) et environ 6 calories (25,12 Joules) à chaque fois qu'ils sont chauffés.
21. Article selon l'une quelconque des revendications précédentes, dans lequel les moyens de chauffage électrique ont un rapport de surface superficielle active par rapport à la masse compris entre environ 3 mm²/mg et environ 6 mm²/mg.
22. Article selon la revendication 21, dans lequel les moyens de chauffage électrique ont une surface superficielle active comprise entre 3 mm² et environ 50 mm², et une masse comprise entre 1 mg et environ 30 mg.
23. Article selon la revendication 22, dans lequel les moyens de chauffage ont une surface superficielle active comprise entre environ 3 mm² et environ 20 mm².
24. Article selon l'une quelconque des revendications précédentes, dans lequel les moyens de chauffage électrique comportent un matériau choisi parmi le groupe constitué du carbone, du graphite, de l'acier inoxydable, du tantale, d'une matrice en céramique-métal, et d'alliages métalliques.
25. Article selon la revendication 24, dans lequel les alliages métalliques sont choisis parmi le groupe constitué des alliages d'aluminium, des alliages de fer, et des alliages de chrome.
26. Article selon la revendication 24, dans lequel les matrices en céramique-métal sont choisies parmi le groupe constitué de l'aluminium au carbure de silicium, du titane au carbure de silicium, et des mélanges de ceux-ci.
27. Article selon la revendication 24, dans lequel le matériau est constitué de tantale.
28. Article selon la revendication 25, dans lequel le matériau est encapsulé dans un revêtement en céramique.

29. Article selon l'une quelconque des revendications précédentes, dans lequel la partie amovible a une extrémité formant embouchure et une extrémité formant tige, la partie amovible (21) comporte en outre un filtre situé au niveau de l'extrémité formant embouchure. 5

30. Article destiné à délivrer à un consommateur une substance comportant un arôme inhalable, comportant plusieurs éléments de chauffage électrique (23; 51; 71) agencés dans une cavité (30) existant dans l'article, une source d'énergie électrique (22) destinée à alimenter les éléments de chauffage, des moyens de commande (24) destinés à commander le chauffage des éléments de chauffage par la source d'énergie pour chauffer au moins un, mais pas tous les éléments, un nombre prédéterminé de fois, et un support délivrant un arôme reçu de manière amovible dans la cavité et agencé à proximité des éléments de chauffage, de sorte que le chauffage des éléments par la source d'énergie libère pour le consommateur une quantité prédéterminée de substance comportant un arôme à partir de la partie du support délivrant un arôme en contact avec un ou plusieurs éléments chauffés. 25

