UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ECTO WORLD, LLC,
SV3, LLC,
Petitioner

v.

RAI STRATEGIC HOLDINGS, INC.,
Patent Owner

Case No. IPR2024-01280
U.S. Patent No. 11,925,202

DECLARATION OF SEETHARAMA C. DEEVI, PH.D. IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,925,202

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(b) an outer housing having two ends; 69
(c) a mouthpiece defined at one of the two ends; 72
(d) an electrical power source arranged within the outer housing; 74
(e) an electrical resistance heater positioned within the outer housing, the electrical resistance heater being configured for electrical connection with the electrical power source 76
(f) a storage compartment defined within the outer housing, the storage compartment being configured for storage of a liquid aerosol-forming material and being arranged such that the liquid aerosol-forming material can be wicked into contact with the electrical resistance heater to volatilize the liquid aerosol-forming material; 80
(g) an air passageway through at least a portion of the outer housing, the air passageway being arranged so that air

drawn into the outer housing combines with volatilized liquid aerosol-forming material to produce an aerosol that can be drawn into the mouth of a user of the electrically-powered, aerosol-generating smoking article through the mouthpiece; and.....87

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(b) Motivation to implement Kim's porous chip to be removable/replaceable and wrapped 133

(c) Motivation to modify Kim's device to incorporate a removable end cap and mouthpiece 136

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(a) An electrically-powered, aerosol-generating smoking article comprising: 138

(b) an outer housing having two ends; 140

(c) a mouthpiece defined at one of the two ends; 141

(d) an electrical power source arranged within the outer housing; 143

(e) an electrical resistance heater positioned within the outer housing, the electrical resistance heater being configured for electrical connection with the electrical power source 144

(f) a storage compartment defined within the outer housing, the storage compartment being configured for storage of a liquid aerosol-forming material and being arranged such that the liquid aerosol-forming material can be wicked into contact with the electrical resistance heater to volatilize the liquid aerosol-forming material; 147

(g) an air passageway through at least a portion of the outer housing, the air passageway being arranged so that air drawn into the outer housing combines with volatilized liquid aerosol-forming material to produce an aerosol that can be drawn into the mouth of a user of the electrically-powered, aerosol-generating smoking article through the mouthpiece; and.....152

(h) a controller configured to activate current flow through the electrical resistance heater in response to a draw on the electrically-powered, aerosol-generating smoking article. 154

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I, Seetharama C. Deevi, declare as follows:

I. INTRODUCTION

1. I have been retained by Ecto World, LLC and SV3, LLC ("Petitioner") to provide my opinion concerning the validity of U.S. Patent No. 11,925,202 (attached to the accompanying Petition as EX1001 and henceforth referred to as "the '202 patent") in support of a Petition for *Inter Partes* Review.

2. Specifically, I have been retained as a technical expert by Petitioner to study and provide my opinions on the technology claimed in, and the patentability or unpatentability of, claims 1-30 of the '202 patent ("the Challenged Claims"). This declaration is directed to the challenged claims of the '202 patent, and sets forth the opinions I have formed, the conclusions I have reached, and the bases for each. For purposes of this declaration, I was not asked to provide any opinions that are not expressed herein.

3. I am familiar with the technology described in the '202 patent as of its earliest possible priority date of October 18, 2006. Although, based on my understanding of priority law from counsel (as set forth below), I do not believe that the '202 patent is eligible for the benefit of that priority date. I am also familiar with the technology described in the '202 patent as of its actual filing date—March 31, 2023. I have been asked to provide my technical review, analysis, insights, and opinions regarding the '202 patent. I have used this experience and insight along

with the references identified herein as the basis for my opinions that support the grounds of unpatentability set forth in the Petition for *Inter Partes* Review of the '202 patent.

4. I have reviewed and am familiar with the specification of the '202 patent that issued on March 12, 2024. I understand that the '202 patent has been provided as EX1001. I will cite to the specification using the following formats: EX1001, '202 patent, 1:1-10 (long form) and EX1001, 1:1-10 (short form). These example citations both point to the '202 patent specification at column 1, lines 1-10.

5. I am being compensated by Petitioner at my standard hourly rate for the time I spend in connection with this proceeding. My compensation is not dependent in any way on the substance of my opinions or in the outcome of this proceeding.

II. GROUNDS OF UNPATENTABILITY

6. In forming my opinions about the '202 patent, I have considered the following grounds of unpatentability (see the below table). Based on my review of the prior art references that form the basis of these grounds, it is my opinion that claims 1-30 of the '202 patent would have been obvious to a person of ordinary skill in the art ("POSA") as of both October 18, 2006 (earliest possible priority date) and March 31, 2023 (filing date of the '202 patent).

Ground	Basis	Claims	References
1.	§103	1, 3-15, and 18-29	Takeuchi
2.	§103	6, 7, 14, 15 and 18-29	Takeuchi in view of Pienemann
3.	§103	1-30	Kim in view of Pienemann
4.	§103	1-30	Kim in view of Pienemann and Susa

7. I have been asked to consider how a POSA would have understood the challenged claims in light of the disclosures of the ’202 patent. I also have been asked to consider how a POSA would have understood the prior art references of Takeuchi, Kim, Pienemann, and Susa. Further, I have been asked to consider and provide my technical review, analysis, insights, and opinions regarding whether a POSA would have understood that the combinations of the prior art references listed in the table above render obvious claims 1-30 of the ’202 patent.

II. QUALIFICATIONS

8. In formulating my opinions, I have relied upon my training, knowledge, and experience in the relevant art. I have over 35 years of experience in the development of reduced risk products, focusing on “heat not burn” technology for cigarette alternatives, such as that described in the ’202 patent. As detailed below, I have worked on many projects that are highly relevant to the subject matter of the ’202 patent.

9. My research work for my Ph.D. focuses on Solid State and Metallurgical Reactions. I was granted a Ph.D. from the Indian Institute of Science in 1981. I obtained a Master of Engineering in Mechanical Engineering from the

University of Virginia. I also obtained a Master of Business Administration from the Fuqua School of Business at Duke University.

10. Following academic research positions at University of California, Davis; Brown University; and Indian Institute of Science, Bangalore, I began working at the RD&E Center at Philip Morris USA in Richmond, Virginia in 1988. I began as a Research Scientist developing reduced risk products and remained with the Altria family of companies until 2013 except for several academic fellowships.

11. From 1994 until 1996, I was a guest scientist at Oak Ridge National Laboratory's Metals and Ceramics division, and then at the Department of Materials Science and Engineering of California Institute of Technology, and the Department of Materials Science and Engineering of the University of Cambridge, England. These positions were continuing education fellowships provided by Philip Morris.

12. During part of my time at Philip Morris and its subsidiaries, I led, conceived, developed, and managed materials for heat sources for reduced risk products using non-electrical heat sources that avoid generating excessive amounts of harmful compounds and ash. The properties of the heat sources were optimized such that the tobacco pellets placed behind the heat source are optimally heated by conduction and convection mechanisms upon puffing. Exothermic reactions were

controlled such that the smokers could use a "heated tobacco product" under normal puffing conditions for at least 8 puffs. Extensive product testing has shown significant reduction in harmful and potentially harmful constituents of smoke as compared to traditional cigarettes – as measured by tar, gas and vapor phase constituents of aerosol.

13. The heat source materials and processes that we developed in the laboratories were scaled up to a pilot plant and the pilot plant data was used to design, build, and manufacture patented heat sources.

14. A sufficient number of heat sources were manufactured to qualify for a continuous manufacturing plant and to assemble products with tobacco pellets and filters for a consumer test market. I managed the Materials Research Development group and directed the mixing, extrusion, debindering and decomposition, machining, and quality control operations of heat source manufacturing, and I oversaw proper functioning of "heated tobacco products" during and after assembly.

15. Starting in 1990, I helped develop new electrically powered "heat not burn" technologies. As alternatives to conventional cigarettes, those products heated tobacco to a desired temperature without burning it. The devices required five principle components: a housing, a heater and/or means of controlling the temperature, an energy source to heat and control the temperature of a heater,

storage for a tobacco product, and a tobacco product that could be heated without burning (hence the concept – "heat but not burn") to generate a sensorially acceptable aerosol during a 2-4 second puff interval.

16. These product development efforts progressed from heating eight individual heaters in a linear manner to a design where eight heaters can be individually heated with a common base.

17. I also helped develop "amorphous" carbon heaters using powder metallurgical principles with varying electrical resistivity using suitable compounds as base materials and binders. An electrical discharge machining technique was used to machine intricate carbon resistors with excellent quality, for the assembly of linear electrically heated tobacco products using Ni-metal hydride as the battery. A thin film of gold was deposited to reduce the contact resistance.

18. I also researched and managed the development of a thermally efficient flat ceramic heater with a quick response time based on thick film technology using a substrate, resistor, and conductor using screen printing technology, and the development of micro-heating elements using Phosphorous-doped single crystal Si (100 plane) with a positive temperature coefficient of resistance, which was used to control temperature rise during heating and to enable the use of pick and place equipment for the assembly of heaters.

19. I directed numerous analyses of heaters using, among other things, thermal and electrical modeling, to determine optimal heater design(s). In exploring the feasibility of different types of heaters, I weighed considerations such as manufacturing cost and speed, the matching of electrical resistivities to energy sources, strengths of heater blades, usage requirements (e.g., 3 to 6 months of consumer user), and other parameters.

20. For example, I helped develop and analyze heaters made from Haynes 214 alloy (containing nickel and chromium). To ensure protection from chromium present in the alloy, a thin layer of oxidation- and diffusion-resistant platinum aluminide passive coating was developed on the Haynes 214 superalloy. This became one of the primary workhorse materials used to test the concept of a "heated tobacco product" in the laboratory and optimize the properties of a heater such that there is a significant reduction in harmful and potentially harmful products under acceptable sensory preferences of smokers. Heaters and electrically heated tobacco products were tested for 10,000 cycles under cyclic loading and unloading to determine the creep and life cycle times. Determination of creep was found to be necessary since any sagging of the material due to creep would disintegrate the tobacco medium in real applications.

21. In addition to the nickel and chromium-based Haynes 214 alloy, I worked with various electrically conducting high temperature ceramic composites

based on molybdenum disilicide, silicon nitride, silicon carbide, and titanium carbide. These composites were characterized for their TCR, thermal conductivity, oxidation resistance, and cyclic failure, and they were machined into intricate shapes and designs and tested as high temperature resistors. Our studies were extended to develop functionally graded ceramic materials with conductive and resistive portions.

22. I also directed the machinability of ceramic materials using electrical discharge machining techniques, ultrasonic machining, and diamond cutting techniques, to determine the cost-effectiveness of machining from a systems and flexible manufacturing approach.

23. For example, the cost associated with the platinum aluminide coating on Haynes 214 led us to develop a new heater material based on alloys of iron and aluminum without the presence of nickel and chromium. (It is important to note that the majority of the heating elements and high temperature alloys that can withstand heating to a high temperature in cigarette smoking conditions contain nickel and chromium as alloying elements). I was responsible for the alloy design, processing, characterization and development of high strength and creep resistant iron aluminides with exceptional oxidation resistance for use as a heater in a heated tobacco product. I also led strategy relating to the manufacture of such heaters.

24. While with Philip Morris family of companies, I was a member of a Strategic Planning Group under the leadership of President of Operations and Technology, was the Director of Global Innovation, and was the Director of a Strategic Investment Fund, which ultimately became Altria Ventures. After a corporate reorganization culminating with the spin-off of Kraft and Philip Morris International, I became an employee of Altria Client Services of Altria Group, Inc.

25. Since I left Altria in 2013, I have been the President of 4D Strategies. 4D Strategies provides advisory services in product strategy, innovation tools and methods, materials development, and technology management. For example, I was a Strategic Advisor for Innovation for an Asian company for two years. In that role, I helped the company develop innovative products.

26. During that time, I was instrumental in the development of an advanced e-vapor product with energy control, consistent characteristics of an aerosol, a battery management system for a Li-ion battery, rapid charging features, puff control, overheating protection, and short circuit protection. To assure the consistency of aerosol delivery and composition, Li-ion batteries were selected based on the average battery capacity and % of retention after determining the charge-discharge cycling between 0.5 to 10 C rates and up to 500 cycles. The safety of the batteries was tested based on thermal runaway and short circuit testing of batteries.

27. I also developed hyperspectral-imaging technology to understand the unique spectral features of agricultural leaves and products for quality control. The concept was proved in a lab, upgraded to a pilot version, and a commercial unit was built, which proved the feasibility of using this technology to classify agricultural materials and products.

28. I am an inventor on over 65 U.S. patents, including 43 patents that are of direct relevance to the technology claimed in the ’202 patent.

29. I also have authored over 150 peer-reviewed journal articles with a Google citation index of over 20, 000. My publications are listed in my *curriculum vitae*, which includes a more detailed summary of my background, experience, and publications, and is attached to the Petition as EX1008.

III. MATERIALS CONSIDERED

30. In formulating my opinions, I have relied upon my training, knowledge, and experience that are relevant to the ’202 patent. Furthermore, I have considered specifically the following documents listed below in addition to any other documents cited in this declaration:

Exhibit	Description
1001	U.S. Patent No. 11,925,202 to Robinson et al. (“’202 patent”)
1002	’202 Patent Prosecution History
1004	U.S. Patent No. 6,155,268 to Takeuchi (“Takeuchi”)
1006	International Patent Application Pub. No. WO2000/028843 to Pienemann [Certified Translation] (“Pienemann”)
1007	U.S. Patent Application Pub. No. 2006/0016453 to Kim (“Kim”)

Exhibit	Description
1009	Reynolds' Motion for Temporary Relief [Public Version], Certain Disposable Vaporizer Devices; Inv. No. 337-TA-1410
1010	Declaration of Dr. Robert Sturges, *RJ Reynolds Vapor Company et al v. Fontem Holdings 1 BV et al.*, IPR2018-00627, EX1002
1011	Petition for *Inter Partes* Review, *RJ Reynolds Vapor Company et al v. Fontem Holdings 1 BV et al.*, IPR2018-00627, Paper 2
1013	Petition for *Inter Partes* Review, *RJ Reynolds Vapor Company v. Fontem Holdings 1 BV*, IPR2016-01527, Paper 1
1014	Initial Determination, *Certain Tobacco Heating Articles and Components Thereof*, Inv. No. 337-TA-1199 [Public Version]
1015	Declaration of Charles Clemens, *Philip Morris Products SA v. RAI Strategic Holdings, Inc.*, IPR2020-01602, EX2010
1016	Declaration of Dr. Robert Sturges, *RJ Reynolds Vapor Company v. Fontem Holdings 1 BV*, IPR2016-01270, EX1009
1017	Institution Decision, *Philip Morris Products SA v. RAI Strategic Holdings, Inc.*, IPR2020-01602, Paper 9
1018	EP Patent Appl. No. 0845220 to Susa ("Susa")
1019	P.M. Ling and S.A. Glantz, "Tobacco industry consumer research on socially acceptable cigarettes," *Tobacco Control* **14**, e3 (2005) (http://www.tobaccocontrol.com/cgi/content/full/14/5/e3) ("Ling")
1020	U.S. Patent No. 2,104,266 to McCormick ("McCormick")
1021	U.S. Patent No. 1,775,947 to Robinson ("Robinson")
1022	U.S. Patent No. 3,200,819 to Gilbert ("Gilbert")
1023	U.S. Patent No. 3,258,015 to Drummond et al. ("Drummond")
1024	U.S. Patent No. 4,079,742 to Ranier et al. ("Ranier")
1025	U.S. Patent No. 4,819,665 to Roberts et al. ("Roberts")
1026	U.S. Patent No. 5,666,977 to Higgins et al. ("Higgins")
1027	U.S. Patent No. 5,743,251 to Howell et al. ("Howell")
1028	U.S. Patent No. 6,234,167 to Cox et al. ("Cox")
1029	CN Patent No. 2719043Y to Hon Lik ("Hon")
1030	U.S. Patent No. 2,057,353 to Whittemore ("Whittemore")
1031	U.S. Patent No. 4,765,347 to Sensabaugh et al. ("Sensabaugh")
1032	U.S. Patent No. 11,758,936 to Robinson et al.

Exhibit	Description
1033	U.S. Patent No. 11,785,978 to Robinson et al.
1034	U.S. Patent No. 10,231,488 to Robinson et al.
1035	U.S. Patent No. 9,901,123 to Robinson et al.
1036	U.S. Patent No. 9,801,416 to Robinson et al.
1037	U.S. Patent No. 8,899,238 to Robinson et al.
1038	U.S. Patent No. 8,079,371 to Robinson et al.
1039	U.S. Patent No. 7,726,320 to Robinson et al.
1040	U.S. Patent No. 7,992,626 to Tilton et al.

31. To the best of my knowledge, the above-mentioned documents and materials are true and accurate copies of what they purport to be. An expert in the field would reasonably rely on them to formulate opinions such as those set forth in this declaration.

32. I have also relied upon various legal principles (as explained to me by Petitioner's counsel) in formulating my opinions. My understanding of these principles is summarized below.

IV. MY UNDERSTANDING OF LEGAL PRINCIPLES

A. My Understanding of Claim Construction

33. I understand that during an *Inter Partes* Review proceeding, claims are to be construed in light of the specification as would be read by a person of ordinary skill in the relevant art at the time the application was filed. I understand that claim terms are given their ordinary and customary meaning as would be understood by a person of ordinary skill in the relevant art in the context of the entire disclosure. A claim term, however, will not receive its ordinary meaning if

the patentee acted as his own lexicographer and clearly set forth a definition of the claim term in the specification. In this case, the claim term will receive the definition set forth in the patent.

B. My Understanding of Obviousness

34. I understand that a patent claim is invalid if the claimed invention would have been obvious to a person of ordinary skill in the art at the time the application was filed. I understand that this means that even if all of the requirements of the claim cannot be found in a single prior art reference that would anticipate the claim, the claim can still be invalid.

35. To obtain a patent, a claimed invention must have been, as of its priority date, nonobvious in view of the prior art in the field. I understand that a patent claim is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art.

36. I understand that to prove that prior art or a combination of prior art renders a patent obvious, it is necessary to: (1) identify the particular references that, singly or in combination, render the patent obvious; (2) specifically identify which elements of the patent claim appear in each of the asserted references; and

(3) explain how the prior art references could have been combined in order to create the inventions claimed in the asserted claim.

37. I also understand that prior art references can be combined under several different circumstances. For example, it is my understanding that one such circumstance is when a proposed combination of prior art references results in a system that represents a predictable variation, which is achieved using prior art elements according to their established functions.

38. I also understand that when considering the obviousness of a patent claim, one should consider whether a teaching, suggestion, or motivation to combine the references exists so as to avoid impermissibly applying hindsight when considering the prior art. I understand this test should not be rigidly applied, but that the test can be important to avoiding such hindsight.

39. I understand that certain objective indicia can be important evidence as to whether a patent is obvious or nonobvious. Such indicia include:
(1) commercial success of products covered by the patent claims; (2) a long-felt need for the invention; (3) failed attempts by others to make the invention;
(4) copying of the invention by others in the field; (5) unexpected results achieved by the invention as compared to the closest prior art; (6) praise of the invention by the infringer or others in the field; (7) the taking of licenses under the patent by others; (8) expressions of surprise by experts and those skilled in the art at the

making of the invention; and (9) the patentee proceeded contrary to the accepted wisdom of the prior art. At this point, I am not aware of any secondary indicia of non-obviousness. But, I reserve the right to review and opine on any evidence of objective indicia of nonobvious that may be presented during this proceeding.

40. I also understand that "obviousness" is a legal conclusion based on the underlying factual issues of the scope and content of the prior art, the differences between the claimed invention and the prior art, the level of ordinary skill in the prior art, and any objective indicia of non-obviousness. For that reason, I am not rendering a legal opinion on the ultimate legal question of obviousness. Rather, my testimony addresses the underlying facts and factual analysis that would support a legal conclusion of obviousness or non-obviousness, and when I use the term obvious, I am referring to the perspective of one of ordinary skill at the time of invention.

C. My Understanding of Priority Law and Written Description Support Law

41. I understand each claim must be analyzed to determine its effective priority date by comparing each of its elements to the application it is in and/or any alleged priority applications.

42. I understand that in order for a claim to claim priority to a previously filed application, the claim must have written description support in that priority

document and the written description needs to have been carried over into the application the claim appears in.

43. I understand that a claim has written description support to a priority document if the document demonstrates to a POSA that the inventor had possession of the invention as of the date of the priority document. Possession of the claimed invention is shown by describing the claimed invention with all of its limitations using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention. I also understand that written description support must be explicit, expressed, or inherent in the priority document. The support cannot merely obviously flow from the priority document.

D. My Understanding of Pre- or Post-AIA Eligibility of a Patent or Patent Application

44. I have been informed that a patent or patent application can be classified as either pre- or post-America Invents Act ("AIA"). Effective March 16, 2013, all applications that included claims only supported by subject matter filed before March 16, 2013 are classified as Pre-AIA applications that must be analyzed under the laws in effect before the AIA was enacted. And all applications that include or included at any time during prosecution a claim that was only supported by subject matter filed on or after March 16, 2013 must be analyzed under the AIA statute and are eligible for post grant review challenges.

E. My Understanding of a Person Having Ordinary Skill in the Art

45. I understand that a person of ordinary skill in the relevant art (herein "POSA") is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity—not an automaton.

46. I have been asked to consider the level of ordinary skill in the field that someone would have had at the time the claimed invention was made. In deciding the level of ordinary skill, I considered the following:

- the levels of education and experience of persons working in the field;
- the types of problems encountered in the field; and
- the sophistication of the technology.

47. My opinion below explains how a person of ordinary skill in the art would have understood the technology described in the references I have identified herein around the October 2006 timeframe. I have been advised that the earliest possible effective filing date for any claims of the '202 patent is October 18, 2006. I have also been advised that some or all of the claims of the '202 patent may not be eligible for priority to this date.

48. Regardless if I use "I" or a "POSA" during my technical analysis below, all of my statements and opinions are always to be understood to be based

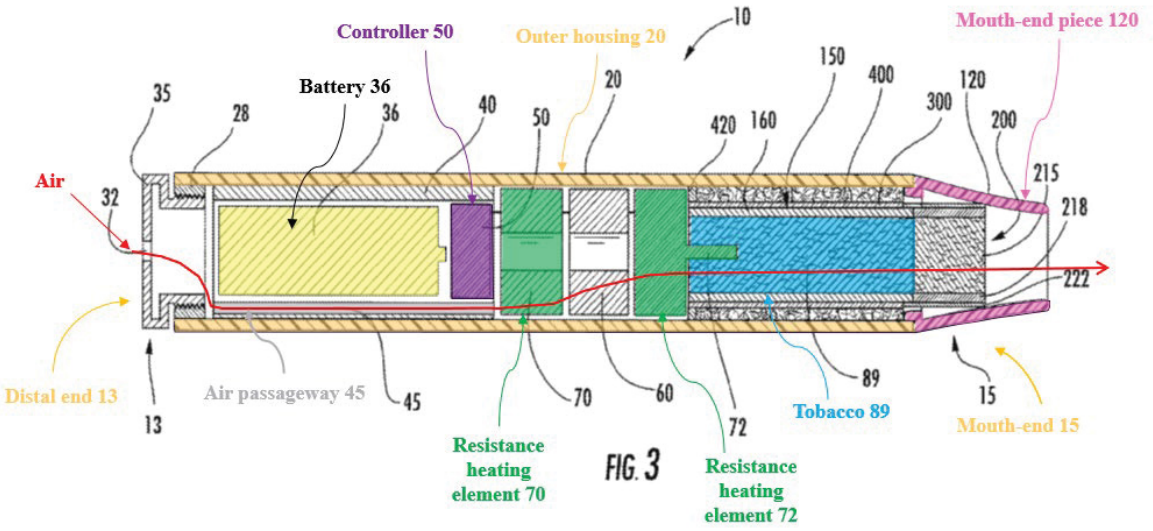
on how a POSA would have understood or read a document at the time of the invention.

V. THE '202 PATENT

A. Overview of the '202 Patent

49. The '202 patent is a recent entry in a chain of continuations dating back to an original application filed on October 18, 2006. EX1001, face. The application that became the '202 patent was filed on March 31, 2023, and the '202 patent itself was granted on March 12, 2024. *Id.* The '202 patent and each patent in its chain of priority is titled "Tobacco-Containing Smoking Article." *Id.*, (54) *see also* EX1032, EX1033, EX1034, EX1035, EX1036, EX1037, EX1038, and EX1039. A "tobacco-containing… smoking article" is also specified in the preamble of the first several independent claims allowed in the family, including the only independent claim in the family's originating patent. EX1039, claim 1; EX1038, claims 1 and 24; EX1037, claims 1 and 22.

50. The '202 patent generally discloses "tobacco products, such as tobacco-containing smoking articles." EX1001, 1:28-29. The "smoking article may include a cigarette incorporated within an electrically powered aerosol generating device," but more generally "possesses at least one form of tobacco." *Id.*, abstract. Figure 3 (below) illustrates an example of this smoking article.

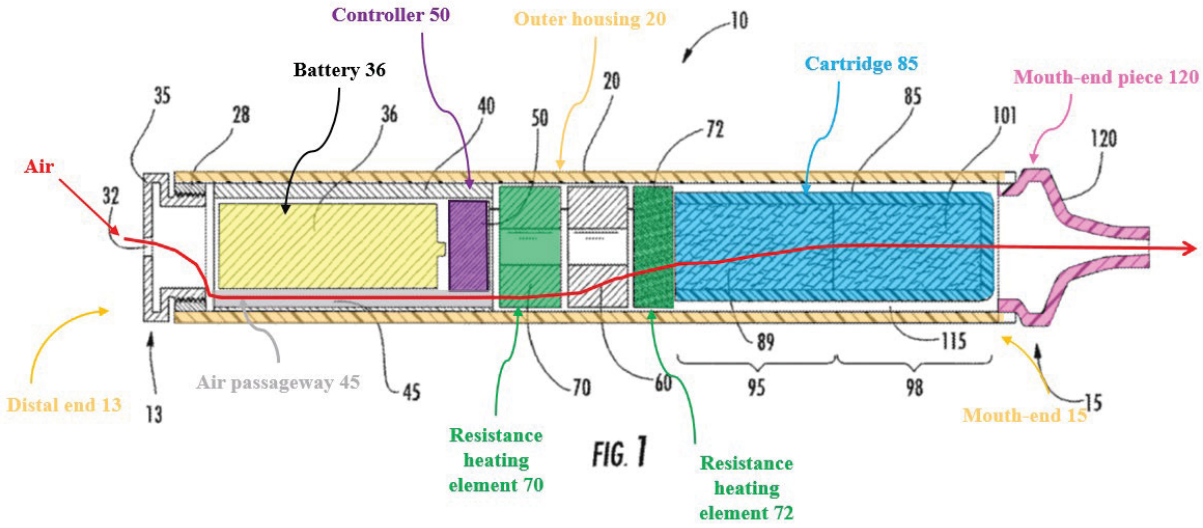


EX1001, FIG. 3 (annotated).

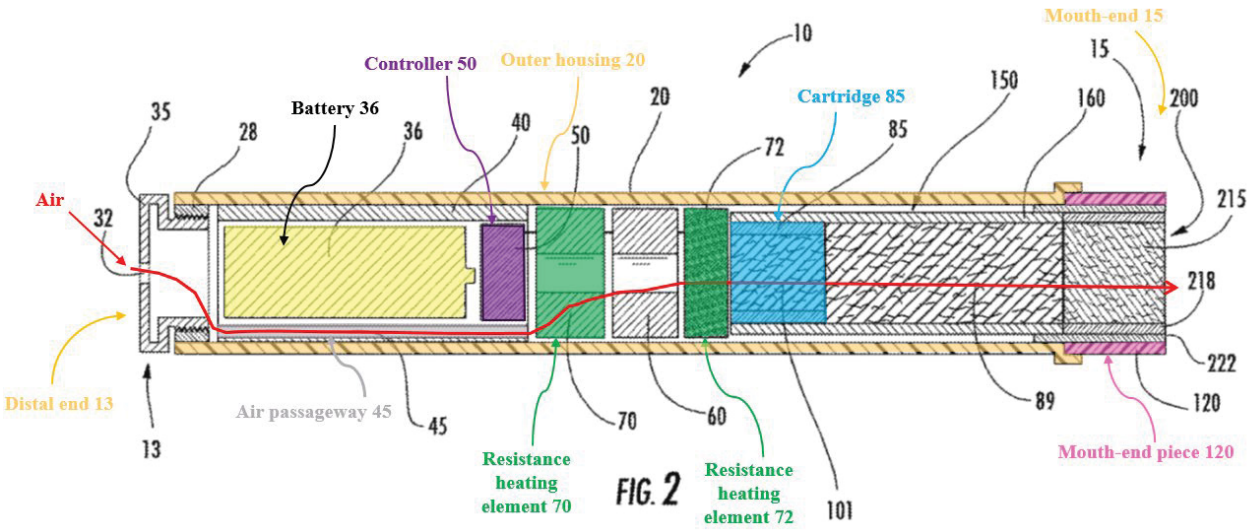
51. The '202 patent explains that the "smoking article 10" (27:45-46) has an "outer container 20." EX1001, 27:45-46 and 28:48. An "air passageway 45" extends through the container 20 to guide air to a "mouthpiece 120." *Id.*, 29:14-20. A "power source 36" provides power for the heating elements. *Id.*, 28:1-8. A storage container that can include "tobacco filler material 89" can wick aerosol-forming material into proximity with a "heating element 72." *Id.*, 22:14-40. The aerosol-forming material can be, for example, a polyol, glycerin, propylene glycol, or mixtures thereof, which can be combined with other liquid materials, such as water. *Id.*, 14:15-29. Around the time of the earliest possible filing date of the '202 patent, numerous such aerosol-forming materials were used in electronic cigarettes from manufacturers other than the applicant. *Id.*, 14:29-38. The smoking article also includes a "controller 50" and "sensor 60" that cooperate to act as a puff actuated controller for selectively activating heating elements. *Id.*, 21:4-12.

"Aerosol that is formed by the action of drawn air passing heated tobacco components and aerosol-forming material in the region occupied by the second heating element 72 is drawn through the mouth-end piece 120, and into the mouth of the smoker." *Id*., 24:50-54.

52. The smoking article 10 of Figure 3 includes a tobacco filling material 89 in the form of an incorporated cigarette 150. EX1001, 27:45-46, 27:51-65. The smoking article 10 of Figure 3 is one of multiple smoking articles 10 disclosed in the '202 patent that incorporate tobacco in different formats, but operate in generally the same way. *Id*., FIGS. 1-3, 19:49-53, 22:9-40, 24:60-25:4, 25:38-41, 26:47-49, 27:45-51. For example, the smoking article 10 of Figure 1 includes a cartridge 85 of tobacco filler material 89, said cartridge 85 having been derived from an earlier electronic cigarette from Ruyan SBT Technology and Development Co., Ld. *Id*., 22:9-40. In another example, the smoking article 10 of Figure 2 includes a cigarette 150 that includes a charge or roll of tobacco 89 and a cartridge 85, where the cartridge 89 may include tobacco or tobacco extract. *Id.*, 24:60-25:4, 25:20-41.



EX1001, FIG. 1 (annotated).



EX1001, FIG. 2 (annotated).

B. Applicant Admits That Each and Every Feature of the Challenged Claims Was Well-Known

53. The ’202 patent claims are directed to elements that the ’202 patent itself acknowledges were in the prior art as of the earliest possible priority date of the ’202 patent. These claim elements include a “smoking article,” “an outer

housing" having "an air passageway" there through, "a mouthpiece," "an electrical power source," "an electrical resistance heater," a "controller configured to activate current flow through the electrical resistance heater in response to a draw on the … smoking article," "a sensor adapted for sensing the draw by a user," and "an end cap defined at a second of the two ends [of the smoking article]." Indeed, the description in the '202 patent admits that each of these features was known and in use before the '202 patent, and were embodied in the Ruyan Atomizing Electronic Cigarette from Ruyan SBT Technology and Development Co., Ltd. (herein, "the Ruyan device"), among other devices and publications that were known at the time. EX1001, 14:29-38.

54. First, the specification of the '202 patent admits that the claimed "smoking article" was known, describing that "Representative smoking articles can possesses certain components comparable to, and operate in a manner generally comparable to, that type of device set forth in EPO 1,618,803 to Hon. Representative smoking articles, and exemplary components thereof, also can be provided using components of those nicotine aerosol delivery systems available through Atlanta Imports Inc., Acworth, Georgia, USA., as an electronic cigar having the brand name E-CIG, which can be employed using associated Smoking Cartridges Type C1a, C2a, C3a, C4a, C1b, C2b, C3b and C4b. Exemplary components for representative smoking articles also have been available

components of those devices available as Ruyan Atomizing Electronic Pipe and Ruyan Atomizing Electronic Cigarette from Ruyan SBT Technology and Development Co., Ltd., Beijing, China." EX1001, 19:34-48.

55. Next, the specification of the '202 patent admits that all of the claimed parts of the outer housing were known in prior art devices. For example, the '202 patent describes, "A representative outer housing can be of the type possessed by the Ruyan Atomizing Electronic Cigarette available from Ruyan SBT Technology and Development Co., Ltd." EX1001, 20:1-4. The '202 patent also describes, "A representative mouth-end piece can be of the type incorporated within a device available as Ruyan Atomizing Electronic Cigarette from Ruyan SBT Technology and Development Co., Ltd … See, also, for example, the types of mouth-end pieces … set forth in U.S. patent application Ser. No. 11/377,630 filed Mar. 16, 2006 to Crooks et al." EX1001, 24:20-29. Moreover, the '202 patent describes the claimed "end cap" as "[a] representative end cover or cap 35 can be of the type possessed by the Ruyan Atomizing Electronic Cigarette available from Ruyan SBT Technology and Development Co., Ltd." EX1001, 20:20-23. Thus, the '202 patent admits that the outer housing is not inventive over the prior art.

56. The specification of the '202 patent also admits that all of the claimed electrical components were known. For example, regarding the claimed "electrical power source," the '202 patent describes, "Representative types of power sources,

and representative arrangements thereof within the outer container, are of the type incorporated within a device available as Ruyan Atomizing Electronic Cigarette from Ruyan SBT Technology and Development Co., Ltd." EX1001, 20:38-43. In addition, regarding the claimed "electrical resistance heater," the '202 patent describes, "Representative types of resistance heating elements are incorporated within a device available as Ruyan Atomizing Electronic Cigarette from Ruyan SBT Technology and Development Co., Ltd." EX1001, 21:58-61. The '202 patent also admits that the claimed "controller" was known, describing that "[r]epresentative types of electronic control components are of the type can be of the type possessed by the Ruyan Atomizing Electronic Cigarette available from Ruyan SBT Technology and Development Co., Ltd. See, also, the types of electronic systems set forth in U.S. Pat. No. 4,947,874 to Brooks et al." EX1001, 20:55-60. In addition, the '202 patent describes the claimed "sensor" by saying "Representative types of sensing mechanism components are incorporated within a device available as Ruyan Atomizing Electronic Cigarette from Ruyan SBT Technology and Development Co., Ltd. See, also, those types of airflow sensing mechanisms proposed in EPO 1,618,803 to Hon; and U.S. Pat. No. 4,735,217 to Gerth et al.; U.S. Pat. No. 4,947,874 to Brooks et al.; and U.S. Pat. No. 5,388,574 to Ingebrethsen." EX1001, 20:64-21:4. Thus, according to the '202 patent, the

claimed electrical components are all within the prior art, and specifically within the prior art Ruyan device.