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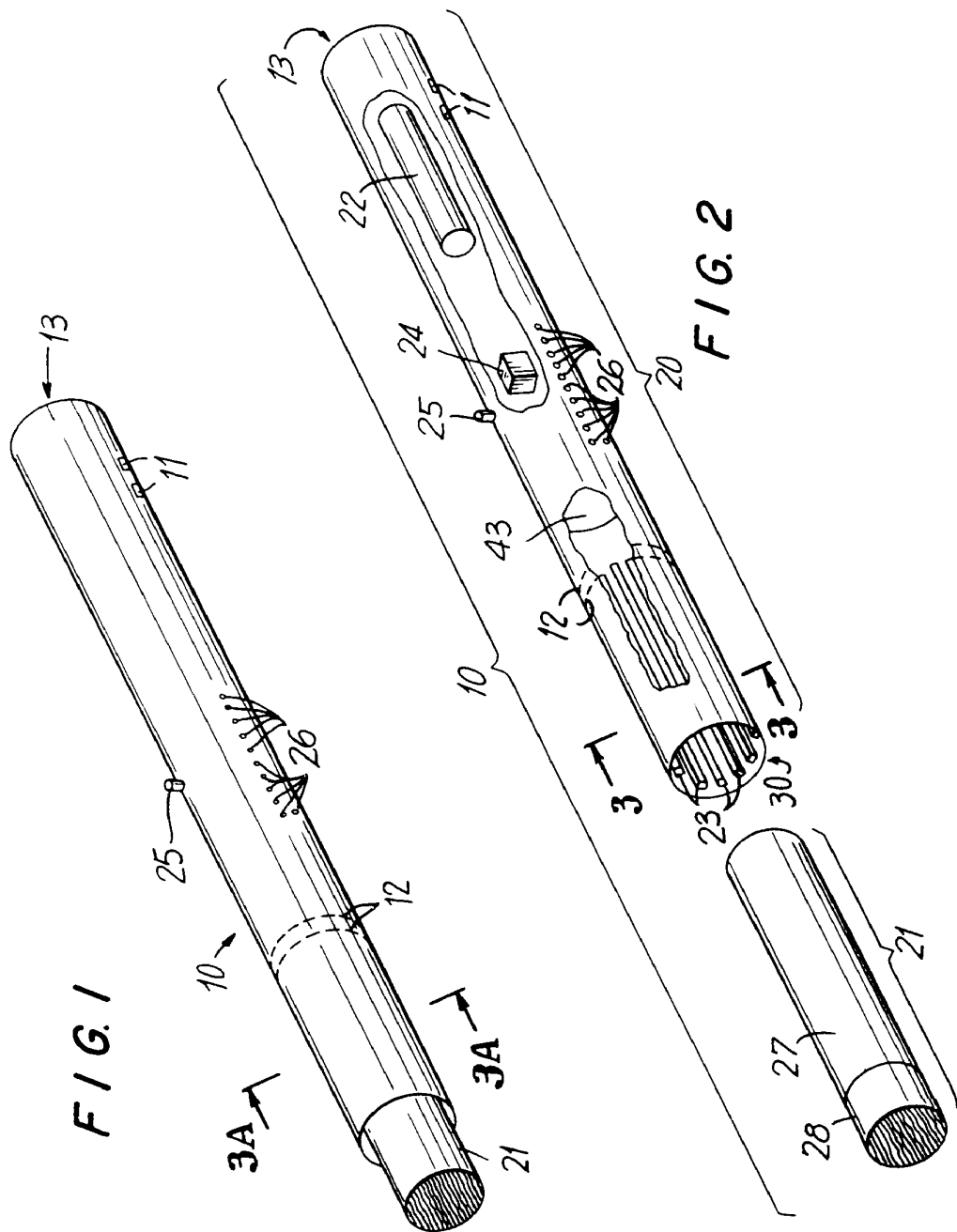
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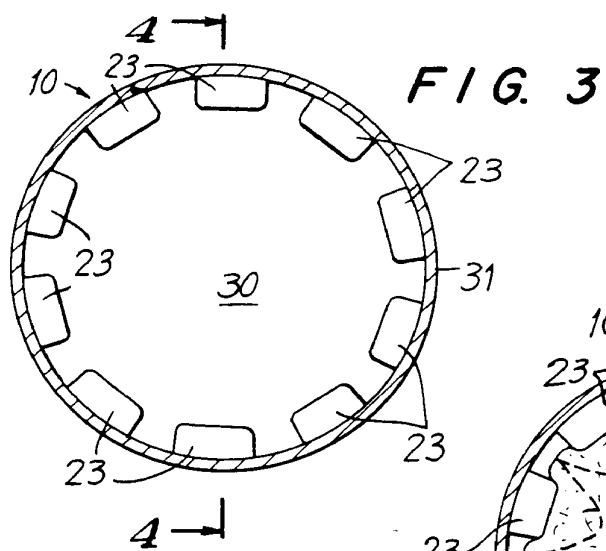
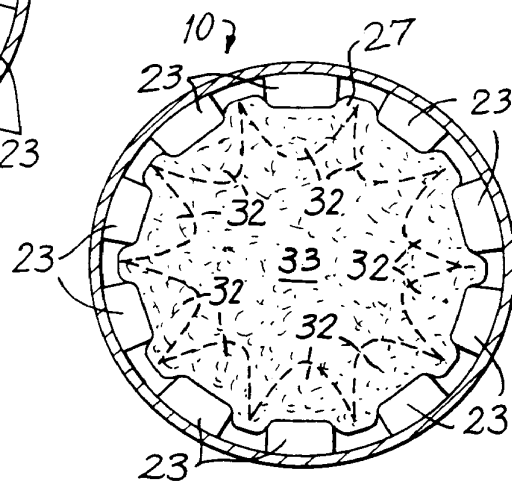
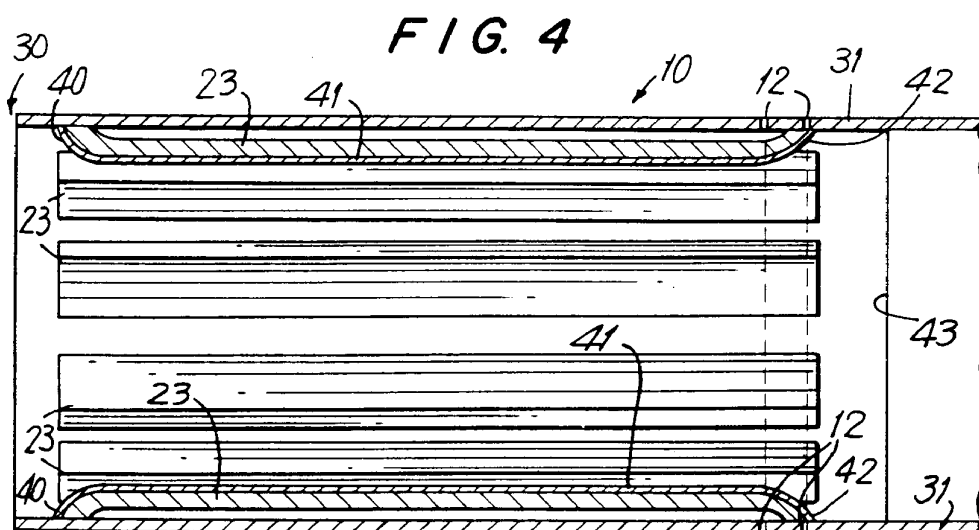
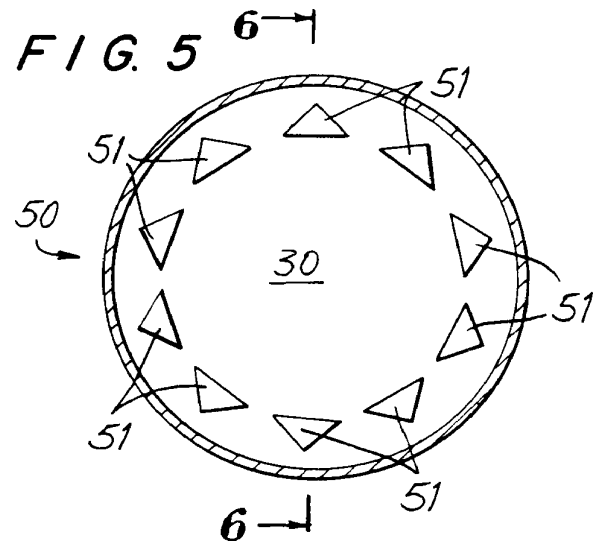
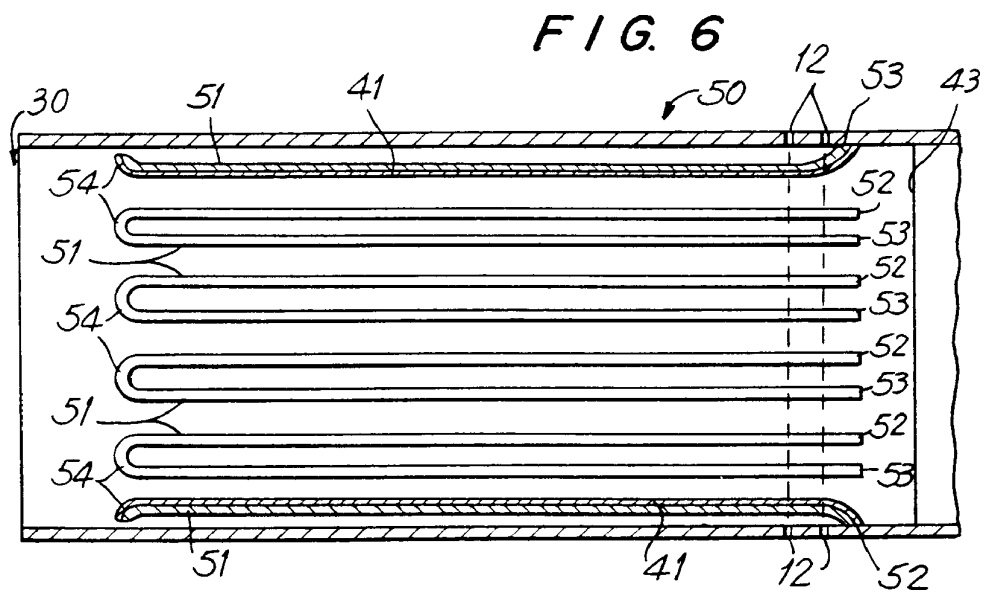