57. According to the specification of the ’202 patent itself, the only purported advancement was to replace the known, publicly available storage compartment (e.g., cartridge) that contained an aerosol-forming liquid with a cartridge containing both aerosol-forming liquid and tobacco. *Id*., 22:9-23:34. However, even here, the ’202 patent starts with prior art examples of the claimed storage compartment: “Representative types of cartridges are of the type incorporated within a device available as Ruyan Atomizing Electronic Cigarette from Ruyan SBT Technology and Development Co., Ltd.” EX1001, 22:19-26, 22:46-49. This supposed point of novelty allegedly results from “modifying” known prior art cartridges to contain both aerosol-forming liquid and tobacco. EX1001, 22:9-23:34 (“Representative types of cartridges are of the type incorporated within a device available as Ruyan Atomizing Electronic Cigarette from Ruyan SBT Technology and Development Co., Ltd. can be modified by adding tobacco extract thereto, or by removing at least a portion of the substrate and nicotine-containing material incorporated therein and replacing that removed portion with a tobacco composition”). In fact, the ’202 patent explicitly states that the only difference between the claimed storage compartment and aerosol-forming material and that of the Ruyan device is replacing “the fibrous substrate and

aerosol-forming material" of the Ruyan device with "tobacco cut filler," "a web of reconstituted tobacco sheet," "aqueous extracted tobacco cut filler pulp," or "tobacco pieces or pellets." EX1001, 22:46-23:3. Each of these tobacco products may be treated with glycerin, propylene glycol, a flavoring agent, and/or tobacco extract. EX1001. The '202 patent further describes that such a cartridge acts as a liquid storage compartment by storing liquid material in contact with one or more forms of tobacco. EX1001, 23:15-34.

58. However, this alleged point of novelty is not expressly recited in any of the challenged claims, and even if it was, the references asserted herein discloses and/or render obvious smoking articles containing tobacco, as well as each and every other feature recited in the claims.

C. Prosecution History of the '202 Patent

59. I understand that the application that became the '202 patent was filed on March 31, 2023, and issued after receiving only a single office action on June 21, 2023. EX1002, '202 Patent Prosecution History, 172. An IDS with over six hundred U.S. patent references and another four hundred pieces of foreign patent and non-patent literature was submitted with the application. *Id.*, 72-129. Prior to examination, a Preliminary Amendment was filed, canceling all of the originally-filed claims and adding new, broader claims. As explained in my concurrently-filed declaration in support of Petitioner's concurrently-filed Petition for Post-

Grant Review of the ’202 patent, I do not believe that these claims are supported by the specification. EX1002, 8-10, 55-59.

60. In the office action, the Examiner rejected all of the pending claims for nonstatutory double patenting over claims in ancestor patents. *Id*., 176-79. The Examiner also noted that the IDS “contains an extremely large number of references” and requested that the applicant point out which portions of which references the Examiner should consider. *Id*., 174.

61. I understand that the applicant filed a terminal disclaimer to obviate the double patenting rejection. I also understand that the applicant did not provide any guidance as to which of the many references of record were particularly relevant. *Id*., 299-306. A notice of allowance was issued on September 21, 2023, and, after another IDS was submitted, a second notice of allowance issued on December 13, 2023. *Id*., 310, 372-81, 397.

62. As detailed below, I believe the claimed concepts were well-known before the ’202 patent. It is my opinion that, had any of the references applied herein been before the Examiner during prosecution, the ’202 patent would not have been allowed.

D. Level of Ordinary Skill in the Art

63. In my opinion, a person of ordinary skill in the art (“POSA”) would have a bachelor’s degree in electrical engineering, mechanical engineering,

chemistry, physics, or an equivalent field, as well as least 3-4 years of industry experience, or a master's degree in the above fields, and 1-2 years of industry experience. Such a POSA would have been familiar with electrically powered smoking articles and/or the components and underlying technology used therein.

64. I am well qualified to determine the level of ordinary skill in the art. I am very familiar with the technology of the '202 patent during the October 2006 timeframe. As mentioned above, by 2006, I had obtained a Ph.D., a Master of Engineering, and a Master of Business Administration. In addition, by October 2006, I had worked for Philip Morris on the development of "heat not burn" technologies for eighteen years dating back to my start with the company in 1988.

65. For at least these reasons, and because of the additional experience outlined above in Section II and in my CV, I am also very familiar with the technology of the '202 patent during the March 2023 timeframe. I thus also qualify as a POSA for the '202 patent as of both October 2006 (earliest possible priority date) and March 2023 (filing date of the '202 patent). My opinions regarding the obviousness of the claims of the '202 patent are the same whether analyzed from the October 2006 or March 2023 timeframe.

E. Claim Construction

66. I understand that, during an *Inter Partes* review, claim terms must be given their ordinary and customary meaning as understood by a POSA at the time

of the invention, in light of the specification and the prosecution history of the patent. I understand that Petitioner affirmatively sets forth a proposed construction for a single claim term, and set forth a contingent proposed construction for a second term as explained below. I understand that, for the purposes of this Petition, Petitioner has taken the position that all other claim terms should receive their plain and ordinary meaning in the context of the '202 patent specification. I have analyzed these claim construction positions, and I agree with Petitioner's positions as explained below.

1. "*wicked into contact with the electrical resistance heater*"

67. I believe that the term "*wicked into contact*," as recited in independent claims 1 and 18 of the '202 patent, should be construed to mean "wicked into contact (1) with the heater, or (2) with an area in close proximity to, and exposed to the heat produced by, the heater." This construction is consistent with the Board's construction of this term in IPR2020-01602, a proceeding involving U.S. Patent No. 9,901,123, ("the '123 patent"), a grandparent to the '202 patent. *Philip Morris Products SA v. RAI Strategic Holdings, Inc*., IPR2020-01602, Paper 32, 10, 15 (P.TA.B. March 30, 2022). I understand that, there, the Board explained:

> Accordingly, we are not persuaded the term "wicked into contact" requires that the liquid mixture must be brought into contact with the electrical resistance heater solely by wicking, as Patent Owner contends. Nothing in the language of claims 1 and 15 would indicate to

> a POSA that "wicked into contact with the electrical resistance heater" cannot include forces other than wicking, particularly when the absorbent fibrous or wicking material is located in proximity to the heater.

Id., 14.

68. I also understand that this construction was affirmed by the Court of Appeals for the Federal Circuit in *Philip Morris Products S.A. v. RAI Strategic Holdings, Inc*., No. 22-1846, 2023 WL 5970786 at *1 (Fed. Cir. Sept. 14, 2023).

69. I have applied herein the Board's construction in IPR2020-01602 for the term "*wicked into contact with the electrical resistance heater*" as meaning "wicked into contact (1) with the heater, or (2) with an area in close proximity to, and exposed to the heat produced by, the heater."

2. "*smoking article*"

70. As discussed in my concurrently-filed declaration in support of Petitioner's concurrently-filed Post-Grant Review Petition against the '202 patent, I believe the claimed "smoking article," devoid of any tobacco, lacks written description support. To the extent that the Board disagrees, then the claimed "smoking article" should be construed to mean "a tobacco containing smoking article." Such a construction is consistent with: (i) the title of the '202 patent; (ii) the entirety of the specification; (iii) the figures; (iv) the alleged point of novelty; and (v) the claim scope in at least seven of the parent/grandparent patents to the '202 patent.

VI. BACKGROUND OF THE TECHNOLOGY

71. I understand that analyzing the state of the art during the years prior to the earliest possible priority date of October 2006 can provide valuable insight into what people of ordinary skill in the art were aware of at the time, and in what direction the industry was moving.

72. Prior to the earliest possible priority date of the ’202 patent, all of the technology at issue in the ’202 patent was broadly applied and well-known by individuals working in the tobacco industry. No individual elements of the ’202 claims were new or novel by October 2006, and there was nothing new or novel about the way in which those elements were combined in the claims of the ’202 patent.

73. Further, there were no technological barriers to combining these elements to form the claimed invention. Indeed, combining these elements would have yielded predictable results. Thus, wicking a liquid aerosol-forming material into contact with a heater that is powered by an electric power source under control of a controller in response to a user’s draw on a mouthpiece of a smoking device was well-known prior to October 2006. Below, I discuss this, and the other claimed technological aspects, in the prior art.

A. Overview of the Development of Aerosol-forming Smoking Articles

74. As I noted above, the ’202 patent admits that every feature recited in the claims was already well known in the art. *See above* Section V.B. In fact, the ’202 patent merely serves as a compilation of the state of the art of cigarette alternatives in October 2006 without adding anything innovative. This is unsurprising given that cigarette alternatives had been in development for well over 70 years by the time of the earliest possible priority date of the ’202 patent.

75. It has long been recognized that smoking tobacco by burning the tobacco produces undesirable side effects like producing carbon monoxide and ammonia that lead to certain cancers in smokers and create dangerous secondhand smoke for non-smokers. EX1019, page 1; EX1020, 1:31-45. Early attempts to minimize these undesirable side effects introduced a technique for heating the tobacco to volatize the nicotine without combusting the tobacco. EX1020, 2:8-15. Around that same time, electric powered vaporizers were being used for medicinal purposes. *See generally* EX1021.

76. In the 1960s, more sophisticated attempts were made to create a cigarette that reduced harmful side effects. These “smokeless” cigarette alternatives provided a form factor that more closely resembled conventional smoking devices such as cigarettes. EX1022, FIG. 1; EX1023, FIGS. 1-9. Reduced toxins were realized by replacing or supplementing conventional tobacco with

tobacco extracts or other chemical compounds. EX1022, 3:26-32; EX1023, 3:75-4:2. These materials were selected due to their ability to convert into an aerosol with the application of relatively low temperatures of less than 400 °C. EX1023, 4:21-26. Because these chemicals are more volatile at lower temperatures, lower intensity heating methods could be employed, such as a battery-powered vacuum tube, EX1022, 2:41-54, or even lower-temperature burning finely-cut tobacco, which was burned but not inhaled by the smoker. EX1023, 4:21-31. This physical separation of heating element and nicotine supply would become fundamental to the development of cigarette alternatives.

77. In the following decades, aerosol-forming materials would become common place in cigarette alternatives. *See* EX1024, 2:63-5:50 (summarizing a history of synthetic tobacco products up to 1919-1973). Mixtures of alcohols and esters were developed to serve as aerosol-forming materials. EX1025, 19:14-33. Importantly, before the end of the 1980s, it had been established that alcohols such as glycerin, propylene glycol, and propylene carbonate form ideal aerosol-forming materials. *Id*. These materials continue to form the basis for aerosol-based cigarette alternatives to this day.

78. The development of microelectronics powered by ever smaller batteries also helped improve the form factors for cigarette alternatives, which increasingly became more specifically electronic cigarettes. By the 1990s,

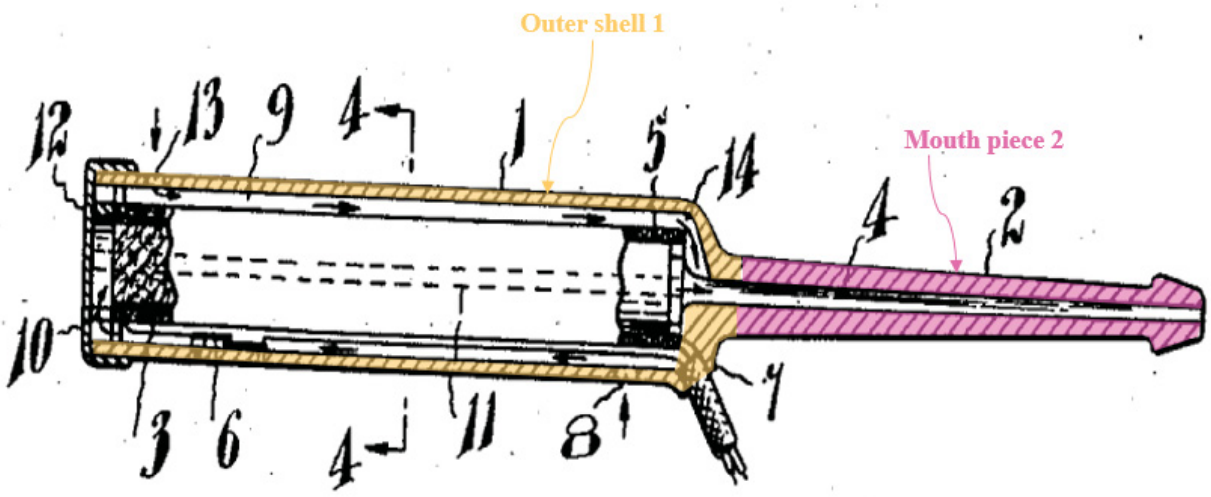
electronic cigarettes included battery power sources providing electric power to micro-controllers to control power supplied to resistive heating elements. EX1026, Abstract; EX1027, 3:4-11. By incorporating solid state transistors, which were also emerging into consumer devices by the 1990s, electronic cigarettes could operate an electrical heater in response to a user drawing on the smoking device via a puff sensor. EX1026, 4:61-65; EX1027, 8:14-19. A liquid aerosol-forming material could be more efficiently delivered directly to the electric heater via capillary action. EX1026, 8:8-15; EX1027, 3:24-26. Interestingly, these technologies would eventually be spun off into aerosol generators for medicinal purposes. *See generally* EX1028.

79. By 2003, still well before the earliest possible filing date of the '202 patent in October 2006, electrically-powered cigarette alternatives had been refined into the modern electronic cigarette. A battery-powered control circuit activates an electric heater. EX1029, 10-11; EX1004 7:52-56 and 6:23-28; EX1006, 44:1-9. Liquid is drawn from a reservoir by a wicking action towards the electric heater. EX1029, 10-11; EX1004, 5:47-52; EX1007, [0017]. By being in close proximity to, or in direct contact with, the heater, the liquid is converted into an aerosol to be inhaled by a user. EX1029, 10-11; EX1004, 7:60-63; EX1007, [0018] and [0019]; EX1006, 42:19-25 and 10:34-36.

B. Smoking Articles Having Housings with Mouthpieces Were Well-Known

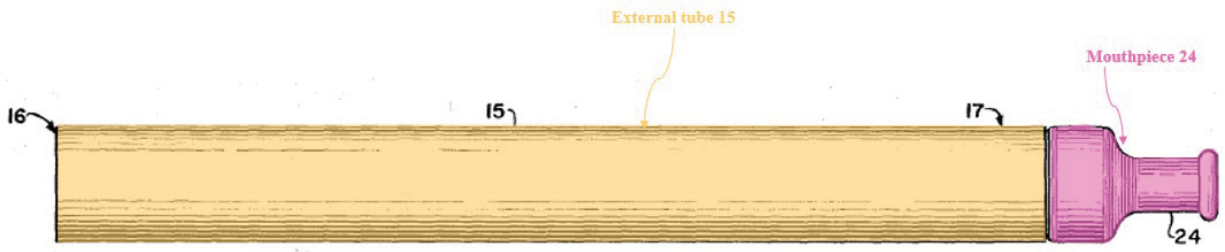
80. As an initial matter, I note that the ’202 patent admits that housings having two ends with a mouthpiece on one end were well known. As explained in Section V.B, the ’202 patent describes a “representative outer housing” in context of the preexisting Ruyan device. EX1001, 20:1-4. The ’202 patent also describes that the Ruyan device includes a “representative mouth-end piece.” EX1001, 24:20-23.

81. The housings illustrated by the ’202 patent and the Ruyan device (EX1029) are little changed from the basic housing described by McCormick approximately 70 years before the earliest possible filing date of the ’202 patent. For example, Figure 3 of McCormick describes a cigarette-holder shaped device having an outer shell 1. EX1020, 2:36-37, 2:50-53. The outer shell 1 includes a “stem or mouth-piece 2” provided at one end thereof and a “removable cover cap” 12 at the distal end. EX1020, 2:50-3:2, 3:26-29, 3:57-60. Given the limitations of battery technology in the 1930s, McCormick’s outer shell 1 includes an inlet for electric terminals 7 that are in connection with an external electric power source. EX1020, 3:14-20. This lone inlet, however, is the only difference between the housing with a mouthpiece claimed by the ’202 patent and the outer shell 1 of McCormick that predates the ’202 patent by most of a century.



EX1020, FIG. 3 (annotated).

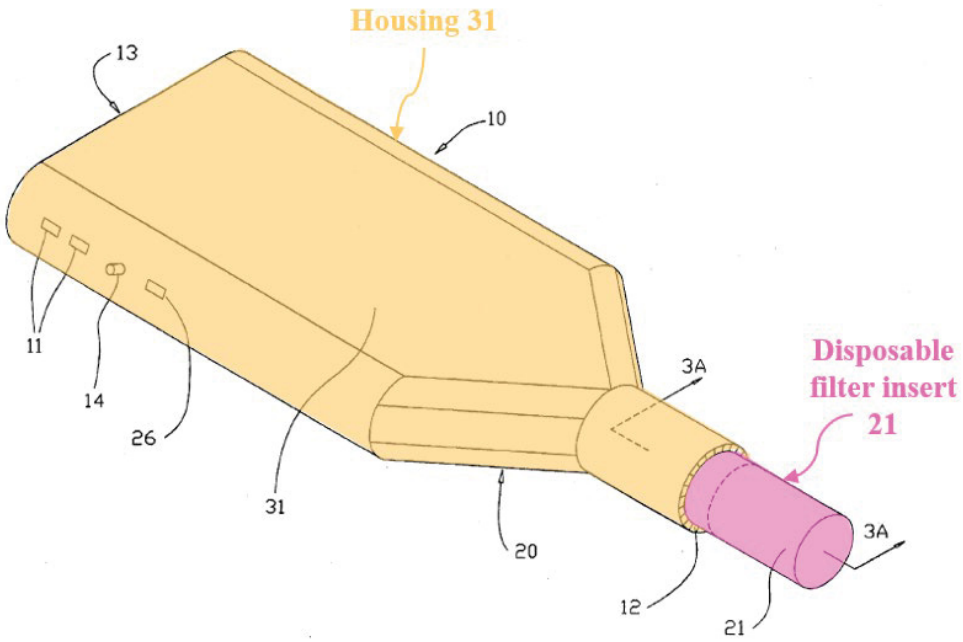
82. This similarity in housing is not unique to the comparison of the '202 patent and McCormick. In fact, the design of outer housings for alternative cigarettes has remained largely unchanged, owing to the necessity of a mouthpiece portion for a smoker to draw out the aerosol. For example, Figure 1 of Gilbert discloses a similar external tube (housing) 15 having a mouthpiece 24 on one end.



EX1022, FIG. 1 (annotated).

83. The presence of a mouthpiece remains a necessary constant. However, the tubular shape of the housing has deviated somewhat to accommodate new technologies. Figure 1 of Higgins shows housing 31 with a "disposable filter insert

21" set within "the mouth end of portion 20." EX1026, 4:49-52. Higgins' housing 31 is expanded in the horizontal direction from a cylindrical tube-shape to a wider, flatter shape, to accommodate larger batteries 22 available at the time, control circuit 24, and liquid medium cartridge 28.



EX1026, FIG. 1 (annotated).

84. Hon, Kim, Takeuchi, and Pienemann are a few among many prior art references that also disclose a housing, whether tubular or shaped to accommodate additional internal components, that disclose a smoking article formed by a housing having a mouthpiece at one end. EX1029, EX10007, EX1004, and EX1006. Thus, this housing structure is as old as alternative cigarettes.

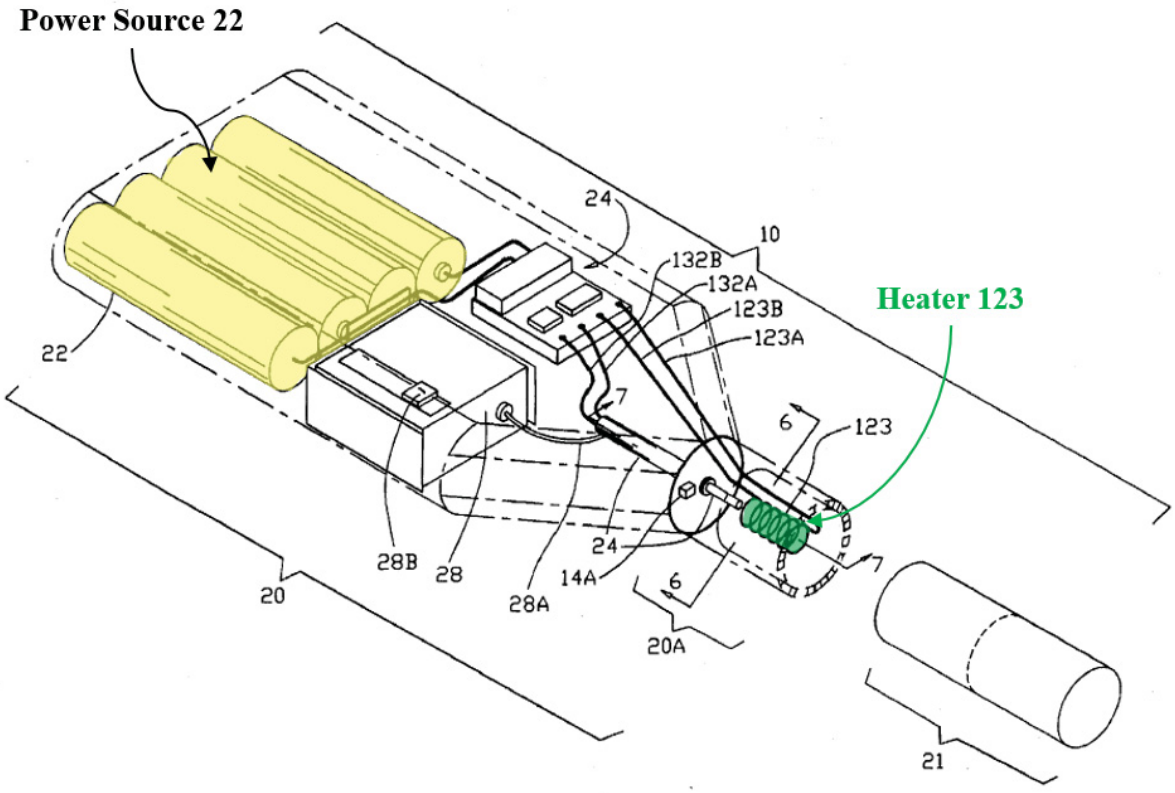
C. Using Electric Heaters Powered by Electric Power Sources Was Well-Known

85. As described in Section V.B above, the ’202 patent further admits that the use of electrical heaters powered by an electric power source, such as a battery, was well known. Specifically, the ’202 patent describes that the Ruyan device includes an electric power source and resistance heating elements that are representative of electric power source 36 and electric resistance heaters 70 and 72, respectively, as described and claimed by the ’202 patent. EX1001, 20:38-43, 21:58-61.

86. Inventors in the alternative cigarette art have experimented with alternative heating methods, such as burning an outer casing of organic matter such as tobacco as in Drummond. EX1023, 4:21-26. However, the burning of a fuel element, as in Drummond, meant that the entire smoking article had to be consumed in a single session, similar to conventional cigarettes. Given this downside, the art quickly focused attention on the use of electric heaters powered by an electric power source.

87. As described above, McCormick’s early smoking device relied on a metallic coil to generate heat from an external electric power source to the tobacco. EX1020, 3:14-20, 3:61-65. However, as battery technology and power circuits improved, an external electric power source was quickly replaced by batteries. *See* EX1022, 2:41-45 (battery 32 powers the heating element). In particular, Howell

describes that electrical resistance heater 27 may be "a heater wire" formed of iron, chromium, and aluminum alloying elements and "connected to a power supply 29, preferably a D.C. power supply such as a battery." EX1027, 3:5-10 and 3:52-59. Similarly, Figure 5 of Higgins shows that heater 123 is powered by power source 22 in the form of replaceable and/or rechargeable batteries. EX1026, 4:55-61.



EX1026, FIG. 5 (annotated).

88. Hon, Kim, Takeuchi, and Pienemann each also describe a smoking article having an electric resistance heater that is powered by an electric power source in the form of one or more batteries. EX1029, EX10007, EX1004, and EX1006.

D. Storing a Liquid Tobacco Product for Aerosol-Generation was Well-known

89. As described in Section V.B above, the '202 patent also compares the claimed storage compartment and aerosol-forming material to that of the Ruyan device. EX1001, 22:46-49. Such storage compartments were well known in the art.

90. For example, a POSA would have also been aware that a storage container for an aerosol-forming liquid could be formed of almost any suitable material depending on the configuration of the aerosol-generating device. For example, where the aerosol-forming liquid is heated while in the storage compartment, a POSA would know to use a thermally conductive material such as a metal (e.g., copper, aluminum, etc.). *See* EX1023, 3:56-58; EX1025, 9:29-33. On the other hand, when the aerosol-generating material is transported to the heat source, a wider variety of materials, including plastic, can be used. *See* EX1022, 3:33-34; EX1031, 4:59-68, 11:51-53. Thus, at least by the early 1990s, it was known to use plastic to form a storage container for holding an aerosol-forming liquid.

1. Liquid Aerosol-forming Materials were Well-known.

91. Aerosol generation has been a primary focus of alternative cigarettes since McCormick described "liberating the active principles of tobacco by controlled heat, sufficient in degree to volatize the nicotine … but not sufficient to produce combustion of the remaining organic matter." EX1020, 2:8-15. Although

McCormick did not expressly describe such "volatize[d]" nicotine as an aerosol, that is precisely what McCormick was generating.

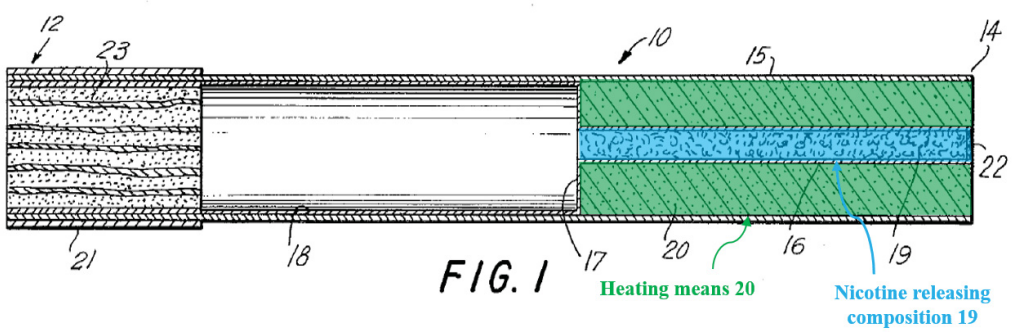
92. Nonetheless, by the 1960s, the aerosol mechanics of evaporated nicotine were much better understood. For example, Drummond discloses "a composition which releases nicotine vapor and potentially aerosol forming materials, including water vapor, when subjected to an elevated temperature below the ignition point of the composition." EX1023, 1:41-52. Drummond's aerosol composition is described as a mixture of tobacco, "tobacco extract having a high nicotine content," and "a suitable flavoring additive, such as an essential oil." EX1023, 14:27-34.

93. By 1989, the use of "glycerin, propylene glycol, triethylene glycol, propylene carbonate, or mixtures thereof" had been found to be particularly effective low-temperature aerosol-forming materials, owing in large part to the low boiling points of these liquids. EX1025, 19:21-33. Given the excellent properties of these aerosol-forming materials, it is no surprise that, over 15 years after Roberts, the '202 patent describes exactly the same "aerosol-forming materials [that] include glycerin, propylene glycol, and mixtures thereof." EX1001, 14:15-29.

2. It was Well-Known to Wick Liquid Materials from a Storage Compartment to a Heater to Generate an Aerosol.

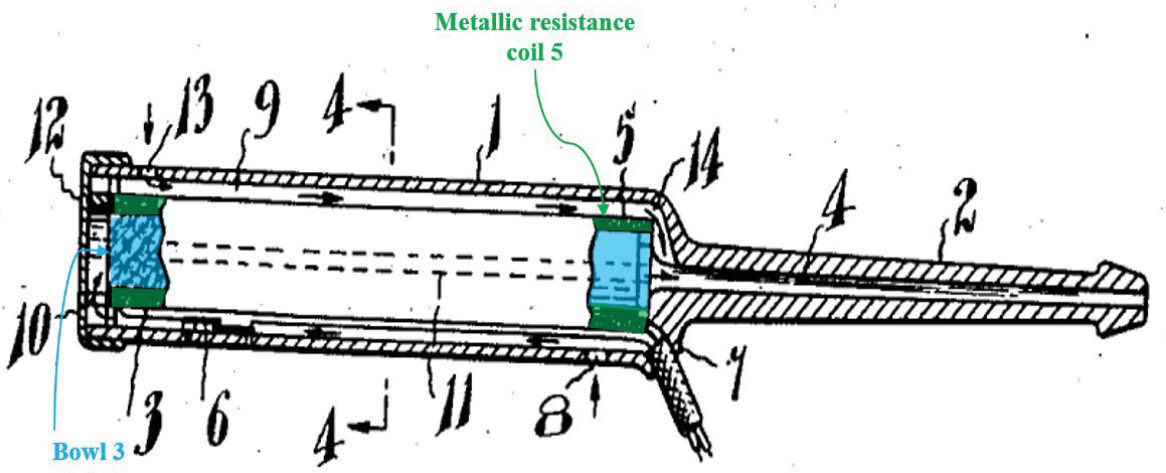
94. As I described above, the physical separation of the tobacco-containing aerosol material from the heating means underpins alternative cigarette technology. Given this physical separation, it is necessary to supply, in some way, the liquid to the heating element, particularly in a measured way so that the liquid is consumed over a desired number of puffs. Alternative cigarettes achieve this supplying in at least three ways: (1) bringing heat to the aerosol material, (2) wicking the aerosol material to the heating element by means of a fibrous wick material, and (3) wicking the aerosol material to the heating element by means of capillary action without a physical wick material.

95. Early attempts at alternative cigarettes focused on bringing heat to the aerosol material. For example, Figure 1 of Drummond shows that nicotine-releasing composition 19 is surrounded by heating means 20. As the heating means 20 burns from outer end 14 towards mouthpiece end 12, the nicotine-releasing composition 19 is heated in a region near the burning heating means, thereby releasing the aerosol. EX1023, 4:74-5:8.



EX1023, FIG. 1 (annotated).

96. Similarly, McCormick's early smoking device used an electric heater to supply heat to the entire aerosol-forming material. EX1020, 3:2-10. Here, McCormick describes that a metallic resistance coil 5 is wound around a central cavity of an insulated chamber, thereby heating the entire bowl. EX1020, 3:2-10.

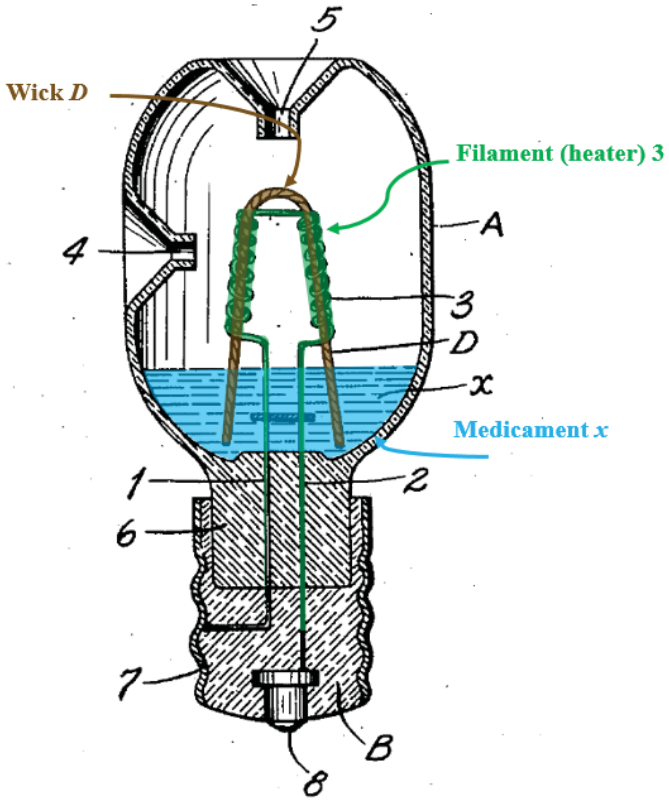


EX1020, FIG. 3 (annotated).

97. However, McCormick's heating of an entire liquid-containing bowl to generate a vapor is inefficient due the large thermal mass of the liquid. Thus, this form of heating required very large currents to generate enough heat to vaporize

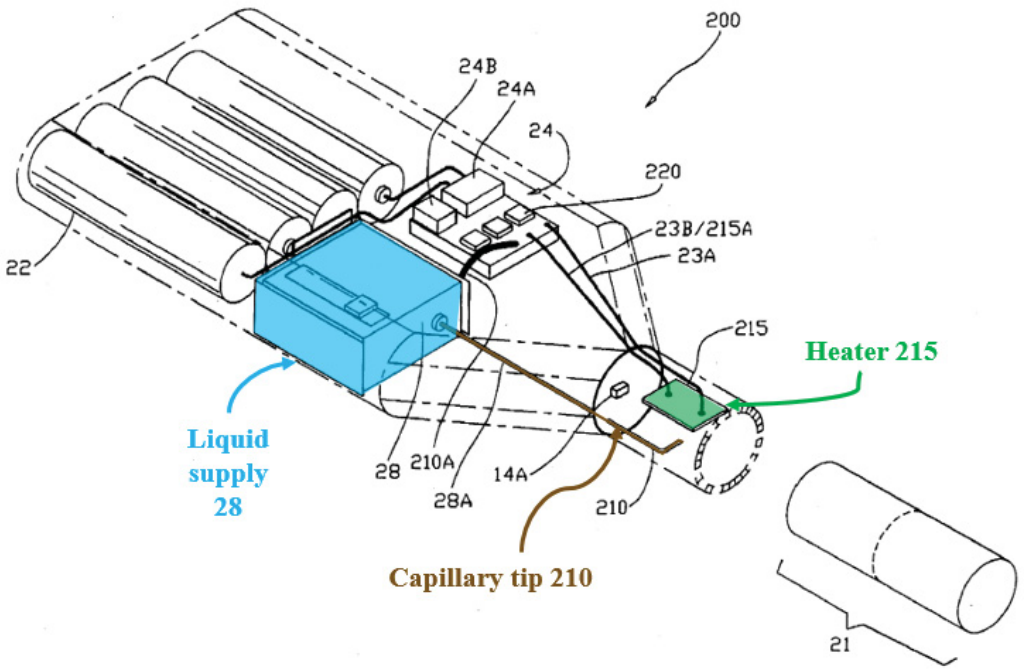
the liquid. In addition, once the entire liquid is heated to the vapor point, a user must either consume all the liquid in the container, or waste a large amount of material allowing the liquid to return to a cooler temperature.

98. These concerns were obviated by wicking small amounts of the liquid from a storage compartment to the electric heater. Around the same time that McCormick was devising his alternative cigarette, Whittemore was devising a therapeutic vaporizing unit that used a physical wick D to draw liquid into close contact with a heating element 3. EX1030, FIG. 2. Whittemore's wick D was formed of "a thread, string, or strand of some suitable wick material" having ends submerged in a liquid medicament *X* so that "a portion of said wick is always in contact with the medicament." EX1030, 1:50-2:25. Heating element 3 is wrapped around wick D, so that "said medicament will be carried by capillary action to a point where it will be vaporized by the heat from the filament 3." EX1030, 2:3-8.



EX1030, FIG. 2 (annotated).

99. While Whittemore discloses using a physical wick to provide capillary action to wick fluid *X* towards heating element 3, this idea was often implemented in alternative cigarettes without the need for a physical wick. Figure 8 of Higgins shows a "capillary spray tip 210 oriented towards heater 215." EX1026, 7:56-59. "[L]iquid tobacco flavor medium is transferred from liquid supply 28 out through capillary tip 210 to heater 215, where the transferred droplets are heated to generate an aerosol." EX1026, 8:11-15.