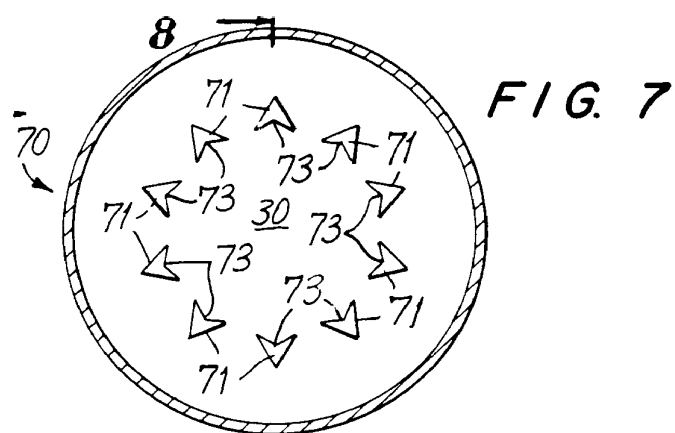
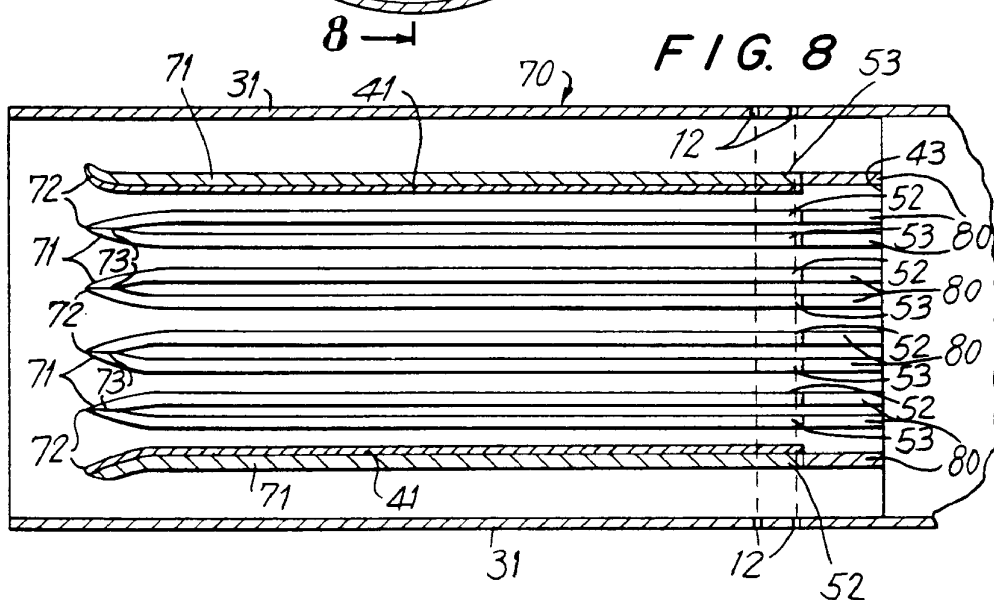
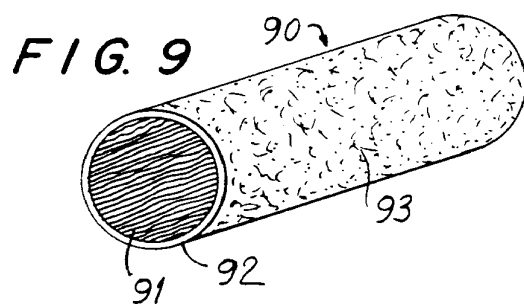
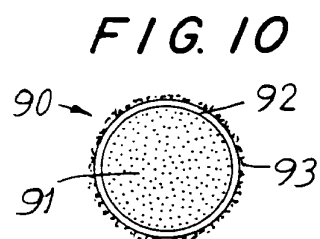