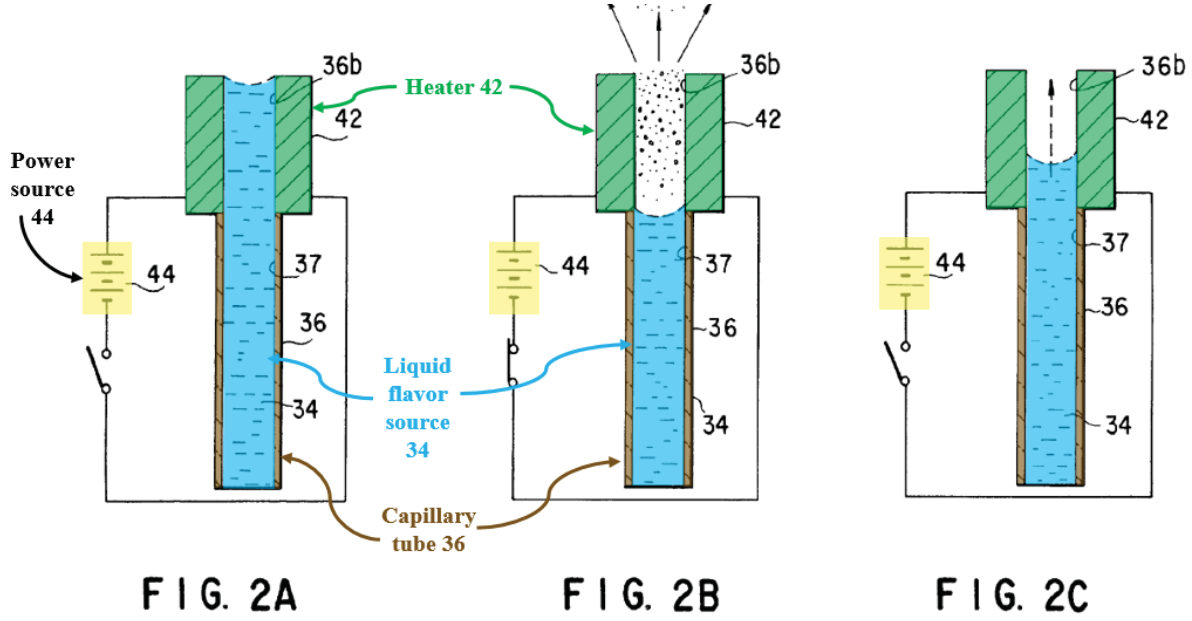


EX1026, FIG. 8 (annotated).

100. Hon and Kim also disclose the wicking of a liquid aerosol forming material into contact with a heating element. EX1029, EX1007. However, as explained in detail below, Takeuchi teaches clearly that the use of a capillary tube or a wicking material both perform the same wicking action.

101. In particular, Figures 2A-2C of Takeuchi show the formation of an aerosol (in Figure 2B) from a liquid that is in contact with a heater 42. In Figure 2A, before the closing of switch 44 and the activation of heater 42, liquid from liquid flavor source 34 has been wicked "by the capillary force of the capillary tube 36" to the top outlet portion of capillary tube 36. EX1004, 7:57-59. When heater 42 is turned on, the liquid within heater 42 is "instantly gasified" into an aerosol, as shown in Figure 2B. EX1004, 7:60-63. Heater 42 is then turned off by

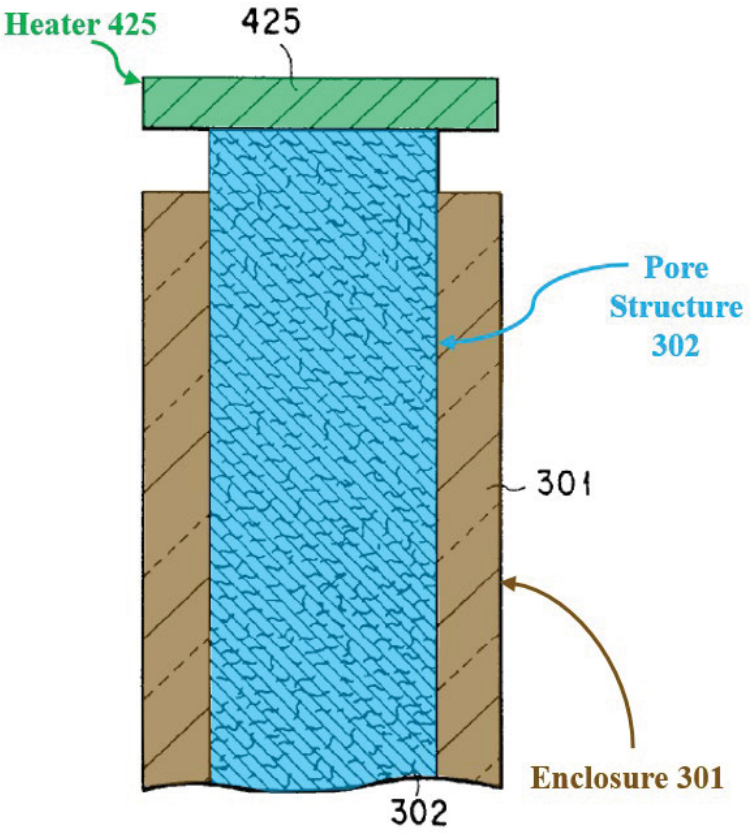
opening switch 44 and liquid again fills to the outlet portion of capillary tube 36. EX1004, 7:64-8:4.



EX1004, FIGS. 2A, 2B, and 2C (annotated).

102. In addition, Figures 14 and 15 of Takeuchi disclose using a physical wick material instead of relying on capillary action. As shown in Figure 15, Takeuchi describes filling enclosure 301 with an "intercommunicating pore structure 302." EX1004, 10:53-55. Intercommunicating pore structure 302 is "a structure having intercommunicating voids or pores through which the liquid may be elevated from the inlet of the passageway which is in fluid communication with the liquid flavor source contained in the liquid container to the outlet of the passageway by the capillary force." EX1004, 3:42-47. This intercommunicating pore structure is formed of an "open-cell foamed structure," such as in Hon and

Kim, or "bundled fibers," which are similar to the thread wick of Whittemore. EX1004, 3:47-50.



EX1004, FIG. 15 (annotated).

103. In view of the above, using capillary action or using a physical wick material have been well known as methods for wicking the liquid aerosol-forming material towards a heater.

E. Controllers Using Puff Detectors for Smoking Articles Were Well-Known.

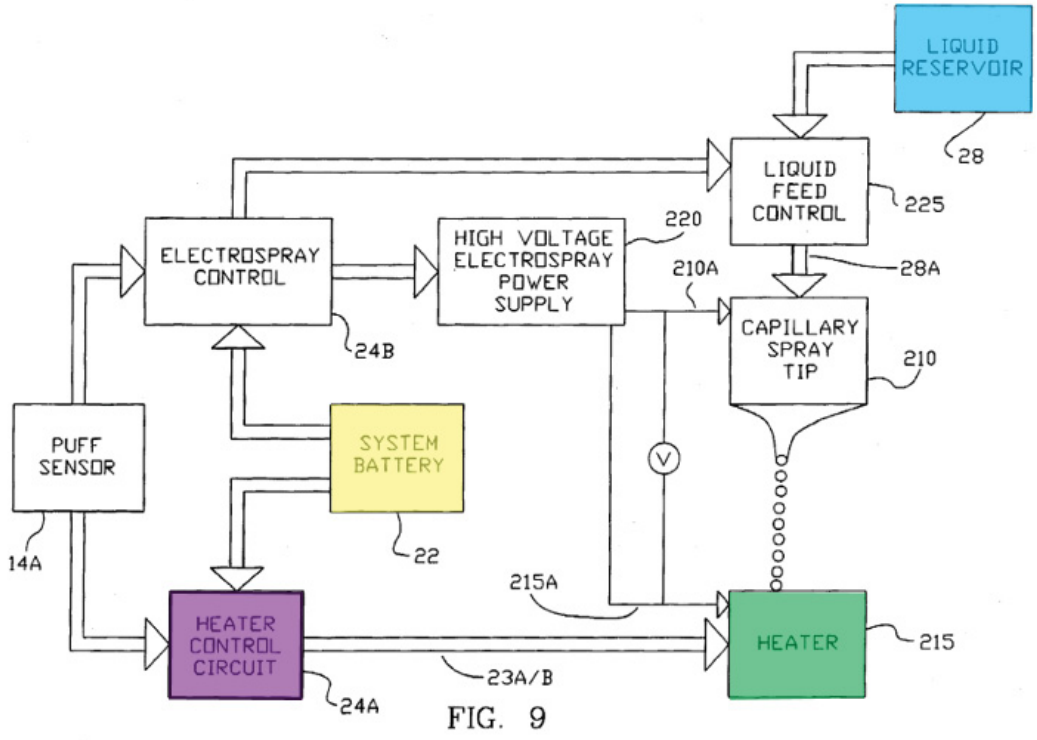
104. As explained above in Section V.B, the "electronic control components," as described within the '202 patent, were also known in the prior art,

as admitted by the '202 patent itself. In particular, the '202 patent relies on the Ruyan device as well as other prior art devices as providing representative "types of electronic control components." EX1001, 22:55-60. Similarly, the '202 patent relies on prior art pressure sensitive switches as representing the described and claimed "draw sensors." EX1001, 21:14-21.

105. In the 1980s and 1990s, electric heaters and power sources proliferated in cigarette alternatives, and more sophisticated electronics were incorporated into the devices. Howell describes an aerosol generator with circuitry that controls the power supply to heater 27. EX1027, 6:19-23. This circuitry can include a "puff-actuated sensor" "that is sensitive to pressure drops occurring in the mouthpiece 39 when a user draws on the mouthpiece." EX1027, 6:16-19. Howell describes that "[i]ntermittent operation" "is preferably achieved by actuation of the motor 149 and the heater 127 by the puff-actuated sensor 137 in combination with appropriate interconnecting circuitry." EX1027, 8:14-19.

106. Higgins similarly describes a puff sensor 14A that activates heater 23. EX1026, 4:61-64. In detail, Higgins discloses that "heater control circuit 24A energizes heater 215." EX1026, 8:8-11. FIG. 9 of Higgins shows that puff sensor 14A "is used to activate heater control circuit 24A," which is "powered by battery 22." EX1026, 7:64-67. Higgins further describes that "electrostatic control circuit 24B could include conventional timing circuitry … to initiate and terminate the

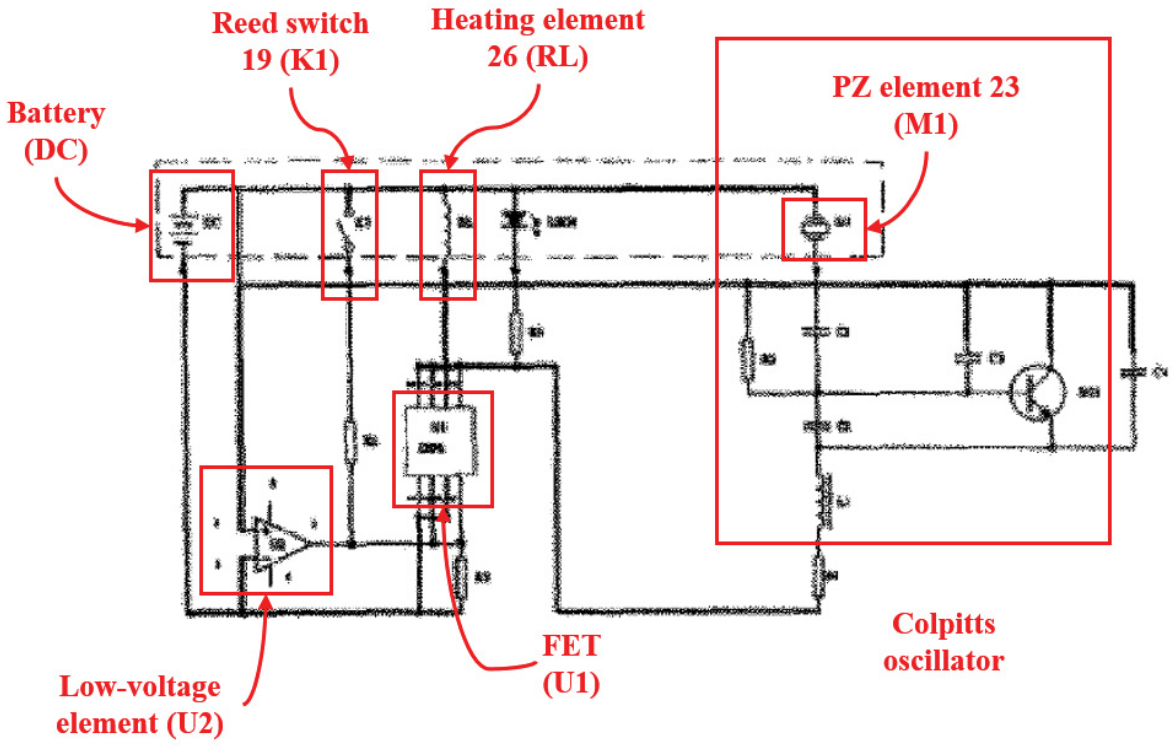
application of high voltage across tip 215 at fixed times after smoker activation of sensor 14A." EX1026, 8:30-33.



EX1026, FIG. 9 (annotated).

107. Hon further discloses a controller that similarly performs puff-actuated control of a heating element. In particular, Figure 12 of Hon shows a "functional diagram of the circuit" including a Reed switch 19 (K1), heating element 26 (RL), piezoelectric element 23 (M1), and low voltage detecting element U2 that controls operation of field effect power transistor U1. EX1029, 10. A user drawing on the device causes "negative pressure" on negative pressure cavity 6, thereby activating electronic circuit board 3. EX1029, 10. By closing Reed switch

19, heating element 26 is turned on. EX1029, 10. Thus, Hon's puff sensor activates current flow through heating element 26 based on a draw on the mouthpiece.



EX1029, FIG. 12.

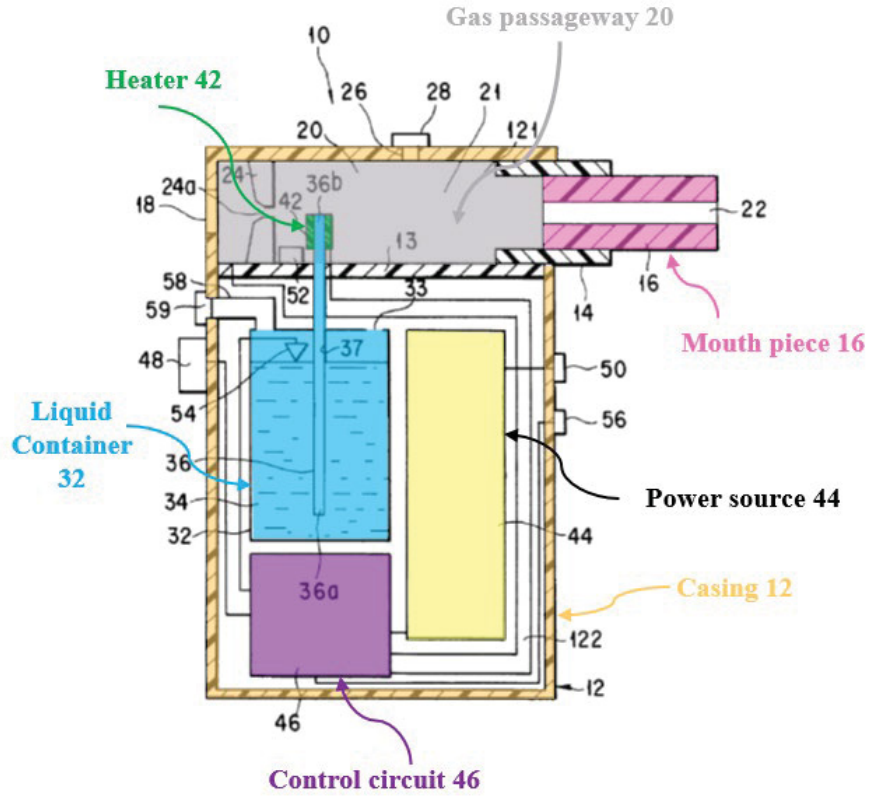
108. Before the earliest possible priority date of the '202 patent, controllers and puff actuated sensors, such as the control circuits in Higgins and Howell, were well-known in the art. Takeuchi and Pienemann additionally disclose puff actuated sensors and controllers that control the flow of current to an electric heater.

VII. OVERVIEW OF THE APPLIED REFERENCES.

109. I provide an overview of each of the applied references below.

A. Takeuchi

110. U.S. Patent No. 6,155,268 to Takeuchi was granted on December 5, 2000. Like the '202 patent, Takeuchi describes "a flavor-generating device for enjoying inhalation of flavor or for enjoying simulated smoking, and more particularly, to a flavor-generating device for generating flavor which is to be inhaled by a user by heating a liquid." EX1004, Takeuchi, 1:3-8. An example embodiment of Takeuchi's device is illustrated in Figure 1 below.



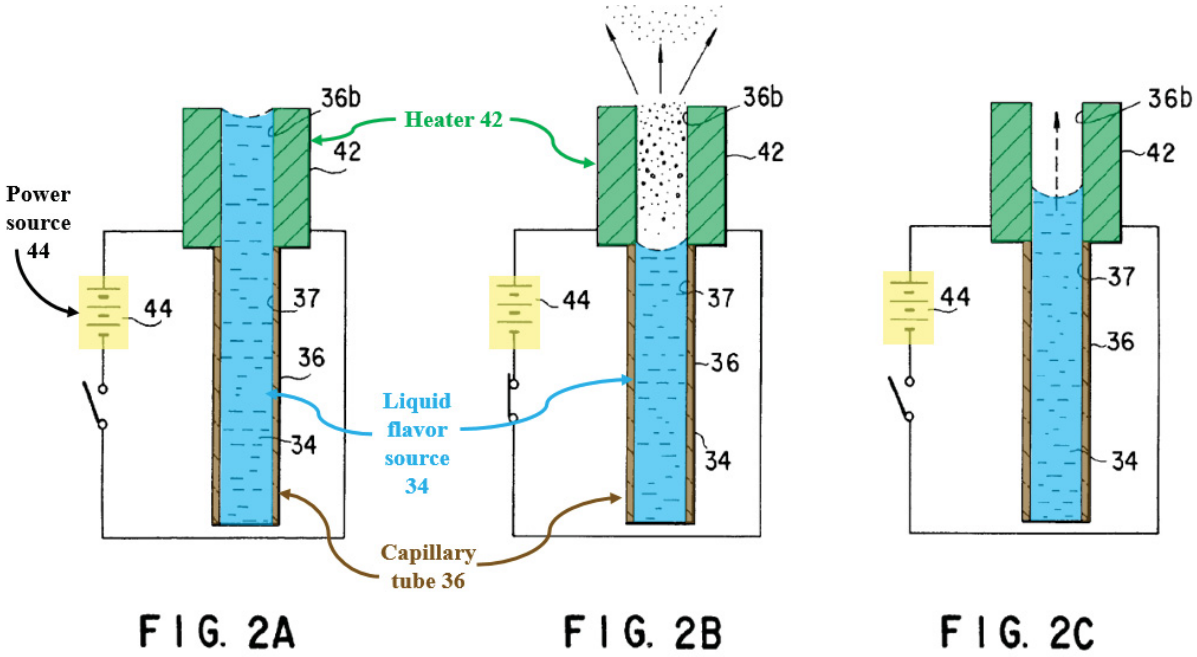
EX1004, FIG. 1 (annotated).

111. Takeuchi explains "[o]ne feature of the present invention resides in that the transportation of a liquid flavor source from the liquid container containing the same to the heater site is effected by the capillary force or capillarity."

EX1004, 3:32-35. The flavor generating device 10 of Figure 1 includes a "liquid container 32 housing a liquid flavor source 34." *Id.*, 4:30-29-38; 5:28-30. "[I]t is possible for the liquid flavor source 34 to contain a substance forming aerosol when heated." *Id.*, 5:34-35. "For example, where the device is used as a simulated smoking article, it is possible for the liquid flavor source 34 to contain tobacco components such as tobacco extracts and a tobacco smoke condensate." *Id.*, 5:43-46.

112. A "capillary tube 36 for transporting the liquid flavor source by the capillary force is inserted within the liquid container. The capillary tube 36 defines a liquid passageway 37 for the liquid flavor source, and its lower end 36a is positioned in the vicinity of the bottom of the liquid container 32." *Id.*, 5:47-50. In some embodiments, "the outlet port 36a [sic] of the liquid passageway 36 is formed by the heater 42 itself." *Id.*, 6:10-12. Thus, while Takeuchi is inconsistent with respect to the numerals 36a and 36b used for the lower end and outlet port of the capillary tube 36 (*e.g.*, *id.*, 4:66, 5:47-50, 6:10-12), Takeuchi discloses the capillary tube 36 being configured to carry an aerosol precursor in the form of liquid flavor source 34 from inside liquid container 32 to a heater 42 positioned in an airway provided in an upper chamber 121 of the device 10. *Id.*, FIG. 1, 4:33-35, 6:4-7, 7:57-59. Capillary tube 36 can also include a pore structure to help transport the liquid flabor source to heater 42. EX1004, 3:36-50.

113. Once the liquid flavor source 34 reaches heater 42, "the liquid flavor source 34 within the outlet port 36a is instantly gasified by the heat generated from the heater 42 as shown in FIG. 2B so as to be supplied into the gas passageway 20. Upon gasification … the liquid flavor source 34 is newly supplied … by the capillary force of the capillary tube 36, as shown in FIG. 2C." EX1004, 7:57-8:4. Takeuchi's device 100 operates by using capillary action to bring liquid aerosol precursor to an outlet of a passageway, then aerosolizing the liquid with a heater at the outlet. The aerosolized liquid in gas passageway 20 is then, "in accordance with the inhaling action of the user," "transferred into the inhalation port 22." EX1004, 8:10.



EX1004, FIGS. 2A–2C (annotated).

114. Takeuchi discloses multiple variations upon the core capillary passage and heater concept. For example, Takeuchi discloses multiple configurations of heater 42, 72, 74, 76, usable with the tube 36, and the possibility to use multiple tubes 36 with the container 32. EX1004, FIGS. 3-7, 8:16-48.

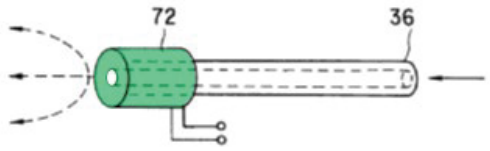


FIG. 3

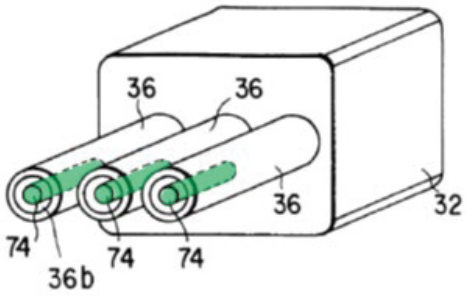


FIG. 6



FIG. 4



FIG. 5

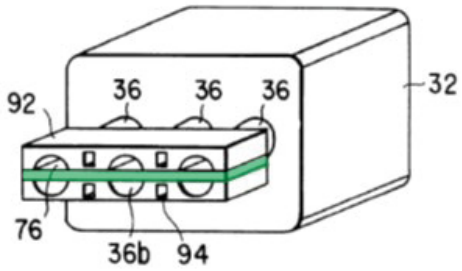


FIG. 7

EX1004, FIGS. 3–7 (annotated).

115. In another example, Takeuchi discloses a second flavor generating device, device 100, having an "exchangeable liquid container 3:2 [sic]" positioned in-line along the gas pathway with plates 361, 362 defining a capillary passageway

371 that terminates at heaters 421, 422. *Id.*, FIG. 8, 9:23-44. The device 100 of Figure 8 (below) has a different style of container 32 and a capillary passageway defined by plates 361, 362, but operates by the same principle and has "essentially the same" electrical connections as the device 100 of FIG. 1. *Id.*, FIG. 8, 8:55-58, 9:5-7, 9:31-44.

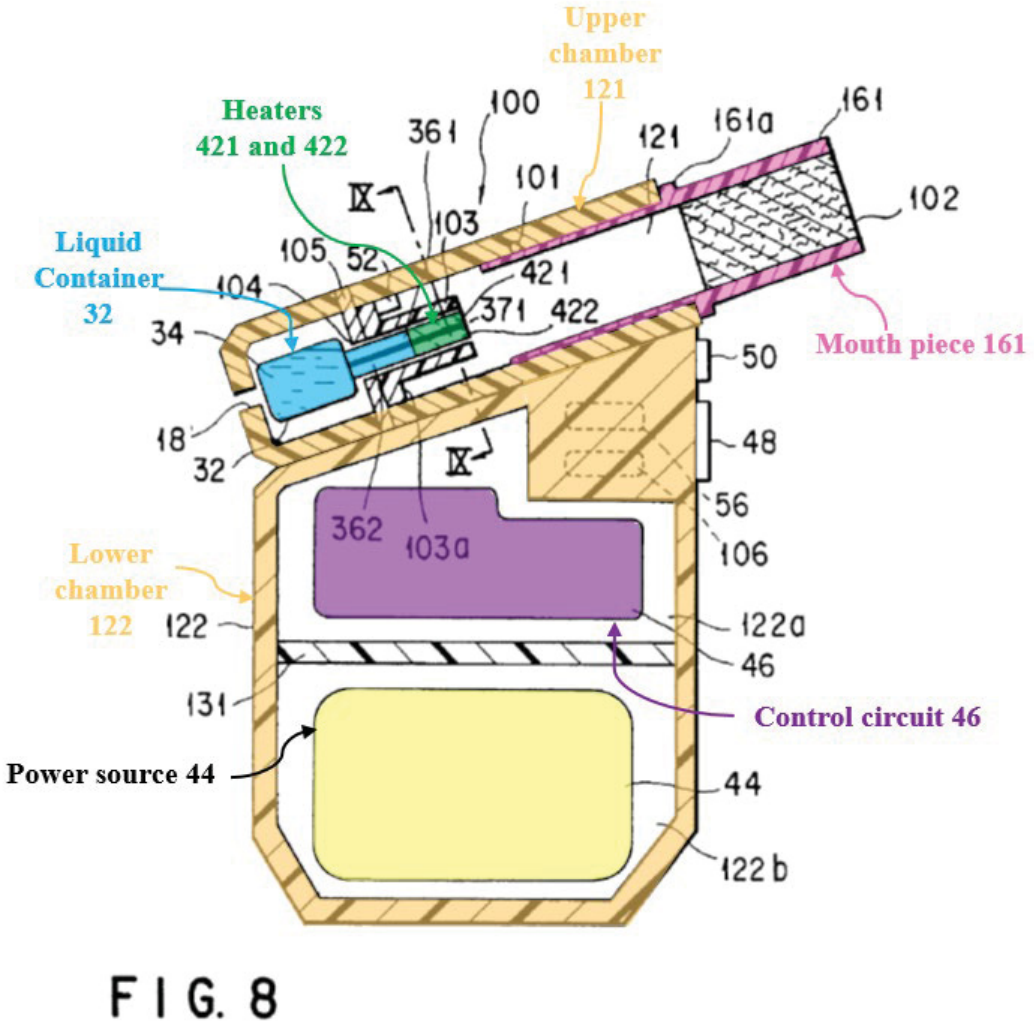


FIG. 8

EX1004, FIG. 8 (annotated).

116. The device 100 of FIG. 8 is also reconfigurable, as Takeuchi demonstrates with optional heaters 423, 424 positioned within the passageway 371 and by alternative positions for the container 32. EX1004, FIGS. 11-13, 10:22-49.

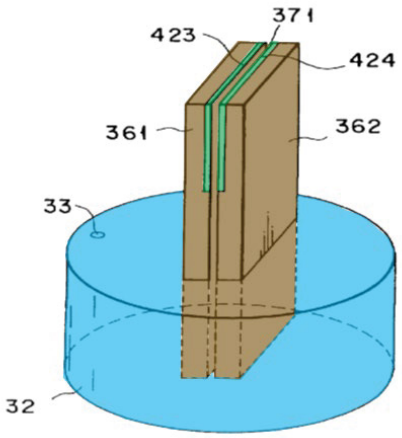
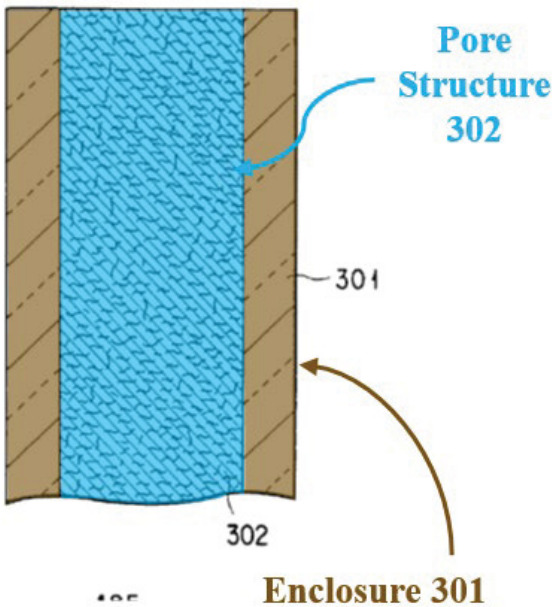


FIG. 11

EX1004, FIG. 11 (annotated).

117. Beyond repositioning the heater, Takeuchi's various devices can also be modified by providing a capillary pore structure in the passageway from the liquid container to the heater. EX1004, 3:36-50. That is, the capillary force can be provided by "an inter-communicating void or pore structure filled in an enclosure … through which the liquid may be elevated from the inlet of the passageway which is in fluid communication with the liquid flavor source … to the outlet of the passageway by the capillary force. Representative examples of the structure include open-cell foamed structure, and bundled fibers." *Id.*, 3:40-50. Takeuchi illustrates this pore structure 302 filling a passageway through an "enclosure 301

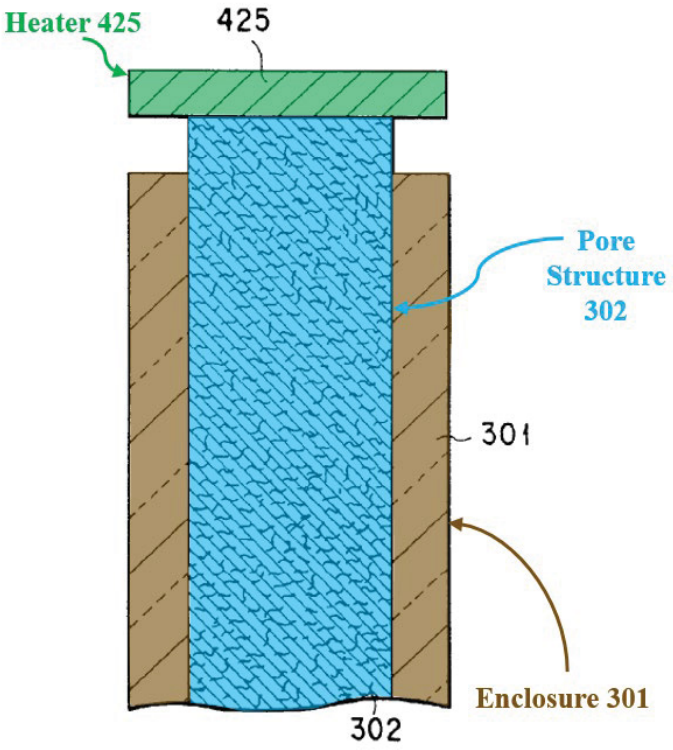
may be provided by a tube, or two plates arranged spaced apart from each other" arranged with a heater as shown in FIG. 1, 10, or 11. *Id.*, 10:55-59.



EX1004, FIG. 14 (annotated).

118. Because Takeuchi's heaters in the embodiments of Figures 1, 10, and 11 are each positioned at the outlet of the liquid passageway (EX1004, FIGS. 1, 10, 11, 6:10-12, 9:31-34, 10:22-27) and the pore structure lifts the liquid to the outlet by capillary force (*Id.*, 3:42-47, *see also* FIG. 14 showing the pore structure 302 extending to the outlet of the enclosure 301), Takeuchi's liquid passageway (both with and without the pore structure) wicks the liquid into contact with the heater in each disclosed embodiment. Moreover, Takeuchi discloses the pore structure itself contacting the heater where it states that the heater arrangements of

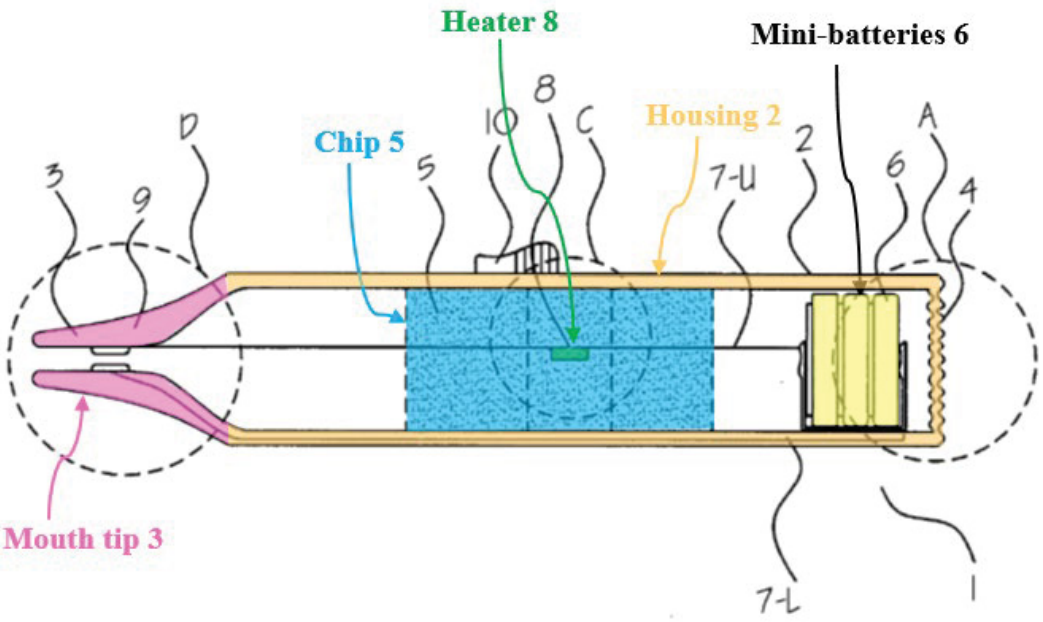
Figures 1, 10, or 11, each with a heater at the outlet of the passageway, can be applied to the embodiment of Figure 14, which shows the pore structure 302 extending to be flush with the end of the enclosure 301 defining the passageway. *Id.*, FIG. 14, 10:55-59. Takeuchi's intent to extend the pore structure into contact with the heater is demonstrated by a further embodiment wherein the pore structure protrudes beyond the end of the enclosure to contact a heater 425 spaced from the enclosure. *Id.*, FIG. 15, 10:59-67.



EX1004, FIG. 15 (annotated).

B. Kim

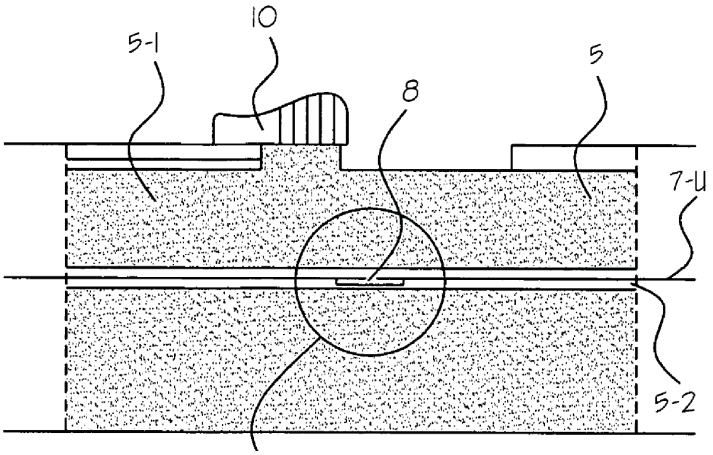
119. U.S. Published App. No. 2006/0016453 was published on January 26, 2006. Like the '202 patent, Kim describes a "device, which, in response to an electric power suppl[y] and suction by a user, evaporates nicotine mixture and delivers them to the user." EX1007, Kim, Abstract. An example embodiment of Kim's device is illustrated in Figure 1 below.



EX1007, FIG. 1 (annotated).

120. Kim explains that Figure 1 shows a "cigarette substitute device (1)." EX1007, ¶[0012]. The device includes a porous chip (5), "preferably in the form of polymeric fibers, and having absorbed therein the volatile liquid composition of mixture of nicotine and volatile palatability enhancing agents." *Id.*, ¶[0015]. An electrical shortening connector (8) or heating coil can be embedded in the chip (5). *Id.*, ¶[0015]. The shortening connector can be powered by onboard batteries (6)

and configured to operate when the device detects the application of the user's lips. *Id.*, [0018].

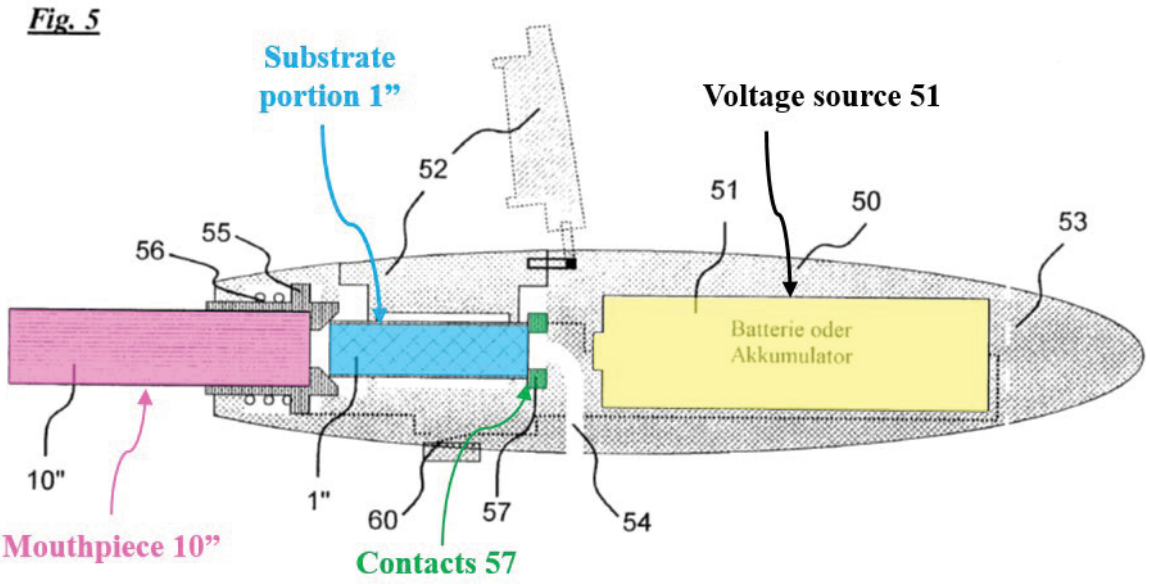


EX1007, FIG. 5 (excerpted).

121. Heat evaporates the mixture from the chip (5) to be delivered into the smoker's mouth. EX1007, ¶[0019].

C. Pienemann

122. International Published App. No. WO 2000/028843 was published on May 25, 2000. Pienemann describes a "system for supplying an inhalable aerosol" that "contains a substrate portion (1") and an inhaling device." EX1006, Pienemann, Abstract. An example embodiment of Pienemann's system is illustrated in Figure 5 below.



EX1006, FIG. 5.

123. Pienemann explains the "system according to the invention for the provision of an inhalable aerosol is particularly suitable as a smoking product, the functioning of which is based on the heating of an aerosol-forming material during the puffs." EX1006, Certified English Translation of Pienemann, 3:7-10. "A preferably cylindrical substrate portion comprising at least one thermal resistor and containing the aerosol-forming material within a wrapper is smoked in a … cigarette- or cigar-shaped inhaler device. The coating of the substrate portion, which is electrically conductive for this purpose at least in sections, preferably serves as a thermal resistor." *Id.*, 3:10-16. "The basic principle of the invention is therefore based on a spatial arrangement of [the] heat source and aerosol former as close as possible." *Id.*, 3:23-25.

124. The substrate portion (variously labeled 1, 1', and 1", *see, e.g*, claim 1) "contains an aerosol-forming material 2 surrounded by an electrically conductive wrapper 3." *Id.*, 5:15-20, FIGS. 1a-c. "The aerosol-forming material 2 may consist of, for example, cut leaf tobacco, cut tobacco stems, reconstituted tobacco, or a carrier material treated with aromatic substances." *Id.*, 5:21-23. The material 2 also contains "a volatile polyol, e.g. glycerol or propylene glycol, to enhance aerosol formation." *Id.*, 6:1-39. Also to increase aerosol formation, the moisture content of the material 2 can exceed the equilibrium moisture of the tobacco or other substance used to form it. *Id.*, 6:3-9.

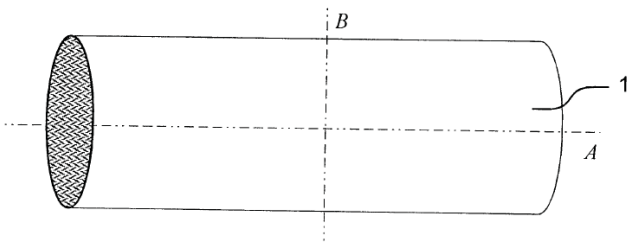


Fig. 1a

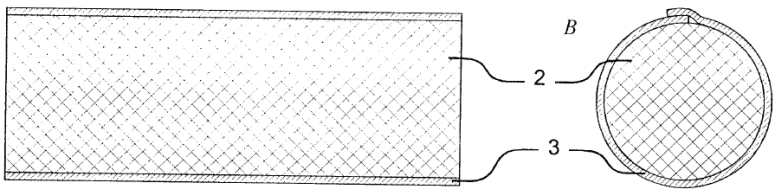
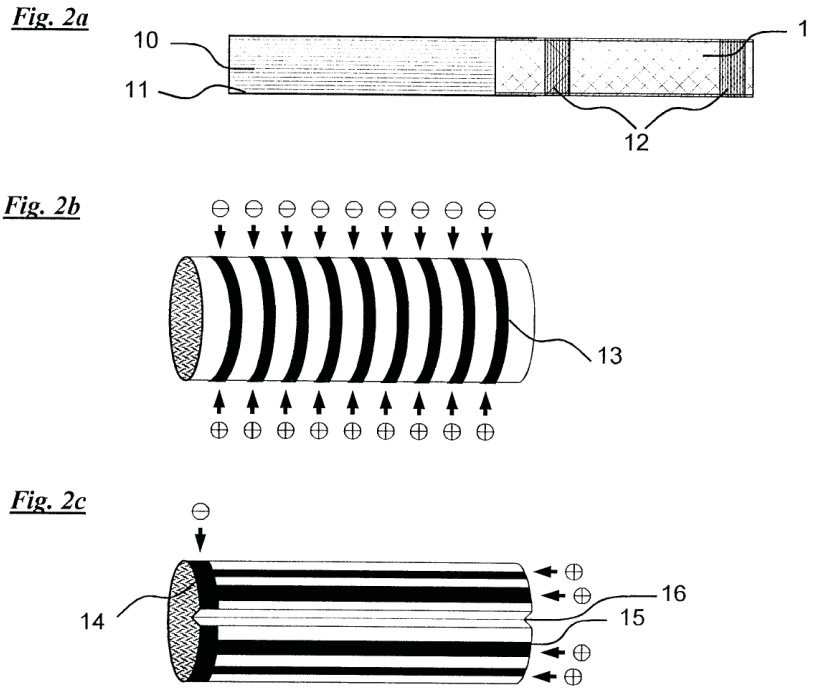


Fig. 1b Fig. 1c

EX1006, FIGS. 1a–1c.

125. The electrically conductive wrapper 3 can include conductive additives applied to one or more layers of wrapping material, such as tobacco or plastic foil. EX1006, 6:10-15. The wrapper 3 can have zones 12, 13, 14, 15 of

increased conductivity that act as electrical contacts and resistance heaters, as shown in Figures 2a-c below. *Id.*, 7:8-10, 7:14-24, and 8:10-15; EX1006, FIGS. 2a–2c.



FIGS. 2a–2c.

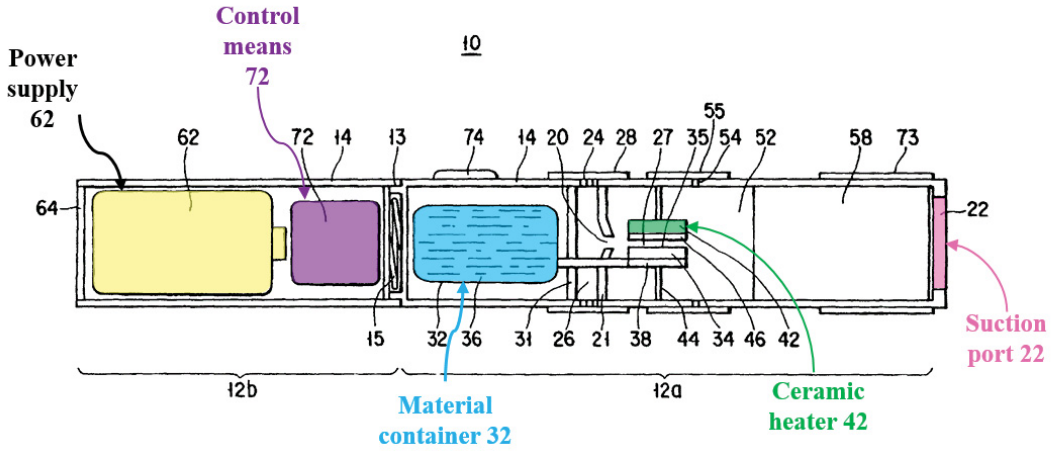
126. Pienemann discloses various inhaler devices that can include the substrate 1, variously labeled substrate 1' or substrate 1", including the inhaler device pictured in Pienemann's Figure 5 above. EX1006, FIGS. 3–5; EX1006, 8:26-29, 9:30–32, 10:17-21. FIG. 5 illustrates a "one-piece embodiment … having a cigar like shape" provided by a "housing 50" with a "screw-off cap 53 at the front end through which a battery or accumulator 51 can be replaced" and a "pivoting flap 52" for receiving "a substrate portion 1". EX1006, 10:17-21. In operation, "current flows between the contacts 55, 57 via the conductive wrapper

of the substrate portion 1'', so that it is heated" and "smoke aerosol can be extracted by dragging upon a mouthpiece 10"." *Id.*, 10:28–31.

D. Susa

127. European Patent Application No. 0845220B1 to Susa et al. was filed on June 9, 1997, and published on March 9, 20003.

128. Susa is directed to "a flavor generation article employed for enjoying inhalation of a flavor and simulated smoking and, more particularly, to a flavor generation article used for generating the flavor as an inhalation target by heating a liquid material with an electric heater." EX1018, 1:5-10. Figure 1 illustrates Susa's device 10. *Id.*, 5:31-34.



F I G. 1

EX1018, FIG. 1.

129. Susa's device 10 includes a container 32 for storing a liquid material 36 for generating a flavor to be inhaled. EX1018, 6:11-23. Susa also describes that

"a tobacco component, e.g., a tobacco extracted component or a tobacco smoke condensate component, may be contained in the liquid material 36." *Id*.

VIII. GROUNDS OF UNPATENTABILITY

130. It is my opinion that claims 1-30 of the '202 patent are unpatentable for at least the reasons set forth below.

A. Ground 1: Takeuchi renders obvious claims 1, 3-15, and 18-29.

1. Independent Claim 1

(a) An electrically-powered, aerosol-generating smoking article comprising:

131. As discussed above in Section V.B, the '202 patent describes that this element was well-known and in public use before the '202 patent's earliest claimed priority date. *See* EX1001, 14:29-38 (admitting that known smoking articles incorporated "aerosol-forming materials"). Takeuchi discloses the claimed "electrically-powered, aerosol-generating smoking article."

132. Takeuchi discloses this limitation in two different embodiments—e.g., the embodiment illustrated in Figure 1 and the embodiment illustrated in Figure 8 (both reproduced below). Each embodiment of Takeuchi discloses "a flavor-generating device for enjoying inhalation of flavor or for enjoying simulated smoking." EX1004, 1:4-9, 4:26-28 ("FIG. 1 shows the construction of a flavor-generating device 10 according to one embodiment of the present invention"); 8:49-51 ("FIG. 8 schematically shows the construction of a flavor-generating

device [100] according to another embodiment of the present invention"). The features of these different embodiments "can be combined appropriately depending on the object of the flavor-generating device." EX1004, 11:1-6.

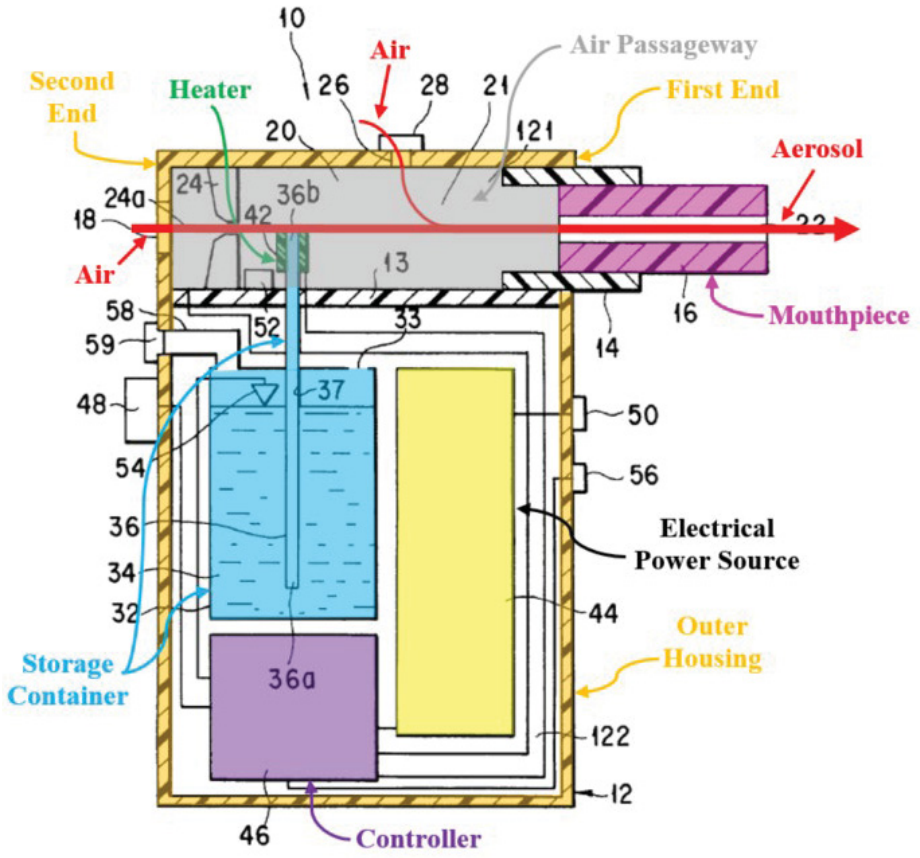


FIG. 1

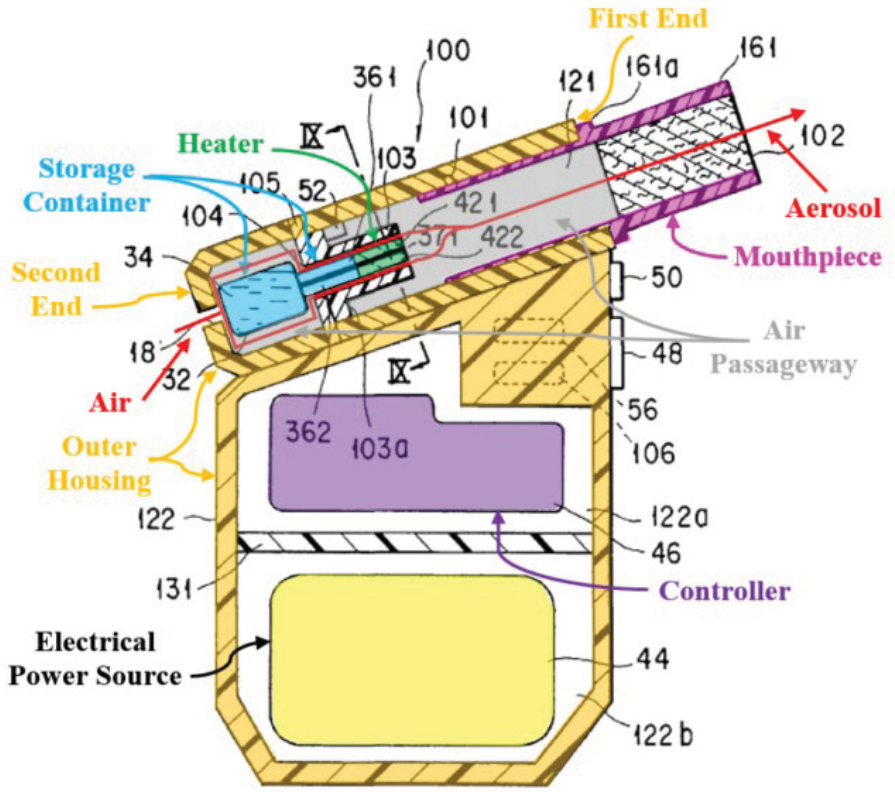


FIG. 8

EX1004, FIGS. 1, 8.

133. To the extent that the term "*smoking article*" is construed to mean "tobacco containing smoking article" (as discussed in Section V.E.2 above), Takeuchi still discloses this limitation. Indeed, Takeuchi discloses that "where the device is used as a simulated smoking article, it is possible for the liquid flavor source 34 to contain tobacco components such as tobacco extracts and a tobacco smoke condensate." EX1004, 5:43-46.

134. Takeuchi also discloses that devices 10 and 100 are both "electrically-powered." For example, Takeuchi describes that "electric power is supplied from a power source 44." EX1004, 6:12-14.

135. Takeuchi further discloses that devices 10 and 100 are configured to be "aerosol-generating." Here, Takeuchi describes, "in order to add smoke to the flavor, it is possible for the liquid flavor source 34 to contain a substance forming aerosol when heated." EX1004, 5:33-35, 10:5-13 ("an aerosol formation efficiency can be more enhanced when the liquid flavor source contains the aerosol generation material").

136. Therefore, Takeuchi discloses the claimed "electrically-powered, aerosol-generating smoking article."

(b) an outer housing having two ends;

137. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Takeuchi discloses the claimed "outer housing having two ends."

138. Indeed, Takeuchi's casing 12 represents "an outer housing having two ends," as illustrated in Figure 1 below. EX1004, 4:30-32;

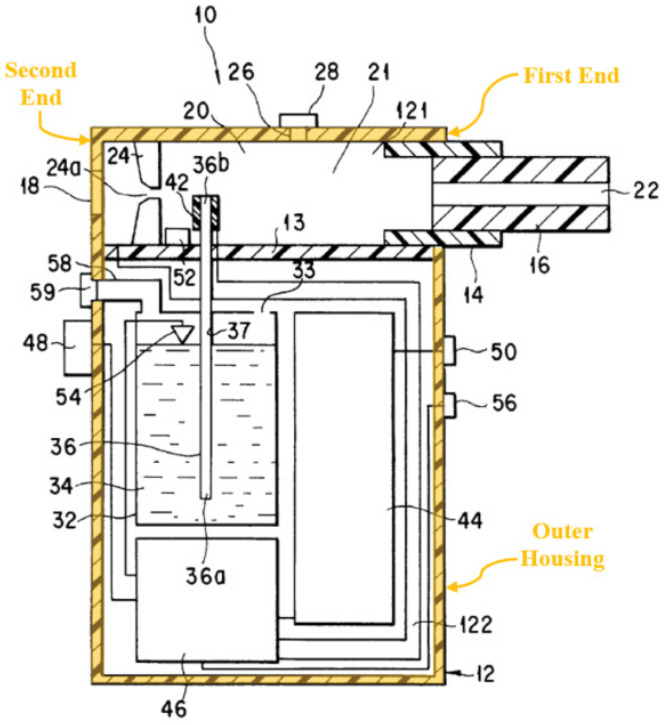


FIG. 1

EX1004, FIG. 1 (annotated).

139. Similarly, Takeuchi discloses that device 100, as shown in Figure 8, also includes a casing surrounding "the upper chamber 121 and the lower chamber 122," and "having two ends." EX1004, 8:59-62.

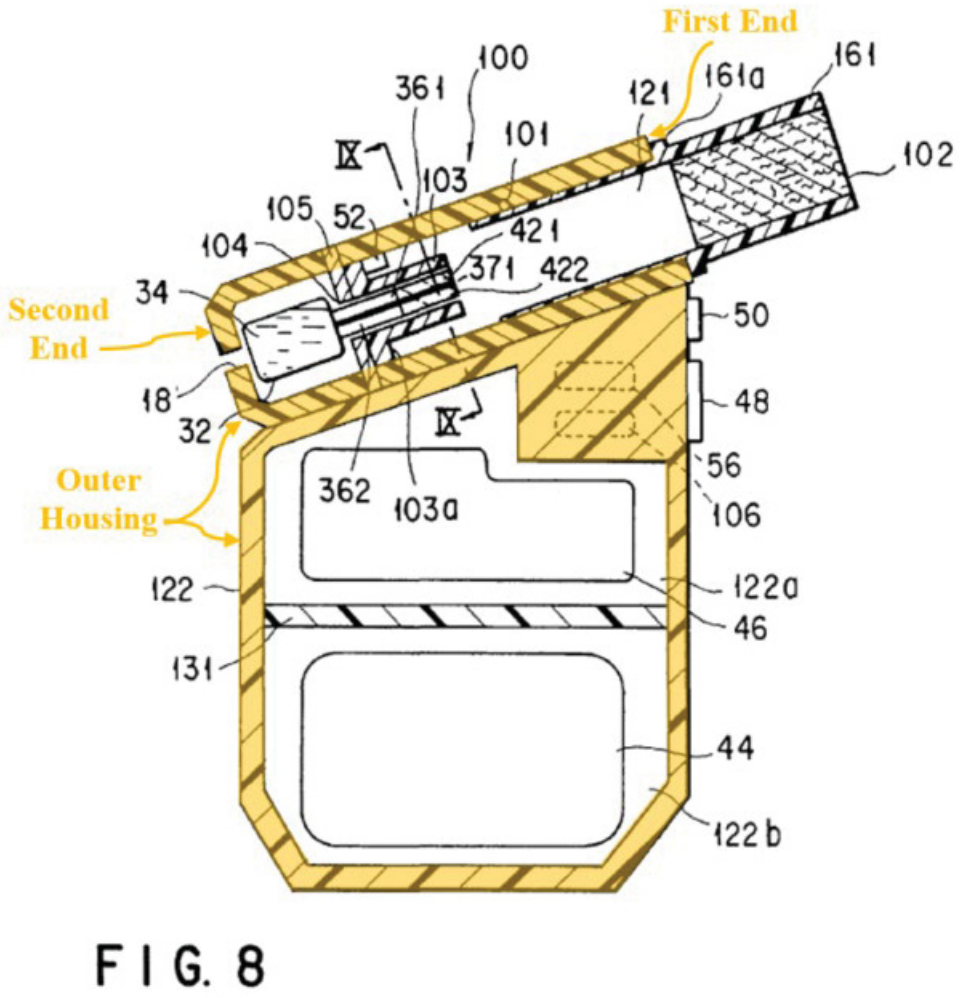


FIG. 8

EX1004, FIG. 8 (annotated).

140. To the extent that Patent Owner argues that device 100's casing does not constitute "an outer housing," because such casing is described as defining two "separate chamber[s] unlike the device shown in FIG. 1 wherein one casing is partitioned by the partition wall 13 into the two chambers" (EX1004, 8:59-62), such an argument would be misplaced. Indeed, even if the claimed "outer housing" did require a single unitary structure, which it does not, a POSA would have found

it obvious to implement device 100's casing as a single unitary structure. Takeuchi discloses that while some feature are described in different embodiments, "these features can be combined appropriately depending on the object of the flavor-generating device." EX1004, 11:1-6. And because a single structure casing is already disclosed in the Figure 1 embodiment, a POSA would have found it obvious to combine such a feature with the remaining features of Figure 8, at least because doing so would not impact the functionality of device 100.

141. Therefore, Takeuchi discloses an "an outer housing having two ends."

(c) a mouthpiece defined at one of the two ends;

142. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Additionally, Takeuchi discloses this limitation.

143. Indeed, Takeuchi discloses that devices 10 and 100 each include "a mouthpiece"—mouth piece 16 and mouthpiece 161, respectively. EX1004, 4:41-43, 9:9-12. As shown in Figures 1 and 8 below, mouth piece 16 and mouthpiece 161 are "defined at one of the two ends" of device 10 and device 100, respectively.

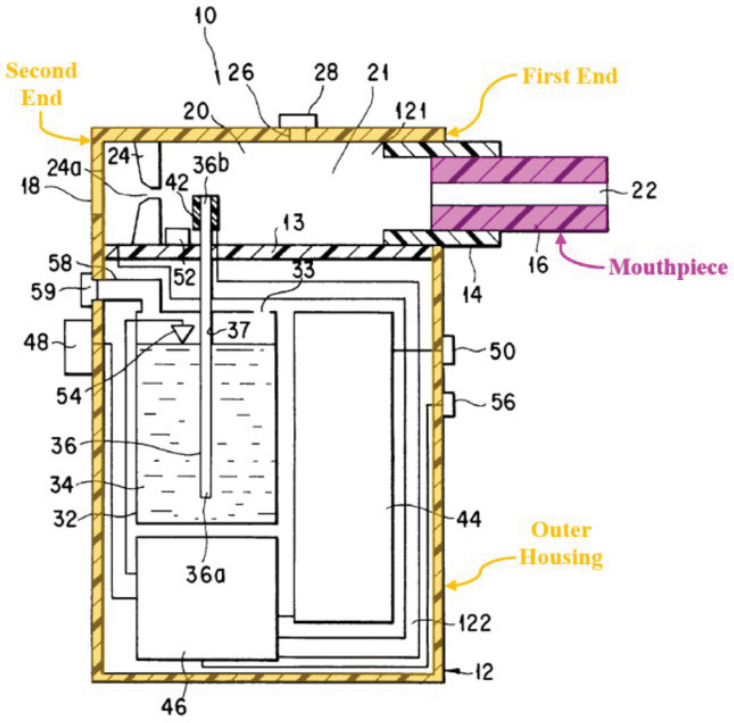


FIG. 1

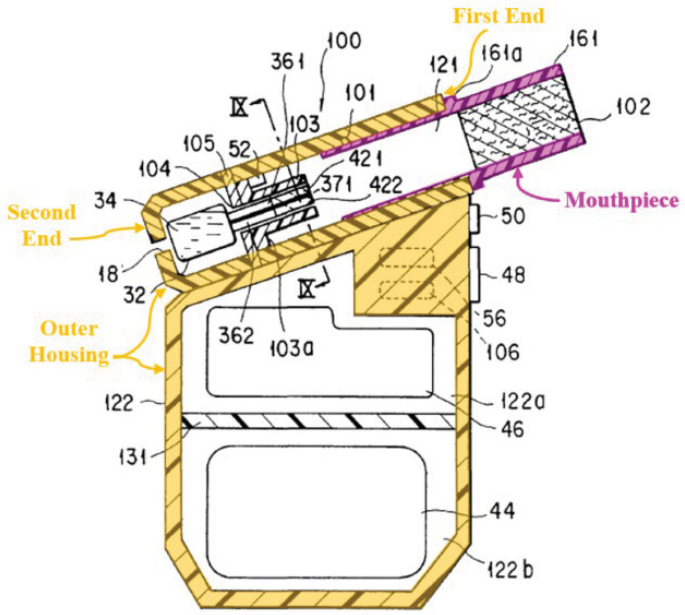


FIG. 8

EX1004, FIGS. 1, 8 (annotated).

144. To the extent that Patent Owner argues that mouth piece 16 and/or mouthpiece 161 do not satisfy this limitation, because they are disclosed as being "detachably inserted" into their respective casing (EX1004, 4:41-43, 9:9-12), such an argument would be flawed. Indeed, the '202 patent similarly discloses that "mouth-end piece 120, which is typically removable, can be maintained in place by friction fit, a threaded screw mechanism that cooperates with a complementing threaded mechanism that is secured to the outer container, or the like." EX1001, 24:16-20.

145. Therefore, Takeuchi discloses "a mouthpiece defined at one of the two ends."

(d) an electrical power source arranged within the outer housing;

146. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Additionally, Takeuchi discloses this limitation.

147. As discussed above, Takeuchi discloses that devices 10 and 100 each include "an electrical power source arranged within the outer housing": "electric power is supplied from a power source 44 detachably mounted within the lower chamber 122 of the casing 12." EX1004, 6:12-14; 9:1-5. Figures 1 and 8 below illustrate power source 44.

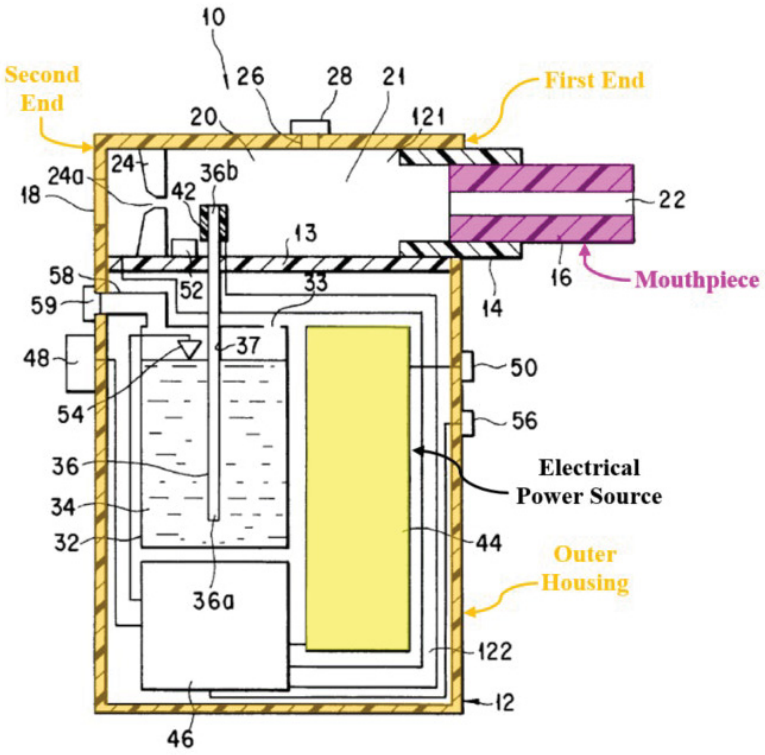

10
26
28
21
Second End
First End
20
121
24
36b
24a
18
42
22
13
58
52
33
16
Mouthpiece
59
14
48
37
50
54
56
36
Electrical Power Source
34
32
44
Outer Housing
36a
122
12
46

FIG. 1

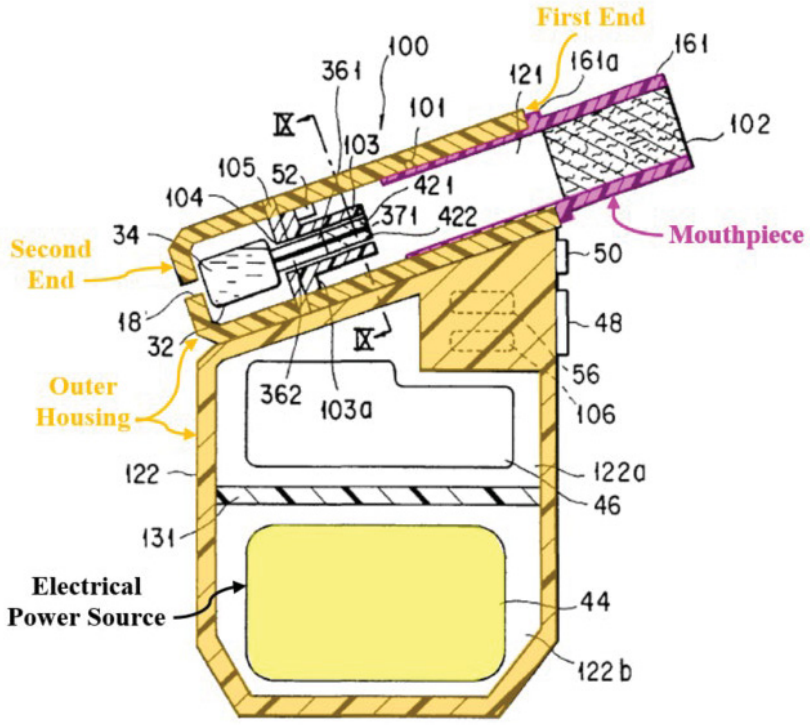


FIG. 8

EX1004, FIGS. 1, 8 (annotated).

148. Therefore, Takeuchi discloses "an electrical power source arranged within the outer housing."

(e) an electrical resistance heater positioned within the outer housing, the electrical resistance heater being configured for electrical connection with the electrical power source

149. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Additionally, Takeuchi discloses this limitation in two different ways.

150. First, Takeuchi discloses "an electrical resistance heater" in the form of heater 42 that "consists of a tubular body mounted to the capillary tube 36" (implemented in device 10), and plate-like heaters 421 and 422 "mounted to the plates 361 and 362" that define liquid passageway 371 (implemented in device 100). EX1004, 6:7-12, 9:29-34. Takeuchi describes that "[a]n electric power is supplied from a power source 44 detachably mounted within the lower chamber 122 of the casing 12 to the electric heater 42." EX1004, 6:12-14, 9:5-7 ("In the device shown in FIG. 8, the electrical connections are essentially the same as those in the device shown in FIG. 1").

151. Takeuchi's heater 42 and plate-like heaters 421 and 422 are highlighted in Figures 1 and 8 below, respectively, and are each clearly implemented "within the outer housing" of device 10 and device 100, respectively.

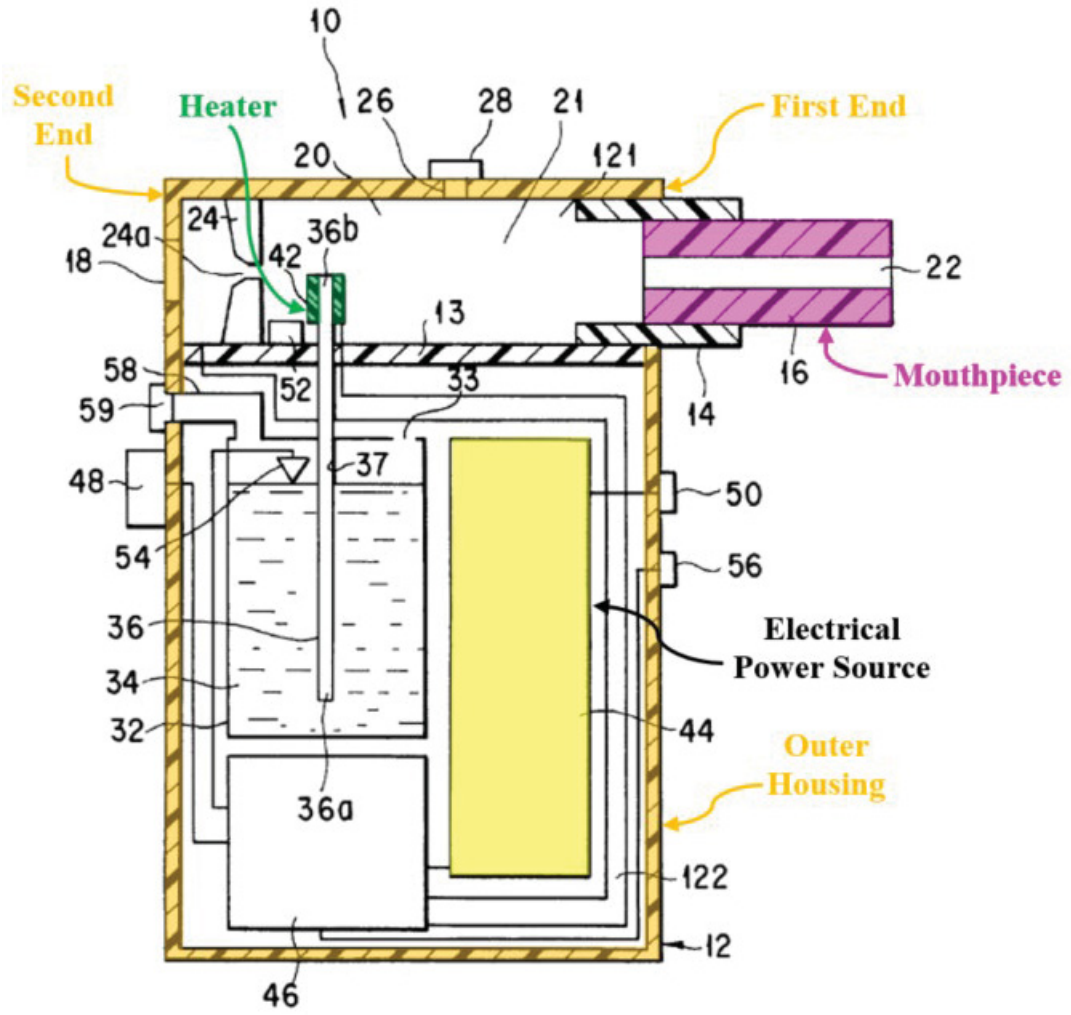

10
Second End
Heater
26
28
21
First End
20
121
24
24a
18
42
36b
22
13
58
52
33
16
Mouthpiece
59
14
48
37
50
54
56
36
Electrical Power Source
34
32
44
Outer Housing
36a
122
12
46

FIG. 1

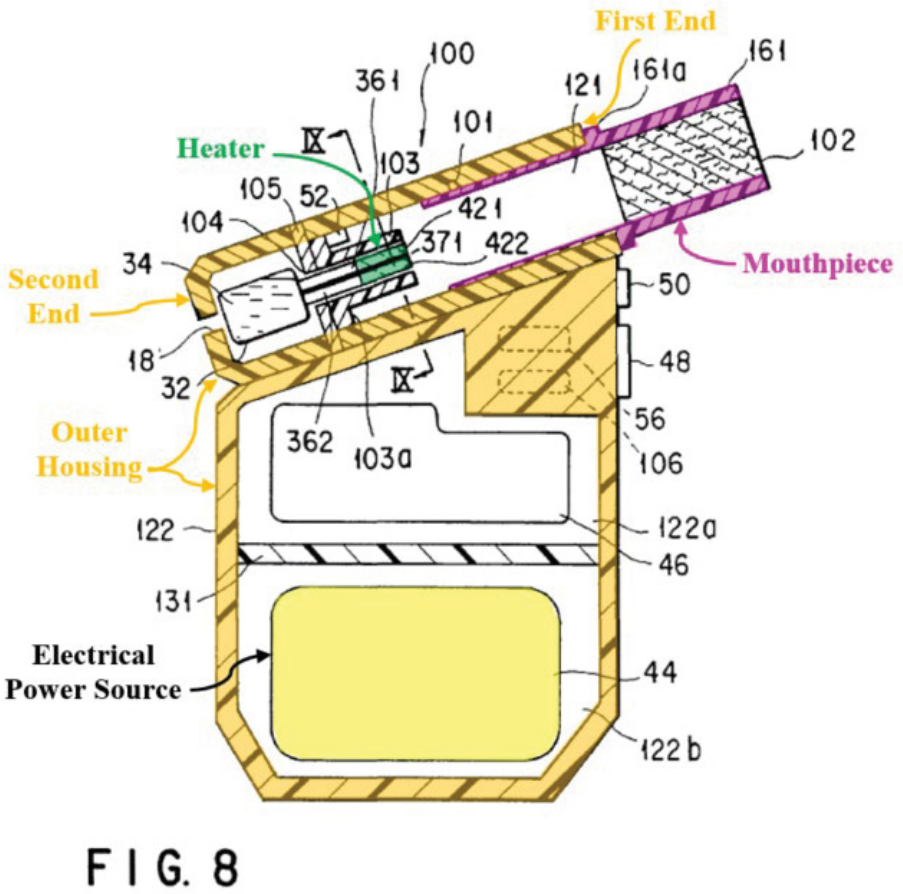


FIG. 8

EX1004, FIGS. 1, 8 (annotated).