FIG. 3A









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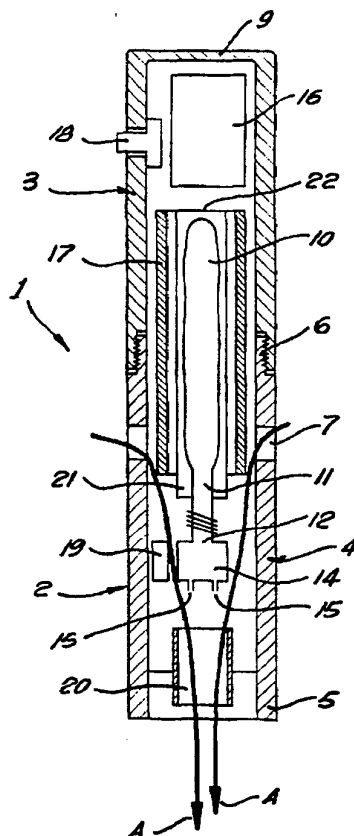
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(54) Title: DISPENSER

(57) Abstract

A dispenser (Fig. 1, 1) comprises a reservoir (10) of a physiologically active substance and a droplet ejection device (14), for example a bubble jet or piezoelectric device, which is controlled to issue a predetermined number of discrete droplets of the substance from ejection orifices (15) upon actuation. Device (14) may be actuated by a pressure transducer (19) responsive to inhalation and issue the droplets into an airstream (A) which enters at slot (7) and is then inhaled via mouthpiece (5). In other embodiments (Fig. 5) the dispenser is finger actuated and directed by hand for topical application. The number and/or frequency of droplets issued is programmatically controlled by a control circuit (16) whereby average and total dose of the substance are predetermined.



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Title: DISPENSER

FIELD OF THE INVENTION

This invention relates to a hand held dispensing device. The device is of particular suitability for the self-administration of physiologically active substances by inhalation and will be herein described with primary emphasis on that use but may be used for other purposes.

BACKGROUND OF THE INVENTION

There are currently three main methods for drug delivery via the respiratory tract, namely metered dose inhalers, dry powder inhalers, and nebulisers.

Metered dose inhalers ("MDI") are widely used in the management of asthma. The MDI comprises a drug packaged with a propellant in a pressurised aerosol container can having a valve which releases a volumetric metered dose of aerosol upon actuation.