152. Takeuchi also discloses the claimed "electrical resistance heater" to generate aerosols under a second interpretation in the form of the combination of both heater 42 and capillary tube 36. I understand that, Patent Owner took the position in a prior IPR that an atomizer includes "at least both the components that cause atomization and the mechanism that transfers liquid from the 'liquid-supply' to those components." EX1011, 18. After taking this position, Patent Owner then concluded that "Takeuchi teaches an atomizer including both … ('heater 42') and

… 'capillary tube 36.'" EX1011, 42. I will refer to this interpretation as "Patent Owner's Heater Interpretation" going forward.

153. Therefore, Takeuchi discloses "an electrical resistance heater positioned within the outer housing, the electrical resistance heater being configured for electrical connection with the electrical power source" under both of the above interpretations.

(f) a storage compartment defined within the outer housing, the storage compartment being configured for storage of a liquid aerosol-forming material and being arranged such that the liquid aerosol-forming material can be wicked into contact with the electrical resistance heater to volatilize the liquid aerosol-forming material;

154. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Additionally, Takeuchi discloses this claim element two different ways.

155. First, Takeuchi discloses the claimed "storage compartment being configured for storage of a liquid" in the form of both liquid container 32 and capillary tube 36 (implemented in device 10). Takeuchi also discloses a "storage compartment being configured for storage of a liquid" in the form of both liquid container 32 and plates 361 and 362 that define liquid passageway 371 (as implemented in device 100). In this case, any compartment that stores liquid would

correspond to the claimed "storage compartment." To the extent that the claimed "storage compartment" requires more than storing a liquid, such as, for example, being replenishable, Takeuchi's liquid container 32 "can be replenished" and/or is "exchangeable." EX1004, 7:18-30, 9:23-26, and claim 9.

156. Takeuchi explains that "liquid container 32 hous[es] a liquid flavor source 34 [and] is fixed within the lower chamber 122 of the casing 12." EX1004, 5:28-30, 9:23-26. Takeuchi similarly explains that liquid flavor source 34 is housed within capillary tube 36 after being brought into "capillary tube 36 by the capillary force of the capillary tube 36 as shown in FIG. 2A." EX1004, 7:57-59. Air passageway 371 (defined by plates 361 and 362) functions in a substantially similar manner to capillary tube 36, due to the similar capillary force that is exerted within air passageway 371. EX1004, 9:26-38.

157. I also understand that Patent Owner's expert admitted in a prior IPR that "a 'storage' body" is disclosed by a structure where "liquid is stored during the transport process," because "storage and transport are not mutually exclusive." EX1016, Sturges Declaration, ¶84. Patent Owner's expert's opinion in this prior IPR is consistent with my interpretation of Takeuchi here.

158. Figures 1 and 8 below show the claimed "storage compartment defined within the outer housing."

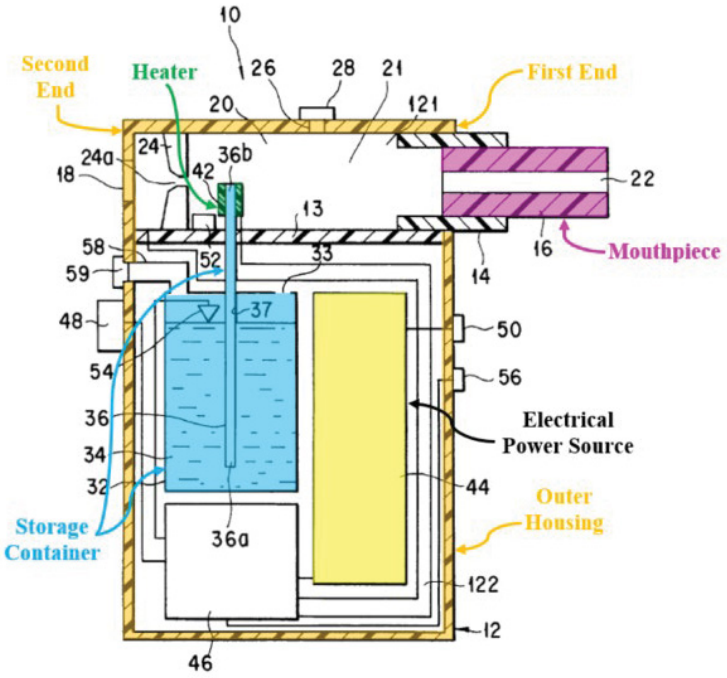


FIG. 1

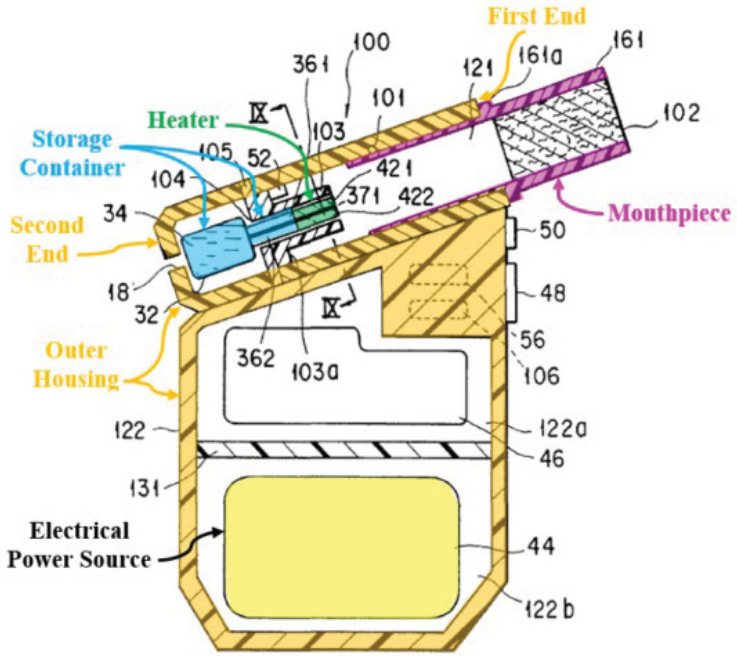


FIG. 8

EX1004, FIGS. 1, 8 (annotated).

159. As discussed above, Takeuchi also discloses that the liquid being stored is an "aerosol-forming material." In particular, Takeuchi describes that "in order to add smoke to the flavor, it is possible for the liquid flavor source 34 to contain a substance forming aerosol when heated." EX1004, 5:33-35, 10:5-13 ("an aerosol formation efficiency can be more enhanced when the liquid flavor source contains the aerosol generation material").

160. Takeuchi further discloses that "the liquid aerosol-forming material can be wicked into contact with the electrical resistance heater." As discussed in Section V.E.1 above, I am construing "wicked into contact with the electrical resistance heater" to mean "wicked into contact (1) with the heater, or (2) with an area in close proximity to, and exposed to the heat produced by, the heater." Takeuchi discloses that the liquid aerosol-forming material is "wicked into contact with the electrical resistance heater" under both of these alternatives.

161. Takeuchi explains that, in the Figure 1 embodiment, liquid flavor source 34 ("*liquid aerosol-forming material*") is "transported to the outlet port 36[b] of the capillary tube 36 by the capillary force of the capillary tube 36 as shown in FIG. 2A" (below). EX1004, 7:57-59 (emphasis added). Subsequently, "liquid flavor source 34 within the outlet port 36a is instantly gasified by the heat generated from the heater 42 as shown in FIG. 2B [(below)] so as to be supplied into the gas passageway 20." EX1004, 7:60-63.

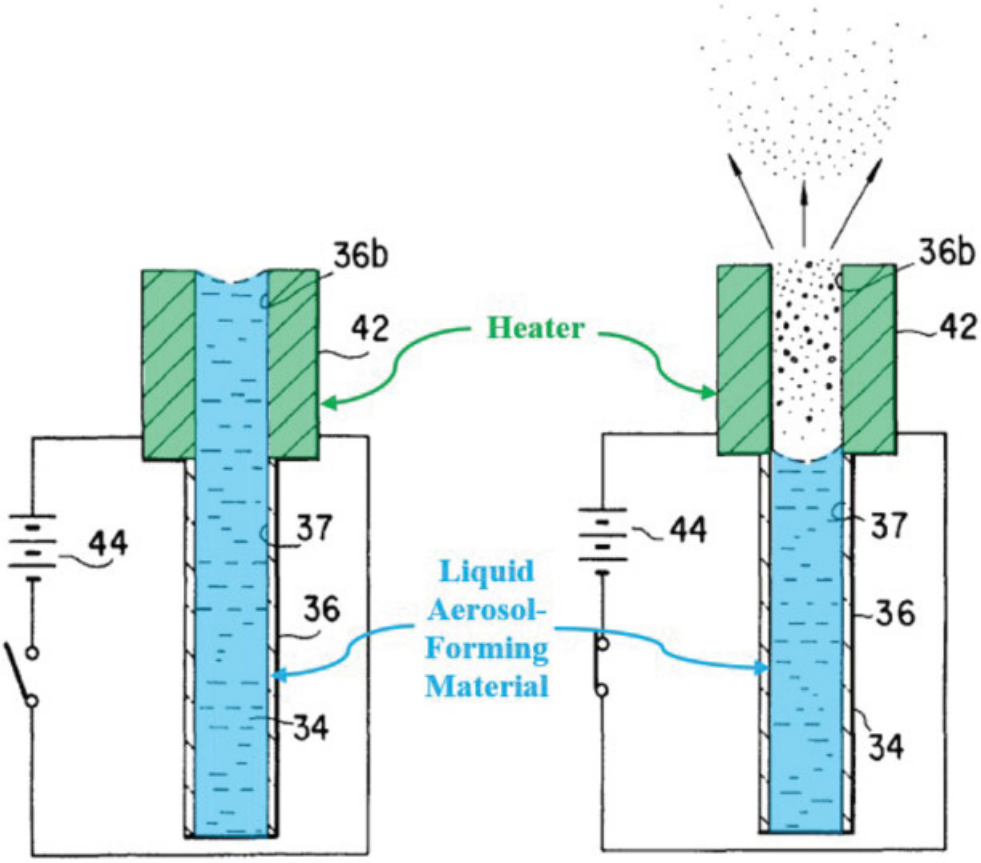
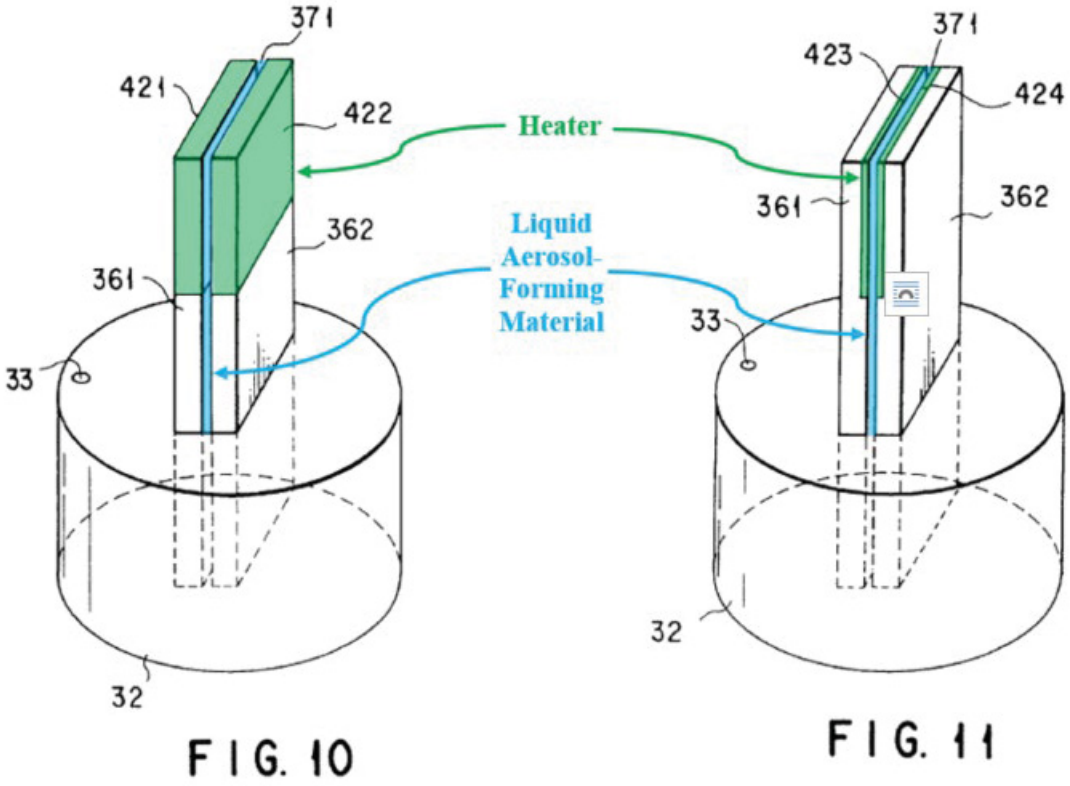


FIG. 2A FIG. 2B

EX1004, FIGS. 2A, 2B (annotated).

162. Takeuchi similarly explains that, in the Figure 8 embodiment, liquid flavor source 34 is transported up liquid passageway 371 by capillary action where "[t]he distal end portion (the outlet portion of the liquid flavor source) of the liquid passageway 371 is heated by plate-like heaters 421 and 422 mounted to the plate 361 and 362, respectively." EX1004, 9:26-38. Heaters 421 and 422 are configured "for heating and gasifying or evaporating the liquid transported from the liquid

container." EX1004, 2:13-16. Example interactions between liquid flavor source 34 and heaters 421 and 422 are illustrated in Figures 10 and 11 below.



EX1004, FIGS. 10, 11 (annotated).

163. A POSA would have understood that the capillary action that transports liquid flavor source 34 up both capillary tube 36 and liquid passageway 371 is an example of wicking. Again, in multiple prior IPRs, Patent Owner's experts provided a similar understanding of wicking. EX1010, ¶41 ("Capillary action was a well-known technique for moving fluids to a heater … Capillary action generally refers to the ability of liquid to flow in narrow spaces, such as that of a wick or a capillary tube, due to the greater adhesion of a liquid to a solid

surface than the internal cohesion of the liquid itself"); EX1015, Clemens Declaration, ¶78 ("This vaporization sets up a capillary action (i.e., wicking) which continues to feed more liquid from the '123 patent's wicking material to the heater…").

164. As illustrated in Figures 2A, 2B, 10, and 11 above, the capillary action (wicking) of capillary tube 36 and liquid passageway 371 results in liquid flavor source 34 (the claimed "liquid aerosol-forming material") being brought into contact both "(1) with the heater," and "(2) with an area in close proximity to, and exposed to the heat produced by, the heater."

165. As also discussed in detail for claim 3 below, Takeuchi discloses that the enclosure of capillary tube 36 and/or liquid passageway 371 formed by plates 361 and 362 can be filed with "bundled fibers." EX1004, 3:36-50. As I described above in Section VI.D.2, Takeuchi's capillary tube 36 and bundled fibers in pore structure 302, which further help transport liquid source 34 through capillary tube 36, would both be understood by a POSA as examples of wicking. For example, Whittemore describes various fibrous materials ("a thread, string, or stand of some suitable wick material") that are used to "wick" a liquid towards the heater. EX1030, 1:50-2:18. *See also* EX1040, U.S. Patent No. 7,992,626 to Tilton et al., 4:61-5:13 (describing various "porous media 32" that are "constructed so that [a]

working fluid is passively pumped, or wicked, into contact with [a] heat produce device 12 using surface tension forces").

166. Moreover, a POSA would have understood that heaters 42, 421, and 422 "gasifying" and/or "evaporating" liquid flavor source 34 discloses the claimed "electrical resistance heater to volatilize the liquid aerosol-forming material."

167. Therefore, Takeuchi discloses the claimed storage compartment under this first interpretation.

168. Takeuchi also discloses this limitation under the above "Patent Owner's Heater Interpretation". Under this interpretation, Takeuchi still discloses that liquid flavor source 34 ("liquid aerosol-forming material") stored within liquid container 32 ("storage compartment") contacts capillary tube 36, and the subsequent capillary force of capillary tube 36 results in liquid flavor source 34 being "wicked into contact" with heater 42 to become instantly gasified ("volatilize the liquid aerosol-forming material"). EX1004, FIG. 1, 7:57-63;

169. Therefore, Takeuchi also discloses the claimed storage compartment under Patent Owner's Heater Interpretation.

(g) an air passageway through at least a portion of the outer housing, the air passageway being arranged so that air drawn into the outer housing combines with volatilized liquid aerosol-forming material to produce an aerosol that can be drawn into the mouth of a user

of the electrically-powered, aerosol-generating smoking article through the mouthpiece; and

170. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date

171. In addition, Takeuchi discloses the claimed air passageway as shown in Figure 1 below.

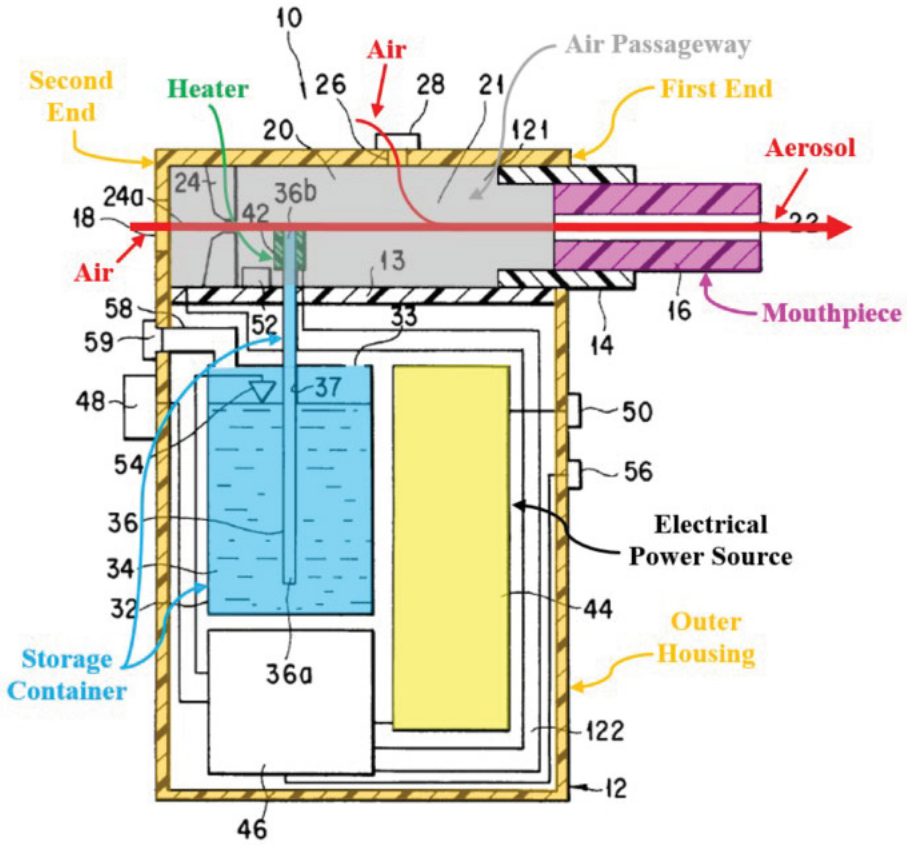
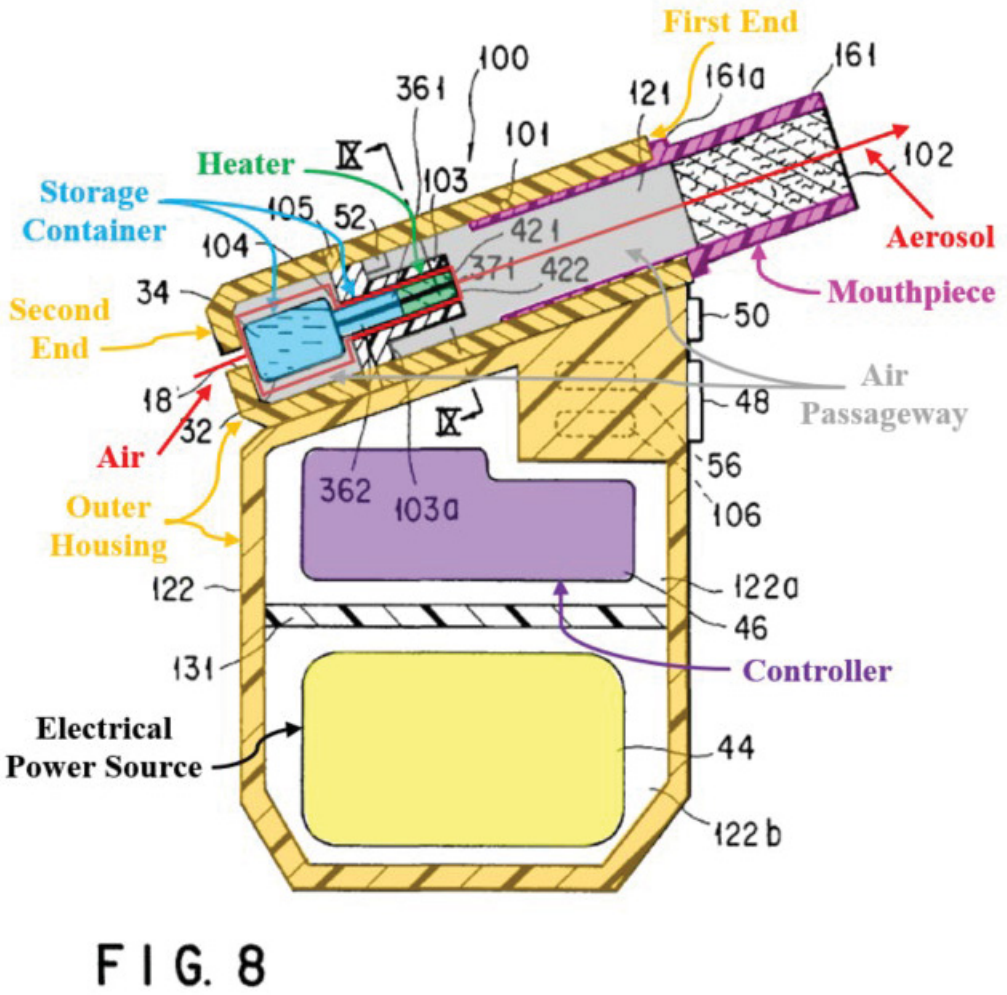


FIG. 1

EX1004, FIG. 1 (annotated).

172. As illustrated, Takeuchi discloses that gas passageway 20 ("an air passageway") extends "through at least a portion of the outer housing" (casing 12). Takeuchi also explains that "[t]he gasified flavor source is mixed with the main air introduced through the air intake port 18 and the squeeze hole 24a into a region around the outlet port 36a of the capillary tube 36 in accordance with the inhaling action of the user and, then, the mixture is transferred into the inhalation port 22." EX1004, 8:5-10, 5:1-11 (disclosing that gas passageway 20 can also include "an outer air introduction hole [] formed through the ceiling of the upper chamber 121 to permit the outer air to be introduced," and subsequently "mixed" with "[a] gas containing a flavor, which is formed by the heating of the liquid flavor source with a heater 42" before "flow[ing] to reach the inhalation port 22").

173. Takeuchi similarly discloses the claimed air passageways as shown in Figure 8 below.



EX1004, FIG. 8 (annotated).

174. As illustrated, Takeuchi discloses that air guiding path 104 ("an air passageway") extends "through at least a portion of the outer housing." EX1004, 9:59-66 ("air passageway (air guiding path) 104 guides, along it, the air introduced by the inhalation action of the user from the air intake port 18," such that "[t]he introduced air embraces or surrounds the gasified liquid flavor source at the outlet portion of the liquid passageway 371, and is directed toward the inhalation port by the air passageway 104"). Takeuchi also explains that "an aerosol formation

efficiency can be more enhanced when the liquid flavor source contains the aerosol generation material, since the mixing of the gasified flavor source with the air and the cooling of the gasified flavor source thereby can be simultaneously effected efficiently by means of the air stream passing through the air guiding path 104." EX1004, 10:5-13.

175. Therefore, both the Figure 1 and Figure 8 embodiments of Takeuchi disclose the recited "air passageway being arranged so that air drawn into the outer housing combines with volatilized liquid aerosol-forming material to produce an aerosol that can be drawn into the mouth of a user of the electrically-powered, aerosol-generating smoking article through the mouthpiece."

(h) a controller configured to activate current flow through the electrical resistance heater in response to a draw on the electrically-powered, aerosol-generating smoking article.

176. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Additionally, Takeuchi discloses this limitation.

177. Specifically, Takeuchi discloses that "the mouth piece 16 is taken in the mouth of the user for the inhaling action through the inhalation port 22. As a result, an inhaling action signal is transferred from the sensor 52 to the control circuit 46. Then, under the control of the control circuit 46, an electric power is supplied from the power source 44 to the heater 42 so as to turn the heater 42 on."

EX1004, 7:50-56, 6:55-62. Takeuchi's control circuit 46 can be implemented using various known components. EX1004, 6:59-62. Moreover, a POSA would have understood that Takeuchi's control circuit 46 and the claimed "*controller*" both perform the same function in substantially the same way (by receiving a signal from a sensor configured to sense a user's draw through the mouthpiece (*see* EX1001, claim 13)), and produce substantially the same results (control of current flow through an electrical resistance heater to generate an aerosol at the mouthpiece in response to the user's draw). Takeuchi's control circuit 46, corresponding to the claimed "controller," is highlighted in Figures 1 and 8 below.

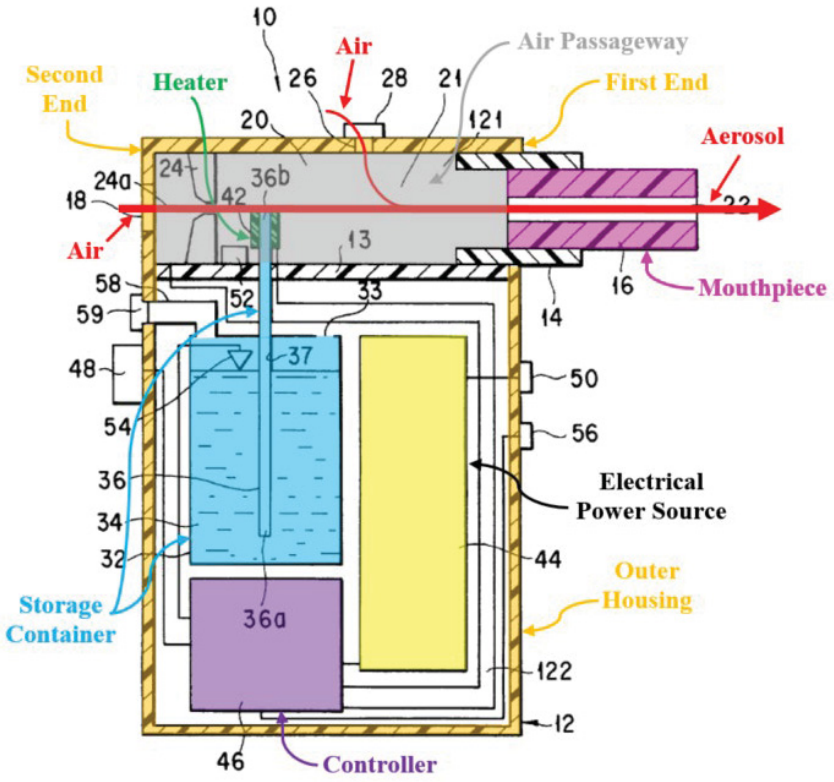


FIG. 1

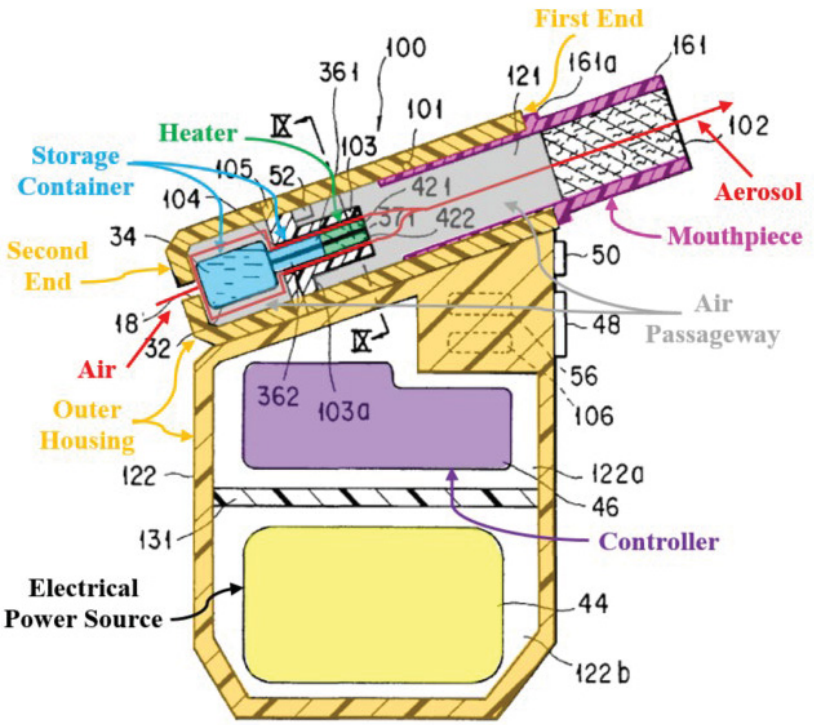


FIG. 8

EX1004, FIGS. 1, 8 (annotated).

178. Therefore, Takeuchi both discloses and renders obvious the claimed "controller."

2. Dependent Claim 3

179. Claim 3 depends from claim 1 and recites that "the storage compartment comprises a fibrous substrate." Takeuchi discloses this claim element.

180. In particular, Takeuchi discloses that a "pore structure [can be] filled in an enclosure" of capillary tube 36 and/or liquid passageway 371 formed by plates 361 and 362. EX1004, 3:62-42. "Representative examples of the structure

include open-cell foamed structure, and bundled fibers." EX1004, 3:47-50. "The intercommunicating pore structure [("fibrous substrate")] refers to a structure having intercommunicating voids or pores through which the liquid may be elevated from the inlet of the passageway which is in fluid communication with the liquid flavor source contained in the liquid container to the outlet of the passageway by the capillary force." EX1004, 3:42-47. As discussed above, both capillary tube 36 (implemented in device 10) and plates 361 and 362 that define liquid passageway 371 (as implemented in device 100) can constitute part of the claimed "storage compartment."

181. An example embodiment showing "intercommunicating pore structure 302 filled in an enclosure 301"—which "may be provided by a tube, or two plates arranged spaced apart from each other"—is shown in Figure 14 below. EX1004, 10:50-57.

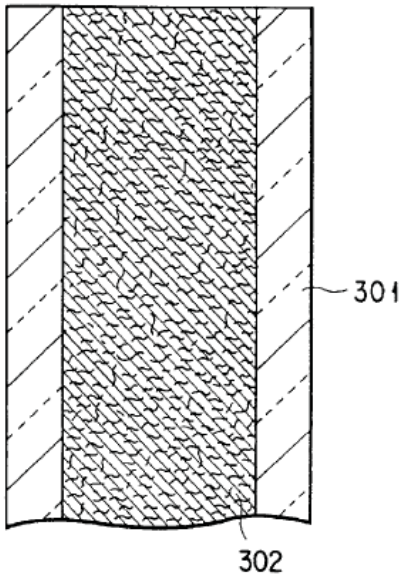


FIG. 14

EX1004, FIG. 14.

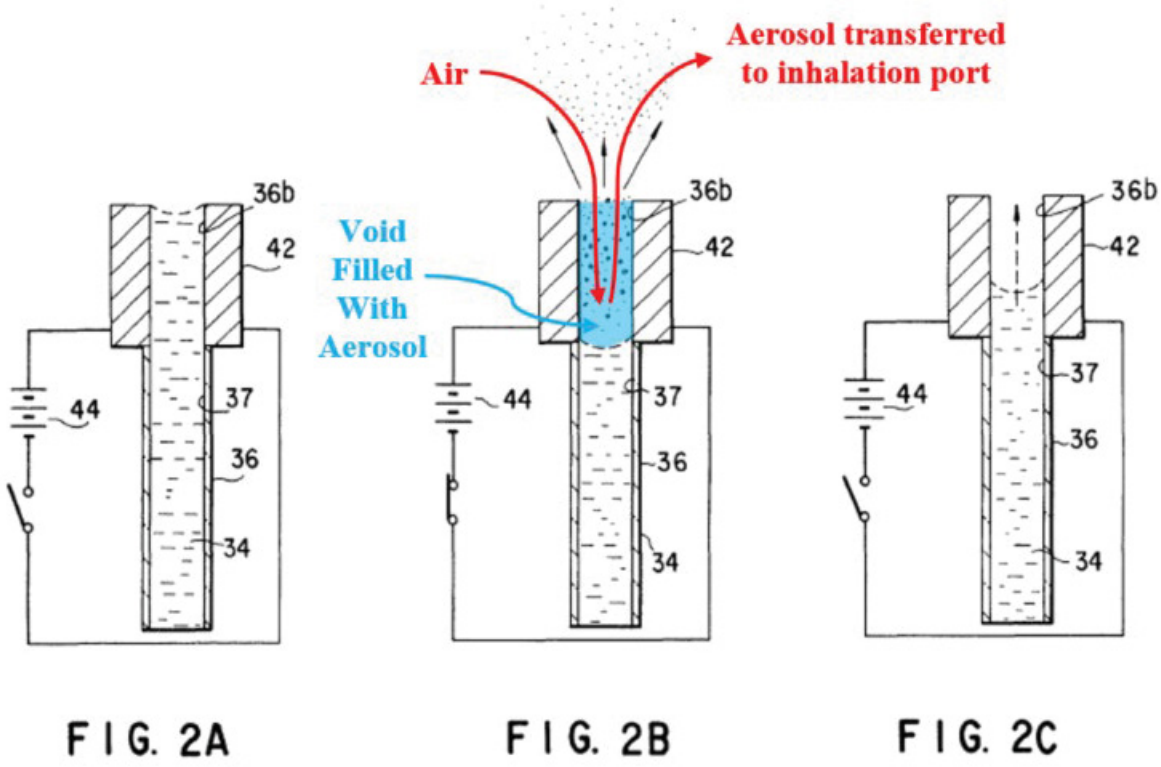
3. Dependent Claim 4

182. Claim 4 depends from claim 1 and recites that "the aerosol that is produced passes at least partially through the storage compartment before exiting through the mouthpiece." Takeuchi discloses this claim element.

183. More specifically, Takeuchi discloses that the mixture of the gasified flavor source and main air introduced through the air intake port 18 ("the aerosol that is produced") exists in "a region around the outlet port 36[b] of the capillary tube 36" before "the mixture is transferred into the inhalation port 22." EX1004, 8:5-10. Takeuchi discloses this claim element in at least two ways.

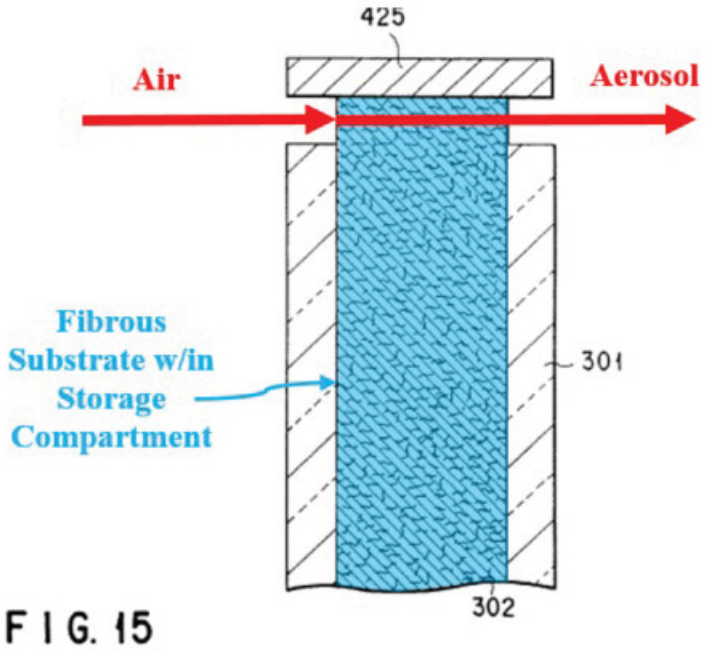
184. First, when "the liquid flavor source 34 within the outlet port 36[b of capillary tube 36] is instantly gasified by the heat generated from the heater 42," a void is left in the upper portion of capillary tube 36 (a portion of "the storage

compartment"). EX1004, 7:57-8:1; As shown in Figure 2B below, this void will be instantly filled by air flowing into the region and mixing with the gasified flavor source and air mixture, creating an aerosol (the claimed "the aerosol that is produced"). As shown in Figure 2C, the inhalation action by the user extracts this aerosol from the upper portion 36b of capillary tube 36, and the upper portion 36b again fills with the liquid flavor source 34 due to the capillary action of capillary tube 36. A POSA would readily understand from Figures 2A-2C that it is the mixing of air into the void formed in upper portion 36b that causes the aerosol to be transported towards the inhalation port. In other words, merely gasifying the liquid into an aerosol would not be sufficient, without the mixing of the passing air into the void region, to cause the aerosol to flow in the direction of the inhalation port.



EX1004, FIGS. 2A-2C (annotated).

185. Second, Takeuchi also discloses that in the embodiment of Figure 15 (shown below), "intercommunicating pore structure 302 may protrude from the enclosure 301," and "heater 425 can be provided on the protruded end of the intercommunicating pore structure 302." EX1004, 10:59-63. As discussed for claim 3 above, intercommunicating pore structure 302 represents "a fibrous substrate" comprised within "the storage compartment." In this embodiment, the gasified flavor source and air mixture ("the aerosol that is produced") "passes at least partially through the storage compartment [("intercommunicating pore structure 302")] before exiting through the mouthpiece."



EX1004, FIG. 15 (annotated).

186. Therefore, both of the above embodiments disclose claim 4.

4. Dependent Claim 5

187. Claim 5 depends from claim 1 and recites "the storage compartment is configured as a cartridge." As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Takeuchi also discloses this claim element.

188. As an initial matter, the '202 patent does not explicitly define a "cartridge." Beyond the "cartridge" needing to function as "the storage compartment" (as recited in claim 5), the only other guidance provided in the '202 patent as to the scope of the claimed "cartridge," is that it can be "removed from the outer housing of the device." EX1001, 5:57-61, 8:17-23 ("removable cartridge

enclosing the aerosol-forming material and tobacco material"). Takeuchi discloses such a removable cartridge for storing aerosol-forming material.

189. Specifically, Takeuchi discloses that liquid container 32 in the Figure 8 embodiment is "exchangeable." EX1004, 9:23-26, claim 9 ("wherein said liquid container is exchangeably mounted"). Therefore, a POSA would have understood that Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) discloses "wherein the storage compartment is configured as a cartridge," as recited in claim 5.

5. Dependent Claim 6

190. Claim 6 depends from claim 5 and further recites that "the cartridge is circumscribed with a wrapping material." As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. EX1001, 18:19-19:24, 25:27-37. Takeuchi also renders obvious this claim element.

191. While Takeuchi does not explicitly disclose that "the cartridge is circumscribed with a wrapping material," a POSA would have nonetheless found such an implementation to be obvious. Takeuchi discloses that its liquid flavor source 34 can be at least partially contained using various structures, including "bundled fibers." EX1004, 3:47-50. Additionally, Takeuchi discloses that the liquid passageway extending from liquid container 32 (at least in the Figure 8

embodiment) is "fluid-tightly sealed at its sides by a sealing material (not shown) such as a plastic film or a metal foil so as to prevent the leakage or the evaporation of the liquid flavor source from the sides of the plates." EX1004, 9:45-50. A POSA would understand Takeuchi's materials as being consistent with the "[e]xemplary wrapping materials, such as laminates of paper and metal foil, and papers" that are discussed by the '202 patent. EX1001, 18:37-49.

192. Therefore, based on the well-known use of various wrapping materials in smoking articles, and Takeuchi's disclosure of using bundled fibers, plastic film, and/or a metal foil to at least partially contain liquid flavor source 34, a POSA would have found it obvious to implement Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) being "circumscribed with a wrapping material."

6. Dependent Claim 7

193. Claim 7 depends from claim 5 and further recites that "the cartridge comprises a plastic material." Takeuchi renders obvious this claim element.

194. Takeuchi discloses that casing 12 can be made of "plastic." EX1004, 4:30-32. As discussed for claim 6, Takeuchi also discloses that the liquid passageway extending from liquid container 32 (at least in the Figure 8 embodiment) can include "a plastic film." EX1004, 9:45-50. Further, Takeuchi discloses that, in some embodiments, liquid container 32 is "formed of a transparent or translucent material." EX1004, 7:36-37. A POSA would have

understood that plastic is such a transparent or translucent material. Finally, as I explained above in Section VI.D.2, a POSA would have understood that plastic cartridges were well-known prior to the late 1990s. EX1022, 3:33-34; EX1031, 4:59-68, 11:51-53.

195. Therefore, based on the well-known use of plastic cartridges, and Takeuchi's disclosure of using plastic, or plastic-like materials for various components within devices 10 and 100, a POSA would have found it obvious to implement Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) comprising "a plastic material," as recited in claim 7.

7. Dependent Claim 8

196. Claim 8 depends from claim 1 and recites that "the storage compartment is configured as a container for holding liquid." Takeuchi discloses this claim element for the reasons discussed in Section VIII.A.1(f) above. EX1004, 5:28-30, 7:57-59, 9:23-38.

8. Dependent Claim 9

197. Claim 9 depends from claim 1 and recites that "the electrical resistance heater is arranged in contact with the storage compartment." Takeuchi discloses this claim element under both the first interpretation of "electrical resistance heater" and the Patent Owner's Heater Interpretation.

198. First, Takeuchi's heater 42 (implemented in device 10) and plate-like heaters 421 and 422 (implemented in device 100) each separately disclose the "electrical resistance heater" under the first interpretation. Takeuchi discloses "wherein the electrical resistance heater is arranged in contact with the storage compartment" under the first interpretation, because heater 42 "consists of a tubular body mounted to the capillary tube 36" (a portion of "the storage compartment"), and plate-like heaters 421 and 422 are "mounted to the plates 361 and 362" that define liquid passageway 371 (a portion of "the storage compartment"). EX1004, 6:7-12, 9:29-34. The fact that Takeuchi's heaters are "arranged in contact with the storage compartment" is also illustrated in annotated Figures 1, 2A-C, 8, 10, and 11 reproduced above.

199. Second, the combination of both heater 42 and capillary tube 36 discloses the "electrical resistance heater" under Patent Owner's Heater Interpretation. Takeuchi discloses "wherein the electrical resistance heater is arranged in contact with the storage compartment" under Patent Owner's Heater Interpretation, because capillary tube 36 "is inserted within the liquid container." EX1004, 5:47-49; As shown in Figure 1, when inserted in liquid container 32, capillary tub 36 is "in contact" with at least the top edge of liquid container 32, such that capillary tube 36 remains fixed in place during use.

9. Dependent Claim 10

200. Claim 10 depends from claim 1 and recites that "the electrical resistance heater is arranged proximate to an absorbent wicking material configured for transferring the liquid aerosol-forming material to the electrical resistance heater." Takeuchi discloses this claim element.

201. As discussed for claim 3 above, Takeuchi discloses that a "pore structure [can be] filled in an enclosure" of capillary tube 36 and/or liquid passageway 371 formed by plates 361 and 362. EX1004, 3:62-42. And for the same reasons discussed for claim 3, a POSA would have also understood that this pore structure represents "an absorbent wicking material configured for transferring the liquid aerosol to the electrical resistance heater." *See* EX1004, 3:42-47. When pore structure 302 is implemented within capillary tube 36 and/or liquid passageway 371 formed by plates 361 and 362, as shown in Figures 14 and 15, pore structure 302 would be "arranged proximate to" the electrical resistance heater for the same reasons as discussed for claim 9 above. *See* EX1004, 6:7-12, 9:29-34. Indeed, pore structure 302 would be implemented throughout the length of capillary tube 36 and/or liquid passageway 371, and would thus either contact or be in proximity to heater 42 and heater plates 421 and 422.

10. Dependent Claim 11

202. Claim 11 depends from claim 1 and recites that "at least a portion of the electrical resistance heater extends into the storage compartment." Takeuchi discloses this claim element under both the first interpretation of "electrical resistance heater" discussed above and under the Patent Owner's Heater Interpretation.

203. As discussed above, Takeuchi's heater 42 (implemented in device 10) and plate-like heaters 421 and 422 (implemented in device 100) each separately disclose the "electrical resistance heater" under the first interpretation. Takeuchi discloses "wherein at least a portion of the electrical resistance heater extends into the storage compartment" under the first interpretation, because Takeuchi discloses that in some embodiments, heater 42 can be implemented within capillary tube 36, and plate-like heaters 421 and 422 can be similarly implemented between plates 361 and 362 that define liquid passageway 371. For example, Takeuchi discloses that heater 42 can be implemented: (i) as "a rod-like heater 74 [that] is inserted into the outlet port 36[b] of the capillary tube;" or (ii) as "a plate-like heater 76 [that] is inserted into the outlet port 36[b] of capillary tub 36." EX1004, 8:22-26. These example implementations for heater 42 are shown in Figures 4 and 5 below.

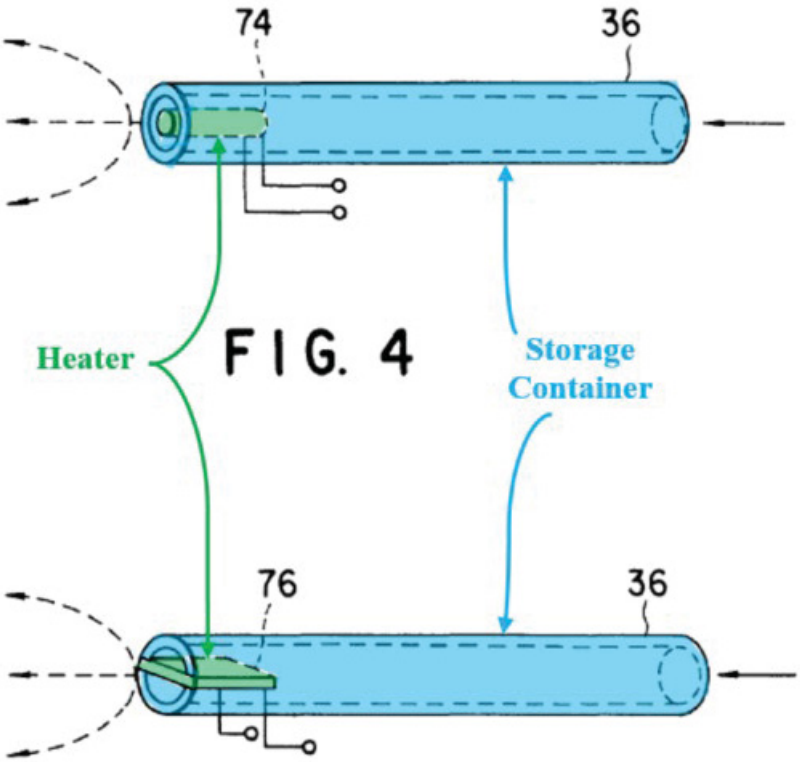


FIG. 4

FIG. 5

EX1004, FIGS. 4, 5 (annotated).

204. Similarly, Takeuchi discloses that plate-like heaters 421 and 422 can be "provided in the opposing surface regions of the plates 361 and 362 defining the liquid passageways therebetween." EX1004, 10:24-27. This example implementation for plate-like heaters 421 and 422 is shown in Figure 11 below.

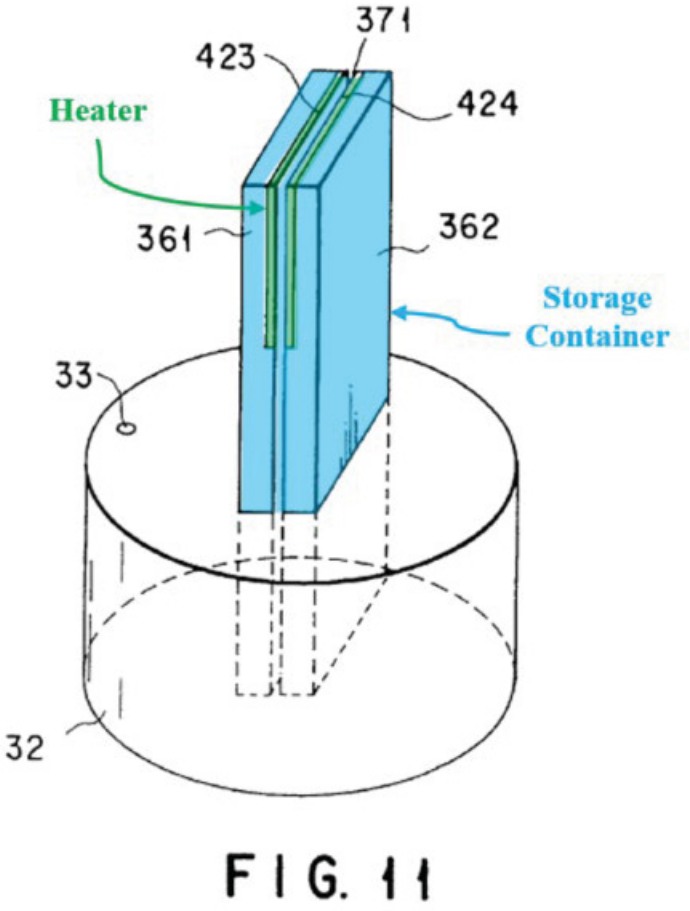


FIG. 11

EX1004, FIG. 11 (annotated).

205. A discussed above, under the first interpretation, capillary tube 36 represents a portion of "the storage compartment" in the Figure 1 embodiment, and plates 361 and 362 that define liquid passageway 371 represent a portion of "the storage compartment" in the Figure 8 embodiment. Therefore, Takeuchi discloses that both heater 42 and plate-like heaters 421 and 422 can "extend[] into the storage compartment" under the first interpretation of "electrical resistance heater."

206. As also discussed above, the combination of both heater 42 and capillary tube 36 discloses the "electrical resistance heater" under Patent Owner's Heater Interpretation. Takeuchi also discloses claim 11 under Patent Owner's Heater Interpretation, because capillary tube 36 "extends into the storage compartment" (liquid container 32) as show in Figure 1.

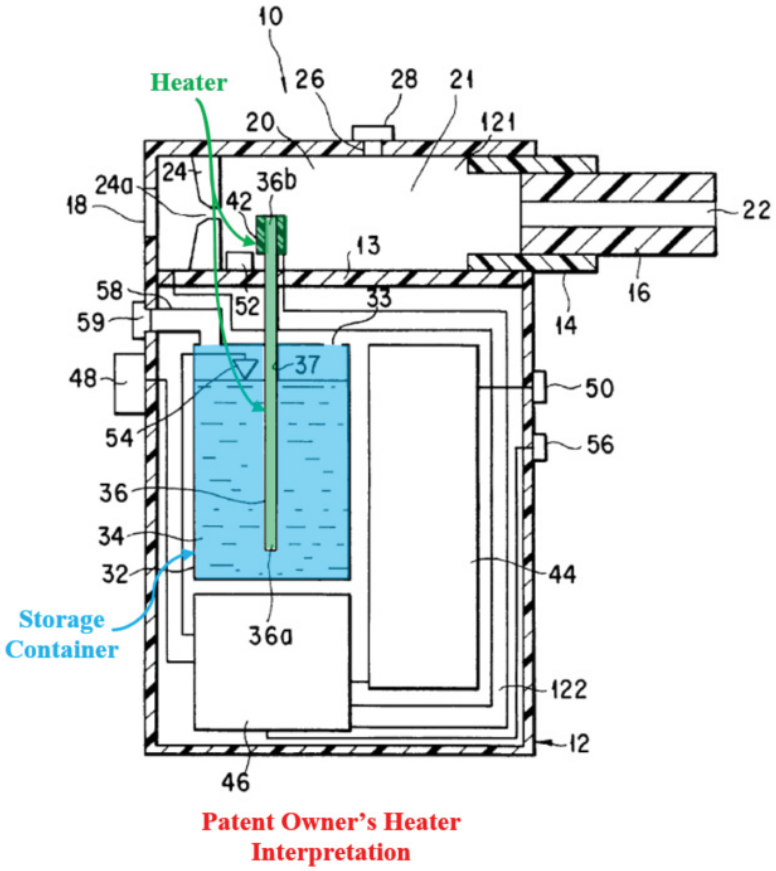


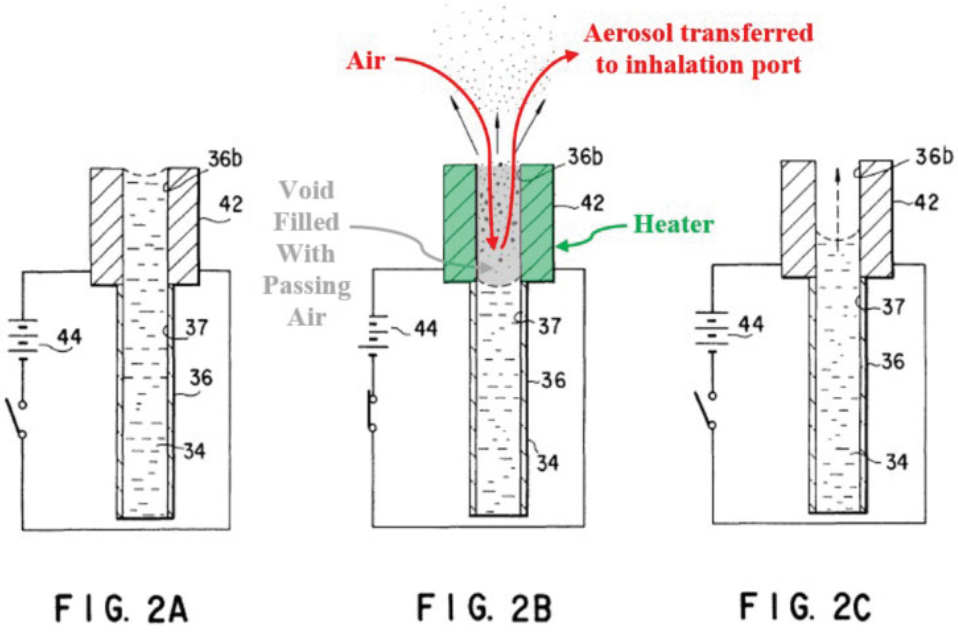
FIG. 1

EX1004, FIG. 1 (annotated).

11. Dependent Claim 12

207. Claim 12 depends from claim 1 and recites that "the electrical resistance heater is configured to allow airflow therethrough." Takeuchi discloses this claim element.

208. As discussed for claim 4, when "the liquid flavor source 34 within the outlet port 36[b of capillary tube 36] is instantly gasified by the heat generated from the heater 42," a void is left in the upper portion of capillary tube 36, which exists within heater 42. EX1004, 7:57-8:1. As also discussed for claim 4 (and shown in Figure 2B below), this void is filled by the passing gasified flavor source and air mixture at least until the upper portion of capillary tube 36 is filled with liquid flavor source 34 again by capillary action (shown in Figure 2C below).



EX1004, FIGS. 2A-2C (annotated).

209. This same passing gasified flavor source and air mixture also fills the void between plate-like heaters 421 and 422 as shown in Figures 10 and 11 below.

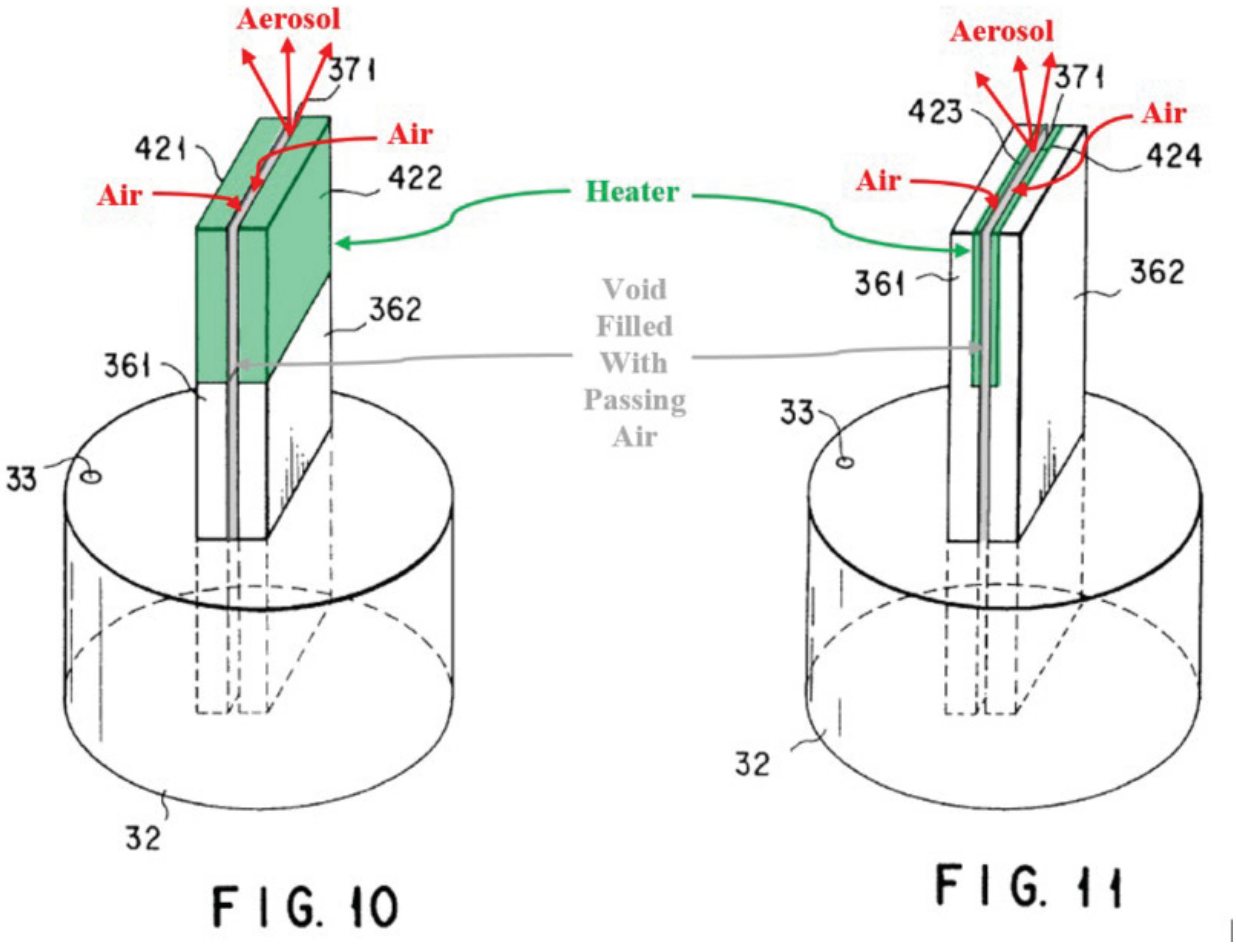


FIG. 10 FIG. 11

EX1004, FIGS. 10-11 (annotated).

210. A POSA would have understood that the gasified flavor source and air mixture filling the void within heater 42, as well as the void between plate-like heaters 421 and 422 discloses the claimed "wherein the electrical resistance heater is configured to allow airflow therethrough."

12. Dependent Claim 13

211. Claim 13 depends from claim 1 and recites "a sensor adapted for sensing the draw by a user on the electrically-powered, aerosol-generating smoking article." Takeuchi discloses this claim element because Takeuchi discloses "sensor 52 for detecting the inhaling action of the user." EX1004, 6:46-54, 2:29-33, 6:23-28, FIG. 1.

13. Dependent Claim 14

212. Claim 14 depends from claim 1 and recites that "the controller is configured to regulate the current flow through the electrical resistance heater during the draw on the electrically-powered, aerosol-generating smoking article." Takeuchi discloses this claim element for at least the reasons discussed in Section VIII.A.1(h) above.

213. Even if something more than turning on the heater in response to a user's draw is required to satisfy claim 14, which it is not, Takeuchi would still both disclose and render obvious this claim. For example, Takeuchi discloses that "the heater can be controlled on the basis of a signal from a sensor for detecting the inhaling action of the user, with the result that the flavor can be supplied to the user with a high stability." EX1004, 2:29-34. A POSA would have understood "high stability" in this context to mean something more than just turning on the heater—e.g., the ability to control the heater such that it remains stable not just at the outset

of the user's draw, but during the user's draw as well. For example, Hon describes, in Figure 12, a power control circuit where low voltage detecting element U2 senses a low voltage from the lithium cell battery DC and turns off field effect power transistor (FET) U1, thereby achieving a circuit with "high stability" despite changes in the voltage of lithium cell battery DC through use of the device. EX1029, 10:7-14.

214. This understanding is reinforced by the fact that Takeuchi discloses that "[t]he signal processing and control are performed within the control circuit 46 in accordance with, for example, a known analog control, a two-position control or a combination thereof." EX1004, 6:59-62. A POSA would have understood that known analog circuits in the late 1990s could do more than just turn on a power supply, and instead had the capability to sense current and voltage (via some form of feedback) and regulate the power supply accordingly. For example, Howell discloses operating a power supply to a heater "continuously at approximately 2.5 Volts and 0.8 Amps," which is "close to the minimal power requirements for volatizing propylene glycol at a rate of 1.5 milligrams per second." EX1027, 5:47-55. Howell also describes that the power to a heater may be supplied "intermittently," based on a signal from the puff-actuated sensor, or based on a timer. *Id*., 9:66-10:14. Thus, a POSA would have known that a control circuit, such

as the one disclosed by Takeuchi, is capable of regulating the current flow to a heater to ensure continuous optimal performance by the heater.

215. Therefore, a POSA would have at least found it obvious that Takeuchi's control circuit 46 had the capability to both turn on heater 42 in response to a user's draw, and "regulate the current flow through the electrical resistance heater during the draw," as recited in claim 14.

14. Dependent Claim 15

216. Claim 15 depends from claim 1 and recites "an end cap defined at a second of the two ends." As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Takeuchi also discloses this claim element for at least two reasons.

217. First, Takeuchi discloses that "a removable cap 59 is provided in the exposed end portion of the pouring port 58." EX1004, 7:22-23. Second, Takeuchi discloses that "[i]t is also possible to arrange an adjusting ring (not shown) having a plurality of openings in a manner to surround the air intake port 18 of the casing 12," such that "the air flow rate into the gas passageway 20 can be adjusted by adjusting the position of the adjusting ring relative to the air intake port 18." EX1004, 4:55-60. As shown in annotated Figure 1 (reproduced above for claim 1),

both removable cap 59 and air intake port 18 (to which the adjusting ring would surround) are implemented "at a second of the two ends" of device 10.

218. Therefore, both Takeuchi's removable cap 59 and adjusting ring disclose the claimed "end cap defined at a second of the two ends."

15. Independent Claim 18

219. Takeuchi discloses claim 18 for the same reasons discussed above for claim 1. Claim 18 is nearly identical to claim 1, but with three minor differences. First, claim 18 omits the "mouthpiece" limitation recited in claim 1. Second, claim 18 recites "a liquid storage" as opposed to the "storage compartment" recited in claim 1. Third, claim 18 recites "a puff-actuated controller" as opposed to just "a controller," as recited in claim 1. None of these differences impact my analysis set forth above for claim 1.

220. Again, even if "regulat[ing] current flow through the electrical resistance heater in response to a draw …" (as recited in claim 18) was argued to be different than "activat[ing] current flow through the electrical resistance heater in response to a draw" (as recited in claim 1), Takeuchi would still both disclose and render obvious this limitation for the same reasons discussed above for claim 14.

221. Therefore, Takeuchi both discloses and renders obvious claim 18 for the same reasons discussed above for claims 1 and 14.

16. Dependent Claim 19

222. Claim 19 depends from claim 18 and recites that "the puff-actuated controller comprises a sensor that senses the draw on the electrically-powered, aerosol-generating smoking article." Takeuchi discloses claim 19 for the same reasons as discussed above for claim 13.

17. Dependent Claim 20

223. Claim 20 depends from claim 18 and recites that "the puff-actuated controller comprises additional control circuitry." Takeuchi discloses this claim element.

224. As an initial matter, the '202 patent does not provide any guidance as to what is meant by "the puff-actuated controller comprises additional control circuitry." Nonetheless, Takeuchi discloses that "[t]he signal processing and control are performed within the control circuit 46 in accordance with, for example, a known analog control, a two-position control or a combination thereof." EX1004, 6:59-62. Thus, a POSA would have understood that control circuit 46 ("the puff-actuated controller") can include several different control circuitry components, any number of which could represent the claimed "additional control circuitry." Additionally, Takeuchi discloses that switch 48 is electrically coupled to control circuit 46, and thus also constitutes "additional

control circuitry." EX1004, 25-45 ("a switch 48 for the heater 42 which can independently turn the heater on").

18. Dependent Claim 21

225. Claim 21 depends from claim 18 and recites "a mouthpiece attached to the outer housing." Takeuchi discloses claim 21 for the same reasons as discussed above for claim 1. In addition, Takeuchi discloses that "mouth piece 16 having an inhalation port 22 through which a user inhales a flavor is detachably inserted into the holder 14." EX1004, 4:41-43, 9:9-11 (disclosing same for mouthpiece 161).

19. Dependent Claim 22

226. Claim 22 depends from claim 18 and recites that "the liquid storage is configured as a container in which the liquid aerosol-forming material can be stored." Takeuchi discloses claim 22 for the same reasons as discussed above for claim 8.

20. Dependent Claim 23

227. Claim 23 depends from claim 18 and recites that "the liquid storage is configured as an absorbent fibrous material." Takeuchi discloses claim 23 for the same reasons as discussed above for claim 3.

21. Dependent Claim 24

228. Claim 24 depends from claim 18 and recites that "the aerosol that is produced passes at least partially through the storage before exiting through the

electrically-powered, aerosol-generating smoking article." Takeuchi discloses claim 24 for the same reasons as discussed above for claim 4.

22. Dependent Claim 25

229. Claim 25 depends from claim 18 and recites that "the electrical resistance heater is arranged in contact with the liquid storage." Takeuchi discloses claim 25 for the same reasons as discussed above for claim 9.

23. Dependent Claim 26

230. Claim 26 depends from claim 18 and recites that "the electrical resistance heater is arranged proximate to an absorbent wicking material configured for transferring the liquid aerosol-forming material to the electrical resistance heater." Takeuchi discloses claim 26 for the same reasons as discussed above for claim 10.

24. Dependent Claim 27

231. Claim 27 depends from claim 18 and recites that "at least a portion of the electrical resistance heater extends into the liquid storage." Takeuchi discloses claim 27 for the same reasons as discussed above for claim 11.

25. Dependent Claim 28

232. Claim 28 depends from claim 18 and recites that "the outer housing comprises a mouthpiece defined at a first end thereof and an end cap defined at a second end thereof." Takeuchi discloses claim 28 for the same reasons as discussed above for claim 12.

26. Dependent Claim 29

233. Claim 28 depends from claim 18 and recites that "the electrically-powered, aerosol-generating smoking article is generally rod-shaped." Takeuchi discloses claim 29 for the same reasons as discussed above for limitation **[1.b]** and claim 15.

B. Ground 2: The combination of Takeuchi and Pienemann renders obvious claims 6, 7, 14, 15, and 18-29.

1. A POSA would have been motivated to combine Takeuchi and Pienemann.

234. A POSA would have been motivated to make three modifications, individually or collectively, to Takeuchi's flavor-generating devices 10 and 100.

235. First, a POSA would have been motivated to implement Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) using a wrapper material, as taught by Pienemann. Second, a POSA would have been motivated to implement Takeuchi's control circuit 46 having additional control/regulating capabilities, as also taught by Pienemann. Third, a POSA would have been motivated to modify Takeuchi's flavor-generating devices 10 and 100 to incorporate a removable end cap, as further taught by Pienemann.

(a) Motivation to implement Takeuchi's liquid container using Pienemann's wrapper material

236. As discussed above, Takeuchi discloses that its flavor-generating devices 10 and 100 each include "liquid container 32 [for] housing a liquid flavor

source 34." EX1004, 5:28-30, 9:23-26. Takeuchi also discloses that liquid container 32 (at least as implemented in device 100 (the Figure 8 embodiment)) is "exchangeable." EX1004, 9:23-26, claim 9 ("wherein said liquid container is exchangeably mounted"). While Takeuchi explicitly discloses certain types of materials that can be used to produce other components within devices 10 and 100—e.g., casing 12 (plastic) and pore structure 302 (bundled fibers) (*see* claims 6 and 7 in Ground 1 above)—Takeuchi does not explicitly disclose the types of materials that can be used to implement liquid container 32. A POSA would have thus looked to the prior art for guidance on what types of materials could be used for liquid container 32. Pienemann is such a prior art reference.