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These devices are portable, small, and convenient to carry but deliver a dose which varies in quantity, delivery speed, and droplet size distribution as the vapour pressure of the propellant varies. The propellant pressure varies with temperature and decreases progressively as the content becomes depleted so that the range in dose variation may be substantial. Incomplete evaporation of the propellant may cause "sticking" and localised concentration of drug droplets at an impact area, and this in turn can cause undesirable side effects. For example bronchosteroids can cause local immuno-suppression and local fungal infection while local concentration of bronchodilator can lead to swallowing, with unwanted systemic affects. In addition, the use of an MDI requires a degree of synchronisation between manual valve actuation and inhalation which many users find difficult.

Dry powder inhalers ("DPI") devices rely upon a burst of inspired air to fluidise and draw a dose of an active powder into the bronchial tract. While this avoids the synchronisation problem of the MDI, DPI's are sensitive to humidity and may provoke asthma attacks in some individuals sensitive to inhaled powder. Moreover, because the force of inspiration varies from person to person, the dose administered varies.

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Nebulisers generate an aerosol by atomising a liquid in a carrier gas stream and require a continuous gas compressor or bulky supply of compressed gas. In general, the droplet size of the aerosol is a function of carrier gas pressure and velocity and hence cannot be easily varied independently of concentration of the active substance in the gas stream. Inhalation reduces the pressure at the nebulizer nozzle and thus dosage and particle size are also influenced by the duration and strength of each breath. Most nebulisers operate continuously during inhalation and exhalation but special control systems can be employed to meter the aerosolised gas flow from the nebuliser to a holding chamber from which the user may draw a charge.

In general the precision of dose delivery of each of these devices is less accurate than desirable and restricts their use to drugs which have broad dosage tolerance. In each case delivery of the active agent to the intended application site is overly dependent on user technique and is variable from dose to dose and person to person. Not only is an improved delivery system required to optimise current nasal and pulmonary therapies utilising locally acting drugs but there has long been recognised a potential for the administration of many additional local and systemic drugs if a more satisfactory means of delivery were

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available. Medical advances suggest that pulmonary delivery of drugs such as peptides, proteins and analgesics might be of considerable advantage compared with conventional oral or injection delivery means. For example it has been suggested that insulin for diabetics may be delivered via the pulmonary route if a suitable means of delivery were available. The deposition of drug particles on lung tissue is a function of size, shape and density of particles or droplets. For many drugs, control of one or more of these factors along with precise dose or dose rate control would be desirable. However, at the present time no means of drug delivery is available which adequately meets such requirements.

Many attempts have been made to provide a cigarette substitute which provides nicotine by inhalation but which avoids the need for combustion of tobacco. Provision of a cigarette substitute involves complexities additional to those involved in the administration of a therapeutic agent. Although it is relatively easy to administer nicotine (for example in tablet form, via transdermal patches and the like), such forms do not satisfy habitual smokers because they do not satisfy important complex physiological and psychological affinities acquired by habitual smokers of combustible cigarettes.

In an attempt to provide an acceptable

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alternative, many cigarette substitutes have been proposed which provide nicotine on inhalation without combustion of tobacco. Conceptually, such devices are less harmful to the inhaler than smoking, avoid the hazards of passive smoking among bystanders and avoid the fire hazard and environmental problems associated with cigarette smoking. However, despite these major advantages, no device so far proposed has met with consumer acceptance.

Early cigarette substitutes employed a porous carrier impregnated with a liquid nicotine containing composition through which an air stream could be drawn to volatilize nicotine. This approach yielded insufficient nicotine per puff, suffered from a tendency for the carrier to dry out and delivered a variable amount of nicotine per puff, depending on factors such as air temperature, humidity, lung capacity of the user and amount of liquid composition remaining in the carrier.