237. Pienemann discloses a "system for supplying an inhalable aerosol [that] contains a substrate portion (1") and an inhaling device." EX1006, Abstract. Pienemann discloses that substrate portion 1 contains an "aerosol-forming material within a wrapper." EX1006, 3:10-14, Abstract. Pienemann explains that the wrapper "may consist of paper … or a plastic foil also made conductive by additives" (EX1006, 6:10-15). Pienemann also explains that substrate portion 1 is configured to be inserted (and removed) from a housing of the inhaling device. EX1006, 9:4-5 ("The cavity inside the housing 20 and the contacts 21 and 22 form a receiving device for holding the substrate portion"), 9:26-29 ("After use, the substrate portion 1 with the mouthpiece 10 is removed from the smoking device

and disposed of"), 10:20-28 ("A pivoting flap 52 … serves to insert a substrate portion 1"). A POSA would have therefore recognized that Pienemann (through its disclosure of a removable substrate having a wrapper) fills in the missing details about how to implement Takeuchi's liquid container 32.

238. Based on the teachings of Pienemann, a POSA would have been motivated to implement Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) using a wrapper material. Takeuchi's liquid container 32 and Pienemann's substrate portion 1 are both disclosed as being exchangeable or removable, and are both designed for use within an aerosol-generating inhaling device. *Compare* EX1004, 1:4-9, 4:26-28, 5:33-35, 8:49-51, 10:5-13 *with* EX1006, Abstract, 3:10-14.

239. Thus, a POSA would have recognized that Pienemann's teachings are applicable to Takeuchi, and that implementing Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) using a wrapper material would have required minimal modifications. In the combined system, Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) would be implemented using Pienemann's wrapper material—e.g., formed from either a paper wrapper or plastic wrapper.

240. Additionally, a POSA would have understood that implementing Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) using a wrapper material would have the added benefit of being able to offer the user a

multitude of choices to fit their personal desires. For example, a user could chose the type of liquid container based on their preferences relating to mouthfeel, taste, reduced waste from liquid container disposal, longevity of the liquid container, and more.

241. A POSA would not have experienced any unreasonable technical hurdles in implementing these modifications. Additionally, a POSA would have understood that implementing Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) using a wrapper material would merely amount to combining prior art elements (Takeuchi's liquid container 32 and Pienemann's wrapping material surrounding substrate portion 1) according to known methods (implementing Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) using a wrapper material consisting of either paper or plastic) to yield predictable results (e.g., a container having the ability to house an aerosol-generating material, and being configured to be removably inserted from in an inhaling device).

(b) Motivation to implement Takeuchi's control circuit having additional control/regulating capabilities

242. As also discussed above, Takeuchi discloses that its flavor-generating devices 10 and 100 each include control circuit 46 that controls "an electric power [] supplied from the power source 44 to the heater 42" in response to an "inhaling action through the inhalation port 22." EX1004, 7:50-56, 6:55-62. Takeuchi also discloses that the purpose of control circuit 46 is to ensure that flavor is "supplied

to the user with a high stability." EX1004, 2:29-34. Takeuchi explains that "[t]he signal processing and control are performed within the control circuit 46 in accordance with, for example, a known analog control, a two-position control or a combination thereof." EX1004, 6:59-62. However, Takeuchi does not explicitly disclose the types of control operations that can be carried out by control circuit 46 during a user's inhalation in order to ensure a high stability flavor delivery. A POSA would have thus looked to the prior art for guidance on what specific types of control operations could be performed by control circuit 46 to achieve the desired high stability goal. Pienemann is such a prior art reference.

243. Like Takeuchi's control circuit 46, Peinemann discloses "a puff detector, which reacts to the pressure change when the user announces air," and in conjunction with electronic circuit 32, adjusts the power supply in response to the user's inhalation. EX1006, 11:10-16. Pienemann discloses that the puff detector and electronic circuit 32 can perform a variety of different control operations in response to a user's inhalation, including supplying power to different "zones" along the substrate portion 1, controlling the power "in such a way that the heating power is set to a higher value on the first puff than on the following puffs, as well as to interrupt the power supply after a defined puff time to avoid overheating." EX1006, 11:10-16, claims 17-20. A POSA would have therefore again recognized

that Pienemann (through its disclosure of various power supply control operations) fills in the missing details about how to implement Takeuchi's control circuit 46.

244. Based on the teachings of Pienemann, a POSA would have been motivated to implement Takeuchi's control circuit 46 such that it is capable of carrying out a variety of power supply control operations, including setting the heating power "to a higher value on the first puff than on the following puffs," and "interrupt[ing] the power supply after a defined puff time to avoid overheating." Takeuchi's control circuit 46 and Pienemann's puff detector/electronic circuit 32 are also each designed to control the power supplied to a heater in response to detection of inhalation by a user. EX1004, 7:50-56, 6:55-62; EX1006, 11:10-16, claims 17-20.

245. Thus, a POSA would have recognized that Pienemann's teachings are applicable to Takeuchi, and that implementing Pienemann's various power supply control operations within Takeuchi's control circuit 46 would have required minimal modifications. In the combined system, Takeuchi's control circuit 46 would be implemented with the ability to perform Pienemann's various power supply control operations so as to regulate the power supplied to heater 42 and/or heater plates 421 and 422 during the course of a user's draw, and based on the characteristics of that draw.

246. Additionally, a POSA would have understood that implementing Pienemann's various power supply control operations within Takeuchi's control circuit 46 would have the added benefits of improved taste through the improved regulation of heat, improved battery life, and improved safety from hazards such as overheating.

247. A POSA would not have experienced any unreasonable technical hurdles in implementing these modifications. Additionally, a POSA would have understood that implementing additional power control operations within Takeuchi's control circuit 46 would merely amount to combining prior art elements (Takeuchi's control circuit 46 and Pienemann's various power supply control operations) according to known methods (implementing Takeuchi's control circuit 46 using known circuity and/or logic to carry out Pienemann's various power supply control operations) to yield predictable results (e.g., implementation of control circuit 46 having the ability to regulate the power supplied to heater 42 and/or heater plates 421 and 422 during the user's draw, and based on the characteristics of that draw).

(c) Motivation to modify Takeuchi's flavor-generating devices to incorporate removable end caps

248. As discussed above, Takeuchi discloses that flavor-generating devices 10 and 100 include various components that are designed to be exchangeable, including liquid container 32 (at least as implemented in device 100 (the Figure 8

embodiment)), and the battery used for power source 44. EX1004, 6:15-17, 9:23-26, claim 9. However, Takeuchi does not explicitly disclose how a user could access these internal components to perform the disclosed exchange. A POSA would have thus looked to the prior art for guidance on what modification could be made to Takeuchi such that at least liquid container 32 and power source 44 could be accessed and exchanged. Pienemann is such a prior art reference.

249. Pienemann specifically discloses that its inhaling device includes housing 50, which "has a screw-off cap 53 at the front end through which a battery or accumulator 51 can be replaced." EX1006, 10:18-20. A POSA would have therefore recognized that Pienemann fills in the missing details about how Takeuchi's devices 10 and 100 could be designed to allow access to the internal components such that they can be exchanged/replaced.

250. A POSA would have recognized that Pienemann's teachings are applicable to Takeuchi, and that implementing Takeuchi's devices 10 and 100 having Pienemann's removable end cap would have required minimal modifications. In the combined system, all or a portion of the left side of casing 12 of Takeuchi's device 10 would be implemented as a removable end cap, as taught by Pienemann. Similarly, all or a portion of the left side wall of upper chamber 121 and the left side wall of lower chamber 122 of Takeuchi's device 100 would also be implemented as a removable end cap, as taught by Pienemann. A POSA would

have understood that the left side of casing 12, the left side wall of upper chamber 121, and the left side wall of lower chamber 122 could each be removably connected to the remainder of their respective housings via a variety of well-known means, such as by friction fit, interlocking grooves, a latching mechanism, a threaded screw mechanism, or the like.

251. Additionally, a POSA would have understood that modifying Takeuchi's flavor-generating devices 10 and 100 to incorporate removable end caps would have the added benefit of reduced replacement costs, reduced repair costs (through the ability to replace individual defective parts as opposed to having to replace the entire device), and improved longevity.

252. A POSA would not have experienced any unreasonable technical hurdles in implementing these modifications. Additionally, a POSA would have understood that modifying Takeuchi's flavor-generating devices 10 and 100 to incorporate removable end caps would merely amount to combining prior art elements (Takeuchi's devices 10 and 100 and Pienemann's removable end cap) according to known methods (implementing the left side of casing 12, the left side wall of upper chamber 121, and the left side wall of lower chamber 122 such that each is removably connected to the remainder of their respective housings) to yield predictable results (e.g., a flavor-generating device that offers a user the ability to access internal components such that they can be repaired or exchanged/replaced).

* * *

253. In addition to the above, a POSA would have been further motivated to combine Takeuchi and Pienemann because both are in the same general field of aerosol-generating inhaling devices, and address the same problems—e.g., problems arising from the aerosol-generating material remaining heated even between times of active inhalation, and problems relating to unnecessary waste when having to dispose of an entire inhalation device. EX1004, 1:17-20, 1:34-38, 1:49-51; EX1006, 1:15-18, 2:13-17, 2:29-33, 4:1-5. Accordingly, a POSA would have had a reasonable expectation of success in implementing each of the above three modifications to Takeuchi's devices 10 and 100 based on the teachings of Pienemann.

2. Dependent Claim 6

254. To the extent that Takeuchi does not itself render obvious that liquid container 32 (at least in the Figure 8 embodiment, the claimed "*cartridge*") is "*circumscribed with a wrapping material*," Pienemann discloses this limitation.

255. Specifically, Pienemann discloses a "system for supplying an inhalable aerosol [that] contains a substrate portion (1") and an inhaling device." EX1006, Abstract. Pienemann discloses that substrate portion 1 is removable from a housing of an inhaling device and contains an "aerosol-forming material within a wrapper." EX1006, 3:10-14, 9:4-5, 9:26-29 ("After use, the substrate portion 1

with the mouthpiece 10 is removed from the smoking device and disposed of"), 10:20-28. Thus, a POSA would have understood that Pienemann's substrate portion 1, like Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) is a "*cartridge*."

256. For at least the reasons discussed in Section VIII.B.1(a) above, a POSA would have been motivated to implement Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) using Pienemann's "wrapper."

3. Dependent Claim 7

257. To the extent that Takeuchi does not itself render obvious that liquid container 32 (at least in the Figure 8 embodiment, the claimed "cartridge") comprises "a plastic material," Pienemann discloses this limitation. Specifically, Pienemann discloses the wrapper used to circumscribe substrate portion 1 (the "cartridge") "may consist of … a plastic foil." EX1006, 6:10-15.

258. For at least the reasons discussed in Section VIII.B.1(a) above, a POSA would have been motivated to implement Takeuchi's liquid container 32 (at least in the Figure 8 embodiment) using Pienemann's plastic foil wrapper.

4. Dependent Claim 14

259. To the extent that Takeuchi does not explicitly disclose that control circuit 46 "regulate[s] the current flow through the electrical resistance heater

during the draw on the electrically-powered, aerosol-generating smoking article," Pienemann discloses this limitation.

260. Specifically, Pienemann discloses "a puff detector, which reacts to the pressure change when the user announces air," and in conjunction with electronic circuit 32, adjusts the power supply in response to the user's inhalation. EX1006, 11:10-16. Pienemann discloses that the puff detector and electronic circuit 32 "*regulate the current flow through the electrical resistance heater during the draw*" through a variety of different control operations, including supplying power to different "zones" along the substrate portion 1, controlling the power "in such a way that the heating power is set to a higher value on the first puff than on the following puffs, as well as to interrupt the power supply after a defined puff time to avoid overheating." EX1006, 11:10-16, claims 17-20 (emphasis added).

261. For at least the reasons discussed in Section VIII.B.1(b) above, a POSA would have been motivated to implement Takeuchi's control circuit 46 such that it is capable of carrying out a variety of Pienemann's power supply regulation operations. Therefore, the combination of Takeuchi and Pienemann renders obvious claim 14.

5. Dependent Claim 15

262. To the extent that Takeuchi does not explicitly disclose that device 10 and/or device 100 includes "an end cap defined at a second of the two ends,"

Pienemann discloses this limitation. Specifically, Pienemann discloses that its inhaling device includes housing 50, which "has a screw-off cap 53 at the front end through which a battery or accumulator 51 can be replaced." EX1006, 10:18-20.

263. For at least the reasons discussed in Section VIII.B.1(c) above, a POSA would have been motivated to implement Takeuchi's devices 10 and 100 having Pienemann's removable end cap. Therefore, the combination of Takeuchi and Pienemann renders obvious claim 15.

6. Independent Claim 18

264. The combination of Takeuchi and Pienemann discloses claim 18 for the same reasons discussed above for claim 18 in Ground 1. To the extent that Takeuchi does not explicitly disclose that control circuit 46 "regulate[s] current flow through the electrical resistance heater during a draw," Pienemann discloses this limitation for the same reasons discussed above for claim 14.

7. Dependent Claims 19-29

265. The combination of Takeuchi and Pienemann discloses claims 19-29 for the same reasons as discussed above for claims 19-29 in Ground 1, respectively.

C. Ground 3: The combination of Kim and Pienemann renders obvious claims 1-30.

1. A POSA would have been motivated to combine Kim and Pienemann.

266. A POSA would have been motivated to make three modifications, individually or collectively, to Kim's cigarette substitute device (1). First, a POSA would have been motivated to modify Kim's technique of activating the heater to use a puff detector, as taught by Pienemann. Second, a POSA would have been motivated to implement Kim's porous chip 5 to be removable and to use a wrapper material, as taught by Pienemann. Third, a POSA would have been motivated to modify Kim's cigarette substitute device (1) to incorporate a removable end cap, as further taught by Pienemann.

(a) Motivation to modify Kim's technique of activating the heater using Pienemann's puff detector and electronic circuit 32

267. As discussed above, Kim discloses that its device (1) includes two metal plates (9-U) and (9-L) that connect when a user presses on the mouth piece (3). EX1007, [0018]. "Then the electric circuit is connected through the electric wires (7-U) and (7-L), three batteries (6), and the red color LED (4)" and the Nicotine mixture is evaporated. EX1007, [0018]-[0019].

268. However, A POSA would have understood that Kim's technique for activating the heater would have been error prone and potentially frustrating to a user. For example, the heater would activate simply if the tip is compressed when

the device is in a user's pocket, bag, or held in their hand, frustrating a user. A POSA would have thus looked to the prior art for ways to control the heater that would not be error prone. Pienemann is such a prior art reference.

269. In particular, Pienemann discloses "a puff detector, which reacts to the pressure change when the user announces air," and in conjunction with electronic circuit 32, adjusts the power supply in response to the user's inhalation. EX1006, 11:10-16. Pienemann discloses that the puff detector and electronic circuit 32 can perform a variety of different control operations in response to a user's inhalation, including supplying power to different "zones" along the substrate portion 1, controlling the power "in such a way that the heating power is set to a higher value on the first puff than on the following puffs, as well as to interrupt the power supply after a defined puff time to avoid overheating." EX1006, 11:17-25, claims 17-20. A POSA would have therefore again recognized that Pienemann (through its disclosure of various power supply control operations) would have addressed these problems in Kim's device (1).

270. Based on the teachings of Pienemann, a POSA would have been motivated to implement Pienemann's puff detector and electronic circuit 32 in Kim's device (1) to control the power supplied to a heater in response to detection of inhalation by a user. EX1004, 7:50-56, 6:55-62; EX1006, 11:10-16, claims 17-20. And a POSA would have been motivated to implement Pienemann's puff

detector and electronic circuit 32 in Kim's device (1) to carry out a variety of power supply control operations, including setting the heating power "to a higher value on the first puff than on the following puffs," and "interrupt[ing] the power supply after a defined puff time to avoid overheating."

271. Thus, a POSA would have recognized that Pienemann's teachings are applicable to Kim, and that implementing Pienemann's various power supply control operations within Kim would have required minimal modifications. In the combined system, Kim's device (1) would be implemented with the ability to perform Pienemann's various power supply control operations so as to regulate the power supplied to heater (8) during the course of a user's draw, and based on the characteristics of that draw.

272. Additionally, a POSA would have understood that implementing Pienemann's various power supply control operations within Kim would have the added benefits of improved taste through the improved regulation of heat, improved battery life by not activating the heater erroneously, and improved safety from hazards such as overheating.

273. A POSA would not have experienced any unreasonable technical hurdles in implementing these modifications. Additionally, a POSA would have understood that implementing Pienemann's power control operations within Kim would merely amount to combining prior art elements (Kim's device (1) and

Pienemann's puff detector and electronic circuit 32) according to known methods (implementing Pienemann's puff detector and electronic circuit 32 for various power supply control operations) to yield predictable results (e.g., implementation of puff detector and electronic circuit 32 having the ability to regulate the power supplied to heater (8) during the user's draw, and based on the characteristics of that draw).

(b) Motivation to implement Kim's porous chip to be removable/replaceable and wrapped

274. As discussed above, Kim's device (1) includes a porous plastic chip (5), which may be "manufactured as a slim plate or a rod with a porous polymeric material, preferably in the form of polymeric fibers, and having absorbed therein the volatile liquid composition of mixture of nicotine and volatile palatability enhancing agents." EX1007, [0015], [0004], [0014], [0017], [0019], Abstract. However, Kim is silent on whether the porous chip (5) is replaceable and certain details about the chip (e.g., how to prevent the liquid from seeping into the device). A POSA would have thus looked to the prior art for guidance on these issues. Pienemann is such a prior art reference.

275. Pienemann discloses a "system for supplying an inhalable aerosol [that] contains a substrate portion (1") and an inhaling device." EX1006, Abstract. Like Kim's liquid containing chip (5), Pienemann discloses that substrate portion 1 contains an "aerosol-forming material within a wrapper." EX1006, 3:10-14,

Abstract. Pienemann explains that substrate portion 1 is configured to be inserted (and removed) from a housing of the inhaling device. EX1006, 9:1-4 ("As shown in Figure 3, there are two contacts (electrodes) 21 and 22 in a housing 20 via which contact is made to the conductive wrapper of a substrate portion received by the smoking device."), 9:4-5 ("The cavity inside the housing 20 and the contacts 21 and 22 form a receiving device for holding the substrate portion"), 9:26-29 ("After use, the substrate portion 1 with the mouthpiece 10 is removed from the smoking device and disposed of"), 10:20-28 ("A pivoting flap 52 … serves to insert a substrate portion 1"). Pienemann also explains that the wrapper "may consist of paper … or a plastic foil also made conductive by additives" (EX1006, 6:10-15). A POSA would have therefore recognized that Pienemann (through its disclosure of a removable substrate having a wrapper) fills in the missing details about how to implement Kim's liquid containing chip (5).

276. Based on the teachings of Pienemann, a POSA would have been motivated to implement Kim's liquid containing chip (5) to be removable and to have a wrapper material. Kim's liquid containing chip (5) and Pienemann's substrate portion 1 are both designed for use within an aerosol-generating inhaling device. *Compare* EX1007, [0004], [0014]-[0015], [0017], [0019], Abstract *with* EX1006, Abstract, 3:10-14.

277. Thus, a POSA would have recognized that Pienemann's teachings are applicable to Kim, and that implementing Kim's liquid containing chip (5) to be removable and to have a wrapper material would have required minimal modifications. In the combined system, Kim's liquid containing chip (5) would be removable/replaceable—e.g., by providing a pivoting flap having a slot for knob 10 and electrical contacts on either end of the chip—and implemented using Pienemann's wrapper material—e.g., formed from either a paper wrapper or plastic wrapper to avoid the liquid from seeping out into the device and potentially contacting the batteries.

278. Additionally, a POSA would have understood that implementing Kim's liquid containing chip (5) to be removable/replaceable would have the added benefit of being able to extend the life of the device and to offer the user a multitude of choices to fit their personal desires. For example, a user could chose the type of porous chip based on their preferences relating to mouthfeel, taste, Nicotine content, and more.

279. A POSA would not have experienced any unreasonable technical hurdles in implementing these modifications. Additionally, a POSA would have understood that implementing Kim's liquid containing chip (5) to be removable/replaceable and using a wrapper material would merely amount to combining prior art elements (Kim's liquid containing chip (5) and Pienemann's

pivoting flap 52, electrical contacts, and wrapping material) according to known methods (implementing Kim's liquid containing chip (5) to be removable/replaceable with electrical contacts and using a wrapper material consisting of either paper or plastic) to yield predictable results (e.g., a container having the ability to house an aerosol-generating material without leaking, and being configured to be removably inserted from in an inhaling device).

(c) Motivation to modify Kim's device to incorporate a removable end cap and mouthpiece

280. As discussed above, Kim discloses that the device (1) includes batteries (6). EX1007, [0012], Abstract, [0018]. However, Kim does not explicitly disclose how a user could access the batteries to replace them once they are dead. A POSA would have thus looked to the prior art for guidance on what modification could be made to Kim such that the batteries (6) could be accessed and exchanged. Pienemann is such a prior art reference.

281. Pienemann specifically discloses that its inhaling device includes housing 50, which "has a screw-off cap 53 at the front end through which a battery or accumulator 51 can be replaced." EX1006, 10:18-20. Pienemann also discloses that "mouthpiece 10' is inserted into a base 42, which is screwed to the housing 40 after insertion of the substrate portion 1' into a smoking device comprising a housing 40." EX1006, 10:1-3. A POSA would have therefore recognized that Pienemann fills in the missing details about how Kim's device (1) could be

designed to allow access to the internal components such that they can be exchanged/replaced using a removable mouth piece and end cap.

282. A POSA would have recognized that Pienemann's teachings are applicable to Kim, and that implementing having Pienemann's removable end cap and mouthpiece would have required minimal modifications. In the combined system, the LED end of Kim's device would be implemented as a removable end cap and the mouthpiece would be removable, as taught by Pienemann. A POSA would have understood that the LED end and mouthpiece of Kim's device could each be removably connected to the remainder of housing 2 via a variety of well-known means, such as by friction fit, interlocking grooves, a latching mechanism, a threaded screw mechanism, or the like.

283. Additionally, a POSA would have understood that modifying Kim's device to incorporate a removable end cap and mouthpiece would have the added benefit of reduced replacement costs, reduced repair costs (through the ability to replace individual defective parts as opposed to having to replace the entire device), and improved longevity.

284. A POSA would not have experienced any unreasonable technical hurdles in implementing these modifications. Additionally, a POSA would have understood that modifying Kim's device to incorporate a removable end cap and mouthpiece would merely amount to combining prior art elements (Kim's device

and Pienemann's removable end cap and mouthpiece) according to known methods (implementing the LED end and mouthpiece such that it is removably connected to the remainder of housing 2) to yield predictable results (e.g., a flavor-generating device that offers a user the ability to access internal components such that they can be repaired or exchanged/replaced).

* * *

285. In addition to the above, a POSA would have been further motivated to combine Kim and Pienemann because both are in the same general field of aerosol-generating inhaling devices, and would have addressed similar problems—e.g., problems arising from the aerosol-generating material remaining heated even between times of active inhalation, and problems relating to unnecessary waste when having to dispose of an entire inhalation device. EX1007, Abstract, [0002]; EX1006, 1:15-18, 2:13-17, 2:29-33, 4:1-5. Accordingly, a POSA would have had a reasonable expectation of success in implementing each of the above three modifications to Kim's device (1) based on the teachings of Pienemann.

2. Independent Claim 1

(a) An electrically-powered, aerosol-generating smoking article comprising:

286. As discussed above in Section V.B, the '202 patent describes that this claim element was well known and in public use before the '202 patent's earliest claimed priority date. Additionally, Kim discloses this claim element.

287. Kim discloses this preamble. For example, Kim discloses a "spot-heating cigarette substitute device, which, in response to an electric power supplies and suction by a user, evaporates nicotine mixture and delivers them to the user." EX1007, Abstract; [0012] ("FIG. 1 is a side elevation in longitudinal section illustrating the preferred embodiment of the cigarette substitute device (1)…").

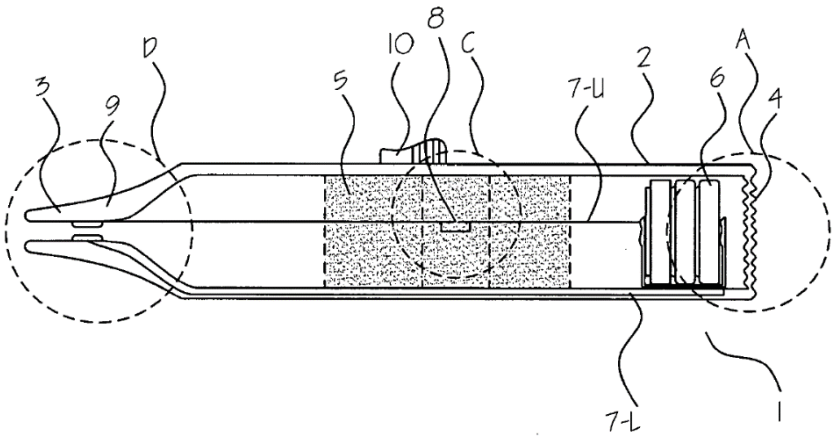


FIG.1

EX1007, FIG. 1.

288. Kim also discloses that the cigarette substitute device (1) is "*electrically-powered*": "The cigarette substitute device (1) of the present invention is comprised of … three 3 Volt mini-battiest (sic) (6)" EX1007, [0012], Abstract, [0018] (describing "three batteries (6)"), [0019] (describing "spare batteries (6-1)"). Kim further discloses that device (1) is configured to be "*aerosol-generating*": "in response to an electric power supplies and suction by a user, evaporates nicotine mixture and delivers them to the user." EX1007, Abstract,

[0019] ("The heat from the spark evaporates the mixture of the Nicotine and volatile palatability enhancing agents").

289. Therefore, Kim discloses an "electrically-powered, aerosol-generating smoking article."

(b) an outer housing having two ends;

290. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Additionally, Kim discloses this claim element.

291. As illustrated in Figure 1, Kim's device (1) includes "a housing (2) in the form of an elongated tube, a mouth tip (3), an LED (Light Emitting Diode) (4)." EX1007, [0012], [0013] ("FIG. 2 is an enlarged perspective view of the portion 'A' in FIG. 1, showing the front tip of the cigarette substitute device (1). The tip is comprised of a red color LED (4)"), [0016] ("FIG. 6 is an enlarged perspective view of the portion 'D' in FIG. 1, showing the lipping tip (3) of the cigarette substitute device (1)"), [0020] ("1. A cigarette substitute device for spot-heating use is comprised of; a) an elongated plastic tube defining a passageway for air drawn through said device…").

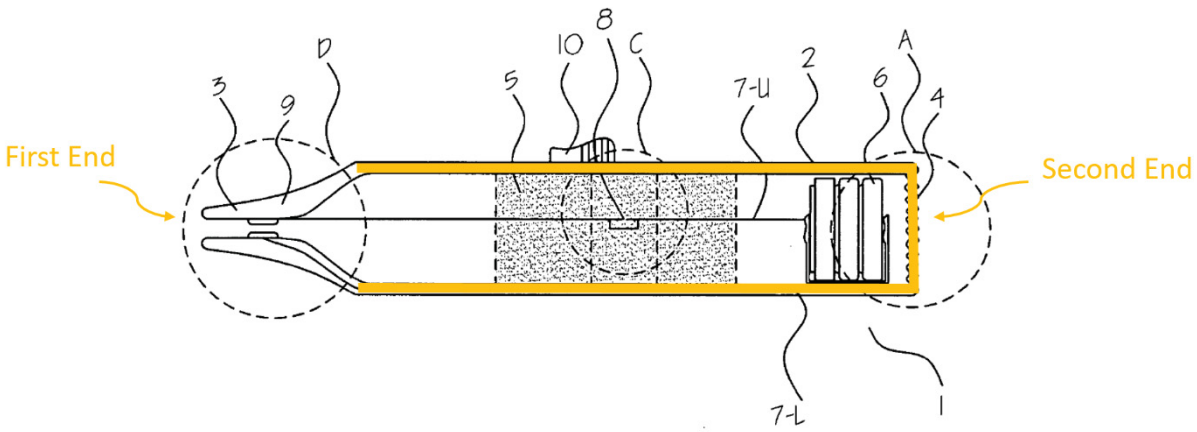


FIG.1

EX1007, FIG. 1 (annotated).

292. Therefore, Kim discloses an "*an outer housing having two ends*."

(c) a mouthpiece defined at one of the two ends;

293. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Additionally, Kim discloses this claim element.

294. As illustrated in Figures 1 and 6, Kim's device (1) includes "a mouth tip (3)" defined at one of the two ends. EX1007, [0012], [0016] ("FIG. 6 is an enlarged perspective view of the portion 'D' in FIG. 1, showing the lipping tip (3) of the cigarette substitute device (1)"), [0020] ("A cigarette substitute device for spot-heating use is comprised of… f) a mouth tip made of transparent flexible plastic and holding two metal plates of an on/off electric connector on each upper and lower portion of the flexible mouth tip").

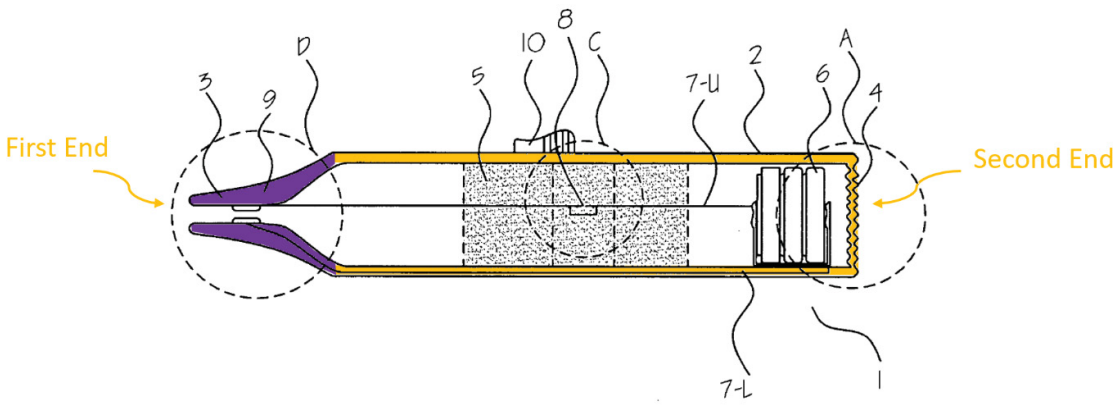


FIG.1

EX1007, FIG. 1 (annotated).

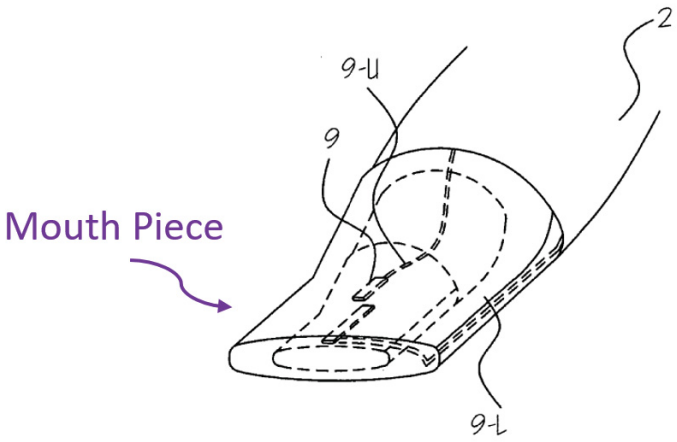


FIG.6

EX1007, FIG. 6 (annotated).

295. Therefore, Kim discloses "*a mouthpiece defined at one of the two ends*."

(d) an electrical power source arranged within the outer housing;

296. As discussed above in Section V.B, the ’202 patent describes that this claim element was well-known and in public use before the ’202 patent’s earliest claimed priority date. Additionally, Kim discloses this claim element.

297. As discussed above, Kim discloses that the cigarette substitute device (1) include “an electrical power source arranged within the outer housing”: “The cigarette substitute device (1) of the present invention is comprised of … three 3 Volt mini-battiest (sic) (6)” EX1007, [0012], Abstract (“A spot-heating cigarette substitute device, which, in response to an electric power supplies and suction by a user, evaporates nicotine mixture and delivers them to the user”), [0018] (describing “three batteries (6)”), [0019] (describing “spare batteries (6-1)”), [0020] (“A cigarette substitute device for spot-heating use is comprised of…e) three 3V mini batteries connected in series”).

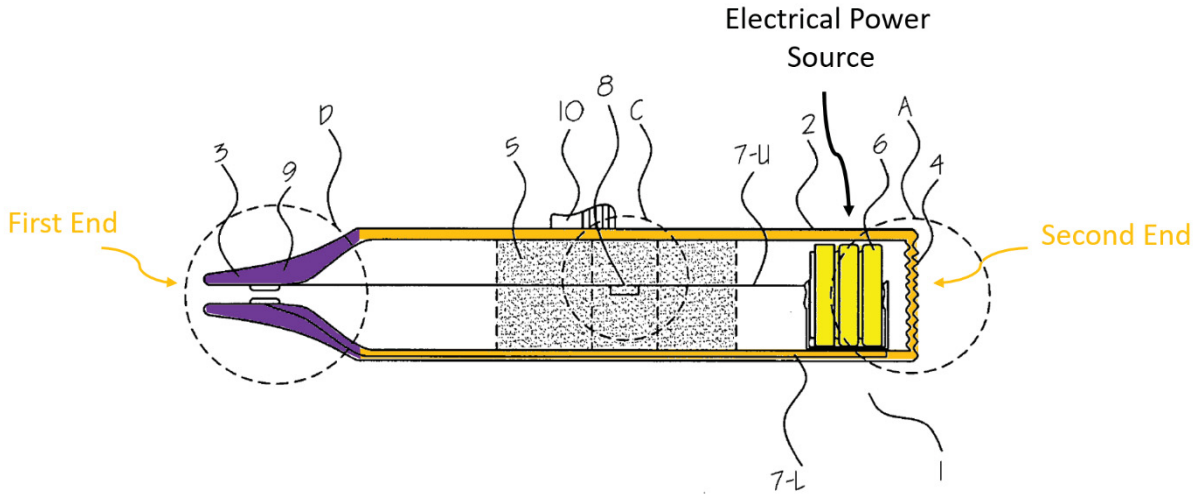


FIG.1

EX1007, FIG. 1 (annotated).

298. Therefore, Kim discloses "an electrical power source arranged within the outer housing."

(e) an electrical resistance heater positioned within the outer housing, the electrical resistance heater being configured for electrical connection with the electrical power source

299. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Additionally, Kim discloses this claim element in two ways.

300. First, Kim discloses "an electrical resistance heater positioned within the outer housing" in the form of "an electric shorting connector (8)" that is "comprised of two electric wires (7-U) whose ends are spaced 0.01 mm part (8-1) on a non-conductive ceramic support (8-2) plate of 1.0 mm thickness, 1.0 mm

width and 5 mm length." EX1007, [0015], [0018], [0019] ("The heat from the spark evaporates the mixture of the Nicotine and volatile palatability enhancing agents out of the porous chip (5) from the pores (5-1) therein").

301. Second, Kim discloses "an electrical resistance heater positioned within the outer housing" in the form of an "electric heating coil (8-3) … instead of the shorting connector." EX1007, [0015] ("If an electric heating coil (8-3) is installed inspite of the electric shortening (8) connector, the ceramic support may not be necessary"), [0020] ("3. A cigarette substitute device for spot-heating use is comprised of... g) an electric wire connected to the LED, batteries, the metal plates of the on/off electric wire and a heating coil in the porous polymeric chip").

302. Both electric shorting connector (8) and electric heating coil (8-3) are "configured for electrical connection with the electrical power source." As Kim describes, "[w]hen a habitual smoker put the cigarette substitute device (1) of the current application between his lips and presses the lipping tip (3) of the device, the two metal plates (9-U) and (9-L) of the on/off electric connector (9) is connected. Then the electric circuit is connected through the electric wires (7-U) and (7-L), three batteries (6), and the red color LED (4). However, as described before, the upper electric wire (7-U) is a 0.01 mm spaced apart. As the electric circuit is connected, an electric fire sparks on this spot (8)." EX1007, [0018].