Subsequent devices delivered nicotine from a pressurised aerosol container from which nicotine can be released by mechanical valve actuator. In one such device the valve is microprocessor controlled to limit the frequency and duration of actuation. However, the dose delivered varies with the vapour pressure of aerosol remaining in the container as well as with duration of valve actuation. The disposable pressure

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container, aerosol valve, and CFC propellant add considerably to active substance cost. These devices share the disadvantages of MDI devices previously discussed.

In yet other devices a nicotine containing substance is heated to vapourise an amount of nicotine which is then available for inhalation. The amount of nicotine delivered by such devices is difficult to control and is temperature dependant. In one such device a plurality of nicotine-containing pellets may be heated sequentially so that each liberates a predetermined dose. However, in that case, the dose is fixed during pellet manufacture, particle size of the aerosol is uncontrolled, and temperature of the inhaled air cannot be varied independently of dose.

Factors such as the quantity of nicotine per puff, the temperature of the puff, the draw, the presence and size distribution of flavour particles in the puff and like factors are of considerable importance in satisfying habitual smokers. The various alternatives proposed to date have simply proved unacceptable to most smokers.

To date no device has provided a satisfactory means of adjusting both the quantity of nicotine delivered in each puff in response to user demand and/or maintaining adequate precision and accuracy in the dose quantum metered out. Further the devices

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have failed adequately to mimic the sensations obtained during smoking.

Because the requirements for a cigarette substitute are particularly difficult to satisfy, the present invention is herein described primarily with reference to nicotine delivery, but it will be understood that the invention is more generally applicable and addresses the general need for a device which can precisely dispense doses and preferably which can dispense doses of a variety of drugs or other substances and which are adjustable from one individual to another or at different times.

Preferred embodiments of devices of the kind under consideration may be used as a less harmful form of administration of nicotine than smoking or may be used to reduce or eliminate nicotine dependence among those wishing to give up smoking.

It is, without limitation, an object of the present invention to provide a method and means for administration or self-administration of an active substance which avoids at least some of the above discussed disadvantages of prior art. It is an object of preferred embodiments of the invention to provide a method and means for dispensing the active substance for administration via inhalation.

It is an object of other preferred embodiments of the invention to provide a cigarette substitute.

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DISCLOSURE OF THE INVENTION

According to one aspect the invention consists in a method for administering a substance to a human or animal subject by inhalation, said method comprising the steps of:

- (i) ejecting a predetermined number of discrete droplets of the substance from at least one droplet ejection device in response to an actuation signal, and
- (ii) entraining the droplets in an inhalation airstream.

According to a second aspect the invention consists in a method for topical application of a substance to a human or animal subject comprising the steps of:

- (1) ejecting a predetermined number of discrete droplets of the substance from at least one droplet ejection device in response to an actuation signal, and
- (2) directing the droplets at a selected area or region of the subject.

According to a third aspect the invention consists in an apparatus for administering a substance to a human or animal subject, said apparatus comprising:

a droplet ejection device containing a substance to be administered, means responsive to an actuation

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signal to eject a predetermined number of discrete droplets of the substance, and

means for directing the ejected droplets at, or into, the subject.

The substance to be administered may be a therapeutic or other physiologically active agent and may be a liquid, a solution or a suspension for example a colloidal solid in a liquid carrier or an emulsion.

In preferred embodiments of the invention, the droplet ejection device ("DED") device is a piezoelectric device of the kind used in ink jet printing or is a thermal "bubble jet" device of the kind used in ink jet printing.

These devices are sometimes referred to as "droplet on demand" devices. By way of example piezoelectric devices are broadly described in "Ink-Jet Printing" [M. Doring Philips Tech Rev 40, 192-198, 1982 No. 7], while thermal devices are broadly described in "Thermal Ink-Jet Print Cartridge Designers Guide" (2nd Edition Hewlett Packard), both incorporated herein by reference.

Briefly, a typical thermal device consists of a liquid-containing chamber provided with an array of twelve coaxially divided nozzles and has twelve thin film resistors, a resistor being located directly behind each nozzle. Each nozzle supplies a droplet of