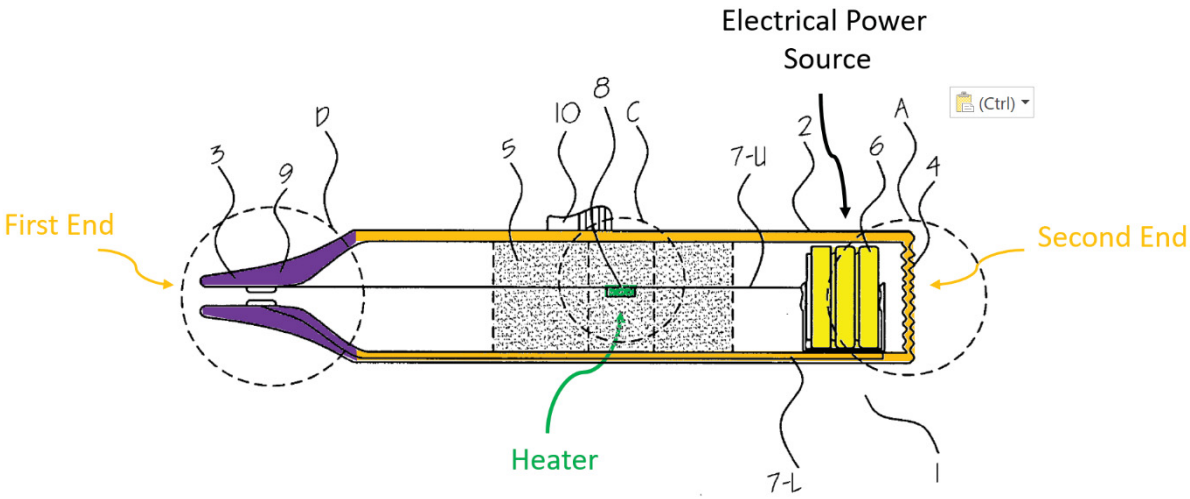


FIG.1

EX1007, FIG. 1 (annotated).

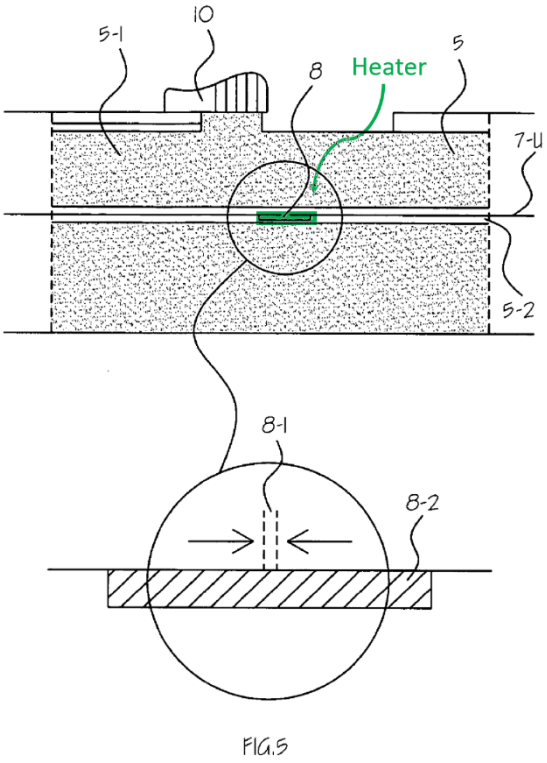


FIG.5

EX1007, FIG. 5 (annotated).

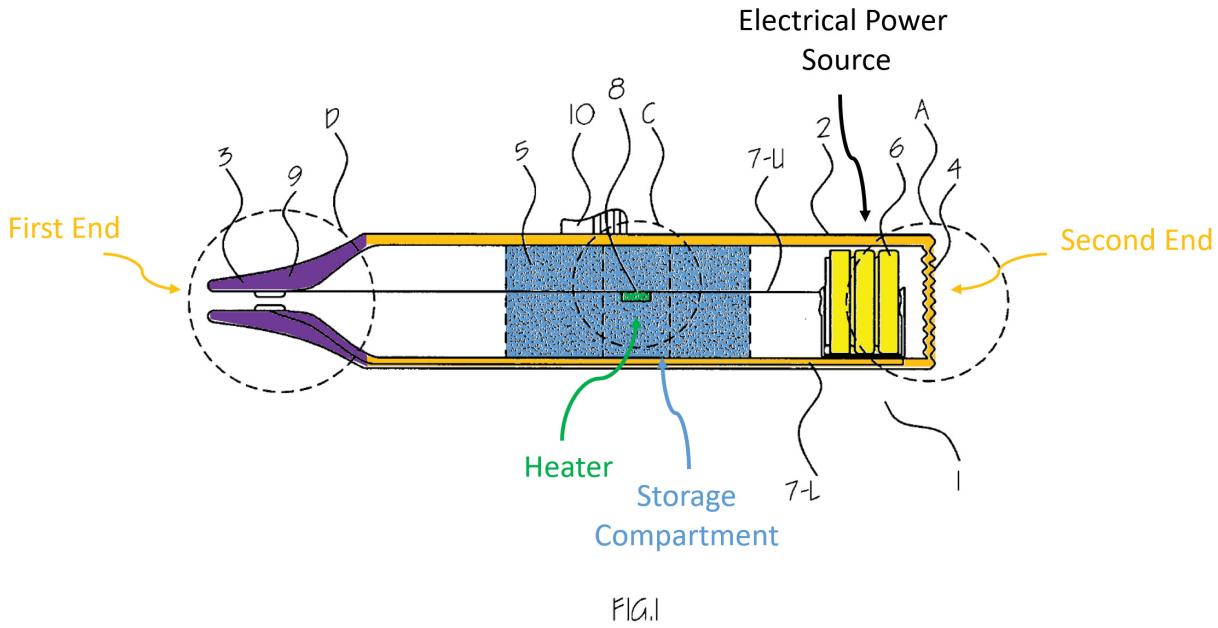
303. Therefore, Kim discloses "an electrical resistance heater positioned within the outer housing, the electrical resistance heater being configured for electrical connection with the electrical power source" two ways.

> **(f) a storage compartment defined within the outer housing, the storage compartment being configured for storage of a liquid aerosol-forming material and being arranged such that the liquid aerosol-forming material can be wicked into contact with the electrical resistance heater to volatilize the liquid aerosol-forming material;**

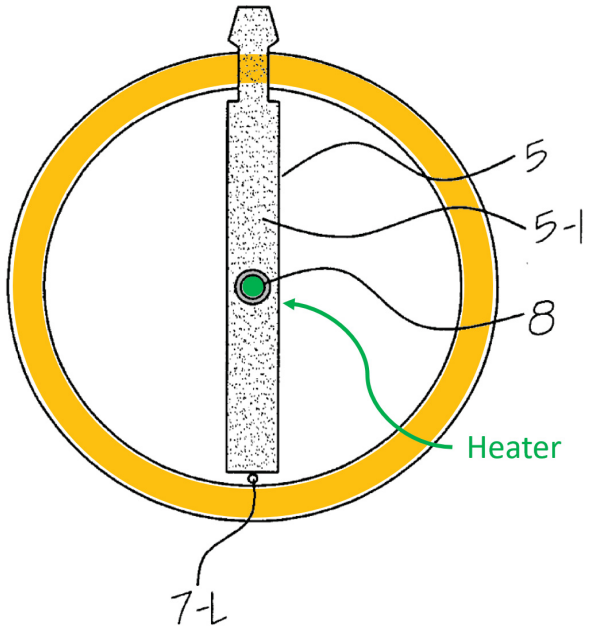
304. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Additionally, Kim discloses this claim element.

305. Kim discloses a "storage compartment defined within the outer housing" and "being configured for storage of a liquid aerosol-forming material" in the form of a porous chip (5), which may be "manufactured as a slim plate or a rod with a porous polymeric material, preferably in the form of polymeric fibers, and having absorbed therein the volatile liquid composition of mixture of nicotine and volatile palatability enhancing agents." EX1007, [0015] ("Mixtures of Nicotine and volatile palatability enhancing agents are absorbed in the pores (5-1) of the porous chip (5)"), [0004], [0014], [0017], [0019] ("The heat from the spark evaporates the mixture of the Nicotine and volatile palatability enhancing agents out of the porous chip (5) from the pores (5-1) therein"), Abstract. Figures 1 and 4-

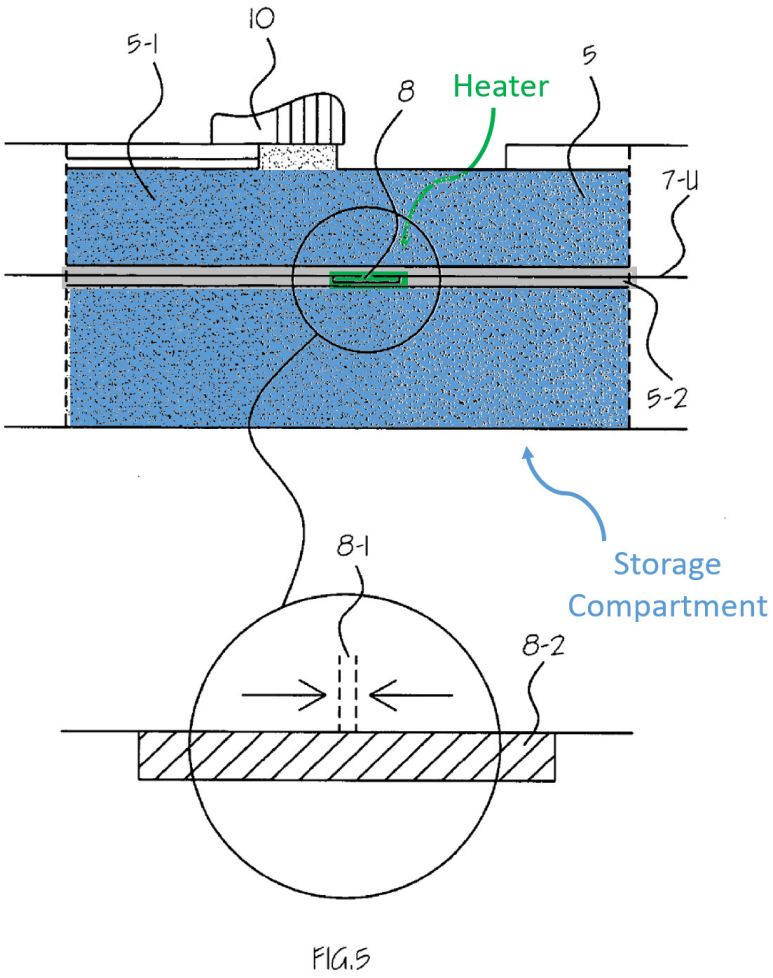
5 below illustrate that the porous chip (5) is within housing (2). EX1007, FIGs. 1, 4-5.



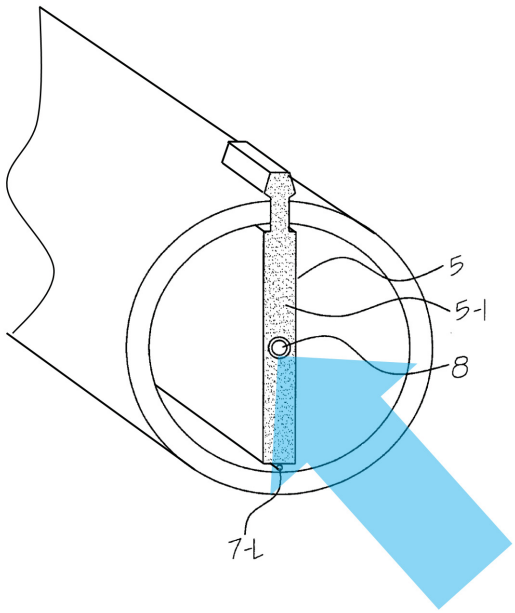
EX1007, FIG. 1 (annotated).



EX1007, FIG. 4 (annotated).



EX1007, FIG. 5 (annotated).



306. Kim further discloses that "the liquid aerosol-forming material can be wicked into contact with the electrical resistance heater to volatilize the liquid aerosol-forming material." As discussed in Section V.E.1 above, "wicked into contact with the electrical resistance heater" should be construed to mean "wicked into contact (1) with the heater, or (2) with an area in close proximity to, and exposed to the heat produced by, the heater."

307. Kim's porous chip (5) causes the liquid aerosol-forming material to be "wicked into contact with the electrical resistance heater." As noted above, Kim discloses "an electrical resistance heater" disposed within the chip (5) in the form of either "an electric shorting connector (8)" that is "comprised of two electric wires (7-U)" or "electric heating coil (8-3)." EX1007, [0015]. The "heat from the spark evaporates the mixture of the Nicotine and volatile palatability enhancing

agents out of the porous chip (5) from the pores (5-1)" such that "[a]s the smoker puffs, the evaporated mixture is delivered to the smokers mouth by the air stream which comes from the out side through the porous hemi circle (11)." EX1007, [0019]. Kim further explains that initially, the porous chip (5) is placed at the most rearward of the device such that the nicotine mixtures absorbed at the most front side of the porous chip evaporates and is consumed first and as the mixture is consumed, a user slides knob (10) to the front side of the device (2) to make the unevaporized mixture with the sparking spot (8). EX1007, [0019].

308. A POSA would have understood that the porous chip (5), which may be polymeric fibers, thus wicks the aqueous mixture into contact with the heater (8), or with an area in close proximity to, and exposed to the heat produced by, the heater (8). For example, Whittemore describes various fibrous materials ("a thread, string, or stand of some suitable wick material") that are used to "wick" a liquid towards the heater. EX1030, 1:50-2:18. *See also* EX1040, 4:61-5:13 (describing various "porous media 32" that are "constructed so that [a] working fluid is passively pumped, or wicked, into contact with [a] heat produce device 12 using surface tension forces").

309. Additionally, a POSA would have understood that heater (8) evaporating the aqueous mixture discloses the claimed "electrical resistance heater to volatilize the liquid aerosol-forming material."

310. If it is argued that the claimed "*storage compartment*" requires more than storing a liquid—e.g., that it must be replenishable, it is my opinion that the Kim-Pienemann combination would still disclose this limitation because the combination would have included a removable/replaceable porous chip (5) as discussed in Section VIII.C.1.b.

(g) an air passageway through at least a portion of the outer housing, the air passageway being arranged so that air drawn into the outer housing combines with volatilized liquid aerosol-forming material to produce an aerosol that can be drawn into the mouth of a user of the electrically-powered, aerosol-generating smoking article through the mouthpiece; and

311. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Additionally, Kim discloses this claim element.

312. As illustrated in Figure 2, Kim's device includes a porous hemi-circle (11) air inlet. EX1007, [0013], FIG. 2.

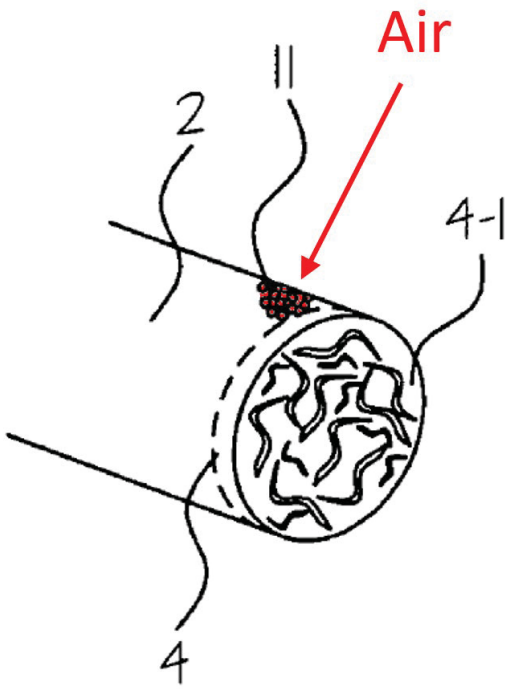
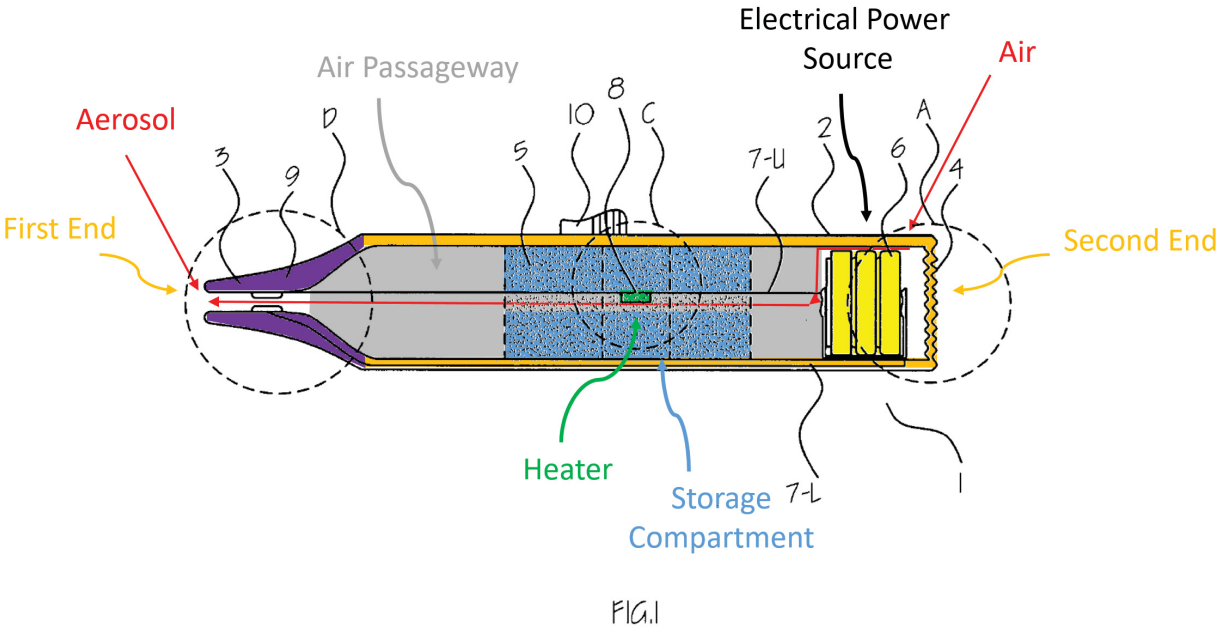


FIG.2

EX1007, FIG. 2 (annotated).

313. Kim explains that when "the two metal plates (9-U) and (9-L) of the on/off electric connector (9) [are] connected," "heat from the spark evaporates the mixture of the Nicotine and volatile palatability enhancing agents out of the porous chip (5) from the pores (5-1)." EX1007, [0018]-[0019]. Thus, "[a]s the smoker puffs, the evaporated mixture is delivered to the smokers mouth by the air stream which comes from the out side through the porous hemi circle (11)." EX1007, [0019] ("the nicotine mixtures absorbed at the most front side of the porous chip evaporates and is consumed first"). Figure 1 illustrates the "*air passageway*".



EX1007, FIG. 1 (annotated).

(h) a controller configured to activate current flow through the electrical resistance heater in response to a draw on the electrically-powered, aerosol-generating smoking article.

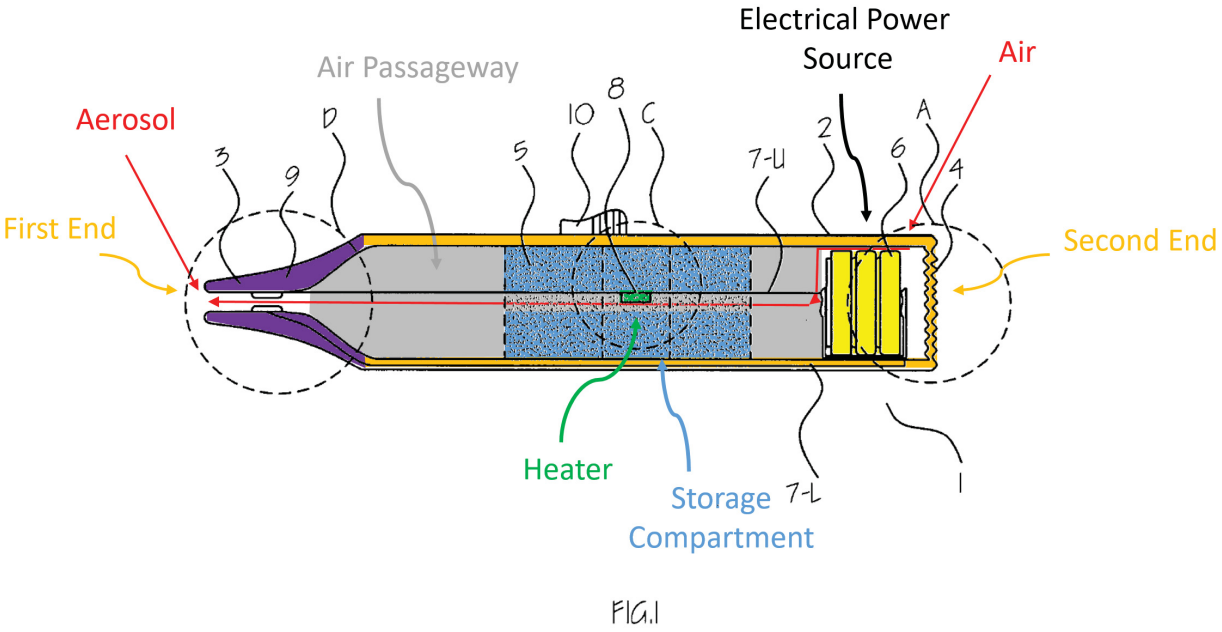
314. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Additionally, the combination of Kim and Pienemann discloses this limitation.

315. As explained above, the combination of Kim and Pienemann includes a controller configured to activate current flow through the electric circuit and heater (8) in response to a draw on the electrically-powered, aerosol-generating smoking article. *See above* Section VIII.C.1(a). A POSA would have also understood that the Kim-Pienemann controller and the claimed "*controller*" both

perform the same function in substantially the same way (by receiving a signal from a sensor/puff detector configured to sense a user's draw through the mouthpiece (*see* EX1001, claim 13)), and produce substantially the same results (control of current flow through an electrical resistance heater to generate an aerosol at the mouthpiece in response to the user's draw).

3. Dependent Claim 2

316. Kim discloses claim 2. As illustrated in Figure 1, the porous chip (5) ("storage compartment") is arranged within the housing (2) and proximate the mouth tip (3) ("mouthpiece"). EX1007, [0012], FIG. 1. In fact, I note that Kim teaches positioning the chip (5) proximate the mouth tip (3) via knob (10). EX1007, [0019]. Additionally, there are not any intervening structures between porous chip (5) and mouth tip (3) that would prevent these two components from being proximate each other.



EX1007, FIG. 1 (annotated).

4. Dependent Claim 3

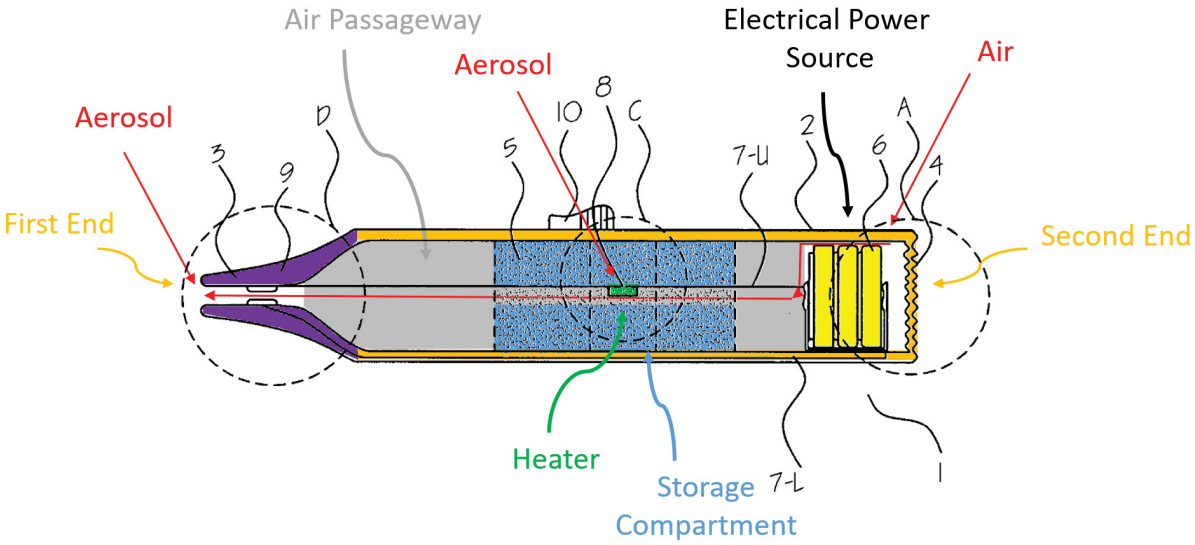
317. Kim discloses claim 3. As noted above, Kim's porous chip (5) may be a porous polymeric material in the form of polymeric fibers. EX1007, [0015] *compare to* EX1001, 22:26-32 (describing fibers of polyethylene terephthalate).

5. Dependent Claim 4

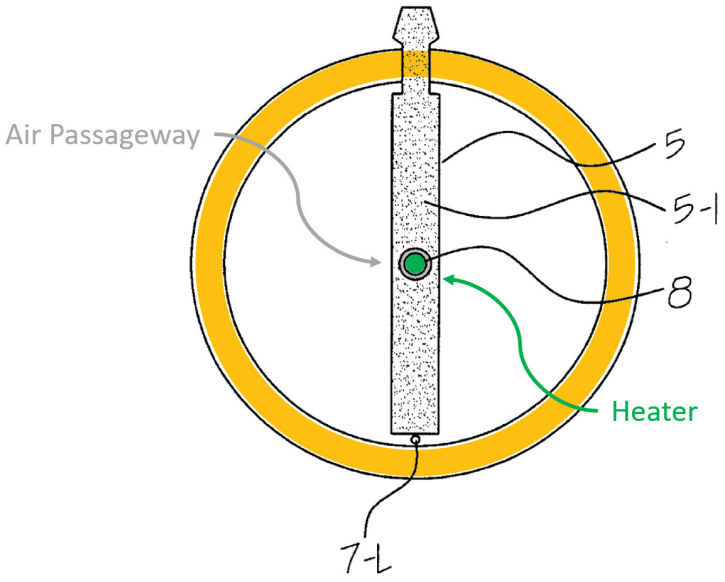
318. The combination of Kim and Pienemann discloses claim 4.

319. As explained above, in Kim-Pienemann, "heat from the spark evaporates the mixture of the Nicotine and volatile palatability enhancing agents out of the porous chip (5) from the pores (5-1)." EX1007, [0018]-[0019]. Thus, "[a]s the smoker puffs, the evaporated mixture is delivered to the smokers mouth by the air stream which comes from the out side through the porous hemi circle

(11)." EX1007, [0019], Abstract ("A solution of a nicotine in an amount effective for its released vapors to satisfy the physiological needs for nicotine of the user, and volatile palatability enhancing agents in an amounts effective for their released vapors to impart a cigarette-like taste and aroma to the released vapor mixture are absorbed in the chip"), [0014] (describing the evaporated mixture as coming out of the chip (5), [0015] (describing cylindrical hole (5-2) at the center of chip (5)). A POSA would have thus understood that the air passes from the porous hemi circle (11) through the chip (5), where it is then combined with the mixture of the nicotine and volatile palatability enhancing agents that have been evaporated by the heater the heater to produce the aerosol, which passes to the front edge of the chip and to the mouthpiece.



EX1007, FIG. 1 (annotated).



EX1007, FIG. 4 (annotated).

6. Dependent Claim 5

320. The combination of Kim and Pienemann discloses claim 5.

321. As noted above, the '202 patent does not explicitly define a "*cartridge*" and merely states that it can be "removed from the outer housing of the device." EX1001, 5:57-61, 8:17-23 ("removable cartridge enclosing the aerosol-forming material and tobacco material"). Nonetheless, the Kim Pienemann combination discloses such a removable cartridge for storing aerosol-forming material.

322. In particular, as described above, the combination of Kim with Pienemann would have included a removable/replaceable porous chip (5) (*see*

above Section VIII.C.1), which discloses "wherein the storage compartment is configured as a cartridge," as recited in claim 5.

7. Dependent Claim 6

323. As discussed above in Section V.B, the '202 patent describes that this claim element was well-known and in public use before the '202 patent's earliest claimed priority date. Nonetheless, the combination of Kim with Pienemann discloses the use of a wrapping material around the porous chip (5) to prevent leakage as explained above. *See above* Section VIII.C.1(b).

8. Dependent Claim 7

324. The combination of Kim and Pienemann discloses claim 7. In particular, Kim states that the chip (5) may be a "porous plastic chip." EX1007, [0020].

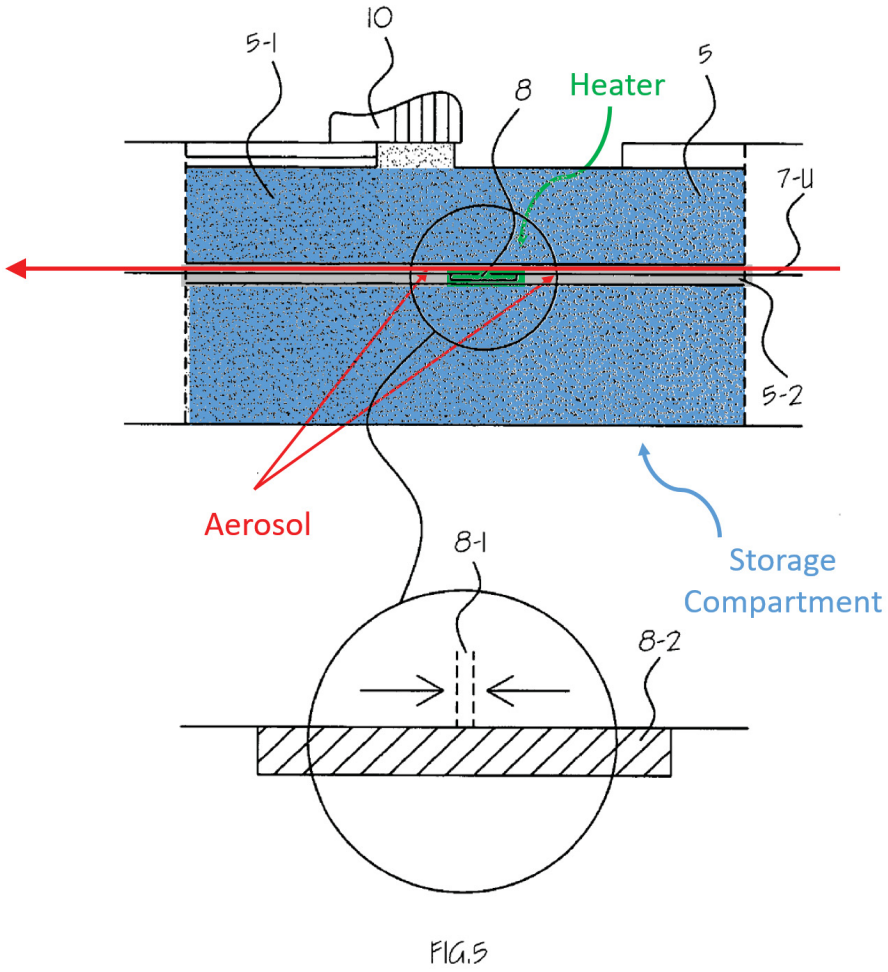
9. Dependent Claim 8

325. Kim discloses claim 8 for the reasons discussed for limitation **[1.e]** above. EX1007, [0004], [0014]-[0015], [0017], [0019], Abstract;

10. Dependent Claim 9

326. Kim discloses claim 9 for the reasons discussed for claim 1 above. For example, Kim states that the heat from the electric shorting connector or coil (8) "evaporates the mixture of the Nicotine and volatile palatability enhancing agents out of the porous chip (5) from the pores (5-1) therein." EX1007, [0019]. A POSA would have understood, or at least found it obvious, for the heater to be arranged in

contact with the chip (5). EX1007, [0015] ("FIG. 5 … show[s] the electric shortening connector (8) embedded in the porous chip (5)" and "Disposed within the porous chip (5) is an electric shortening connector (8)").



EX1007, FIG. 5 (annotated).

11. Dependent Claim 10

327. The combination of Kim and Pienemann discloses claim 10. As noted above, Kim's porous chip (5) may be a porous polymeric material in the form of polymeric fibers and "[d]isposed within the porous chip (5)" is an electric

shortening connector or coil (8). EX1007, [0015]. The heat from the electric shorting connector or coil (8) "evaporates the mixture of the Nicotine and volatile palatability enhancing agents out of the porous chip (5) from the pores (5-1) therein." EX1007, [0019]. A POSA would have thus understood that the connector or coil (8) ("heater") is arranged proximate to Kim's polymeric fibers ("an absorbent wicking material configured for transferring the liquid aerosol-forming material to the electrical resistance heater").

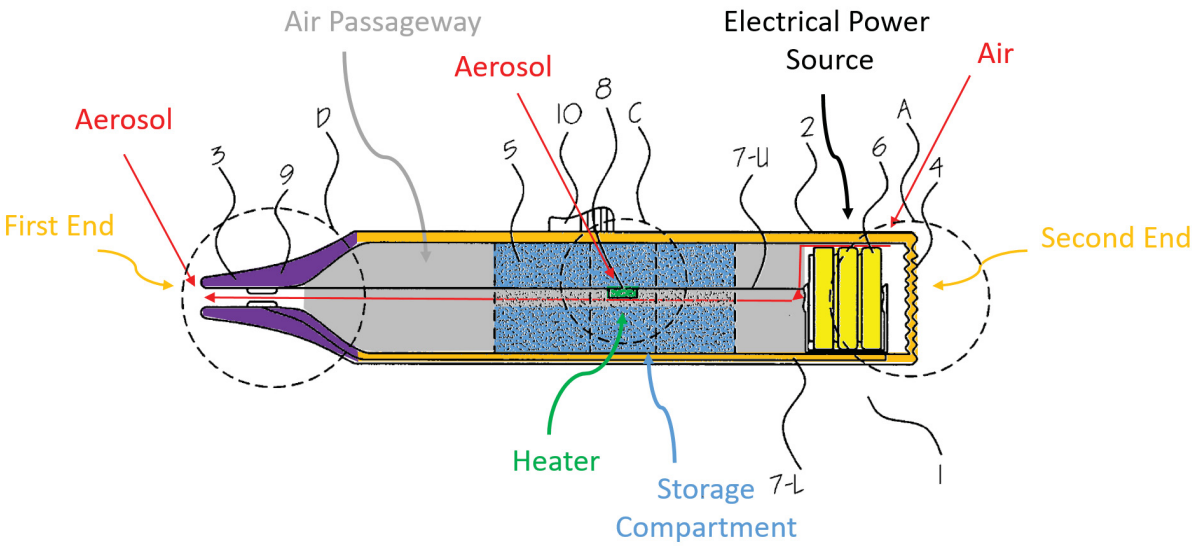
12. Dependent Claim 11

328. The combination of Kim and Pienemann discloses claim 11. As noted above, "[d]isposed within the porous chip (5)" of Kim is an electric shortening connector or coil (8). EX1007, [0015].

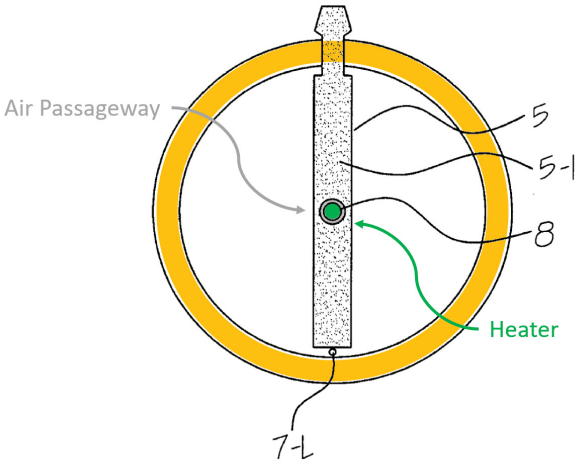
13. Dependent Claim 12

329. The combination of Kim and Pienemann discloses claim 12. As noted above, "[d]isposed within the porous chip (5)" of Kim is an electric shortening connector or coil (8) and the heat therefrom "evaporates the mixture of the Nicotine and volatile palatability enhancing agents out of the porous chip (5) from the pores (5-1) therein." EX1007, [0015], [0019]. A POSA would have understood that the air passes from the porous hemi circle (11) through the chip from (5) and coil (8) ("*heater*") to produce the aerosol which passes to the front edge of the chip and to the mouthpiece. As such, a POSA would have thus understood that the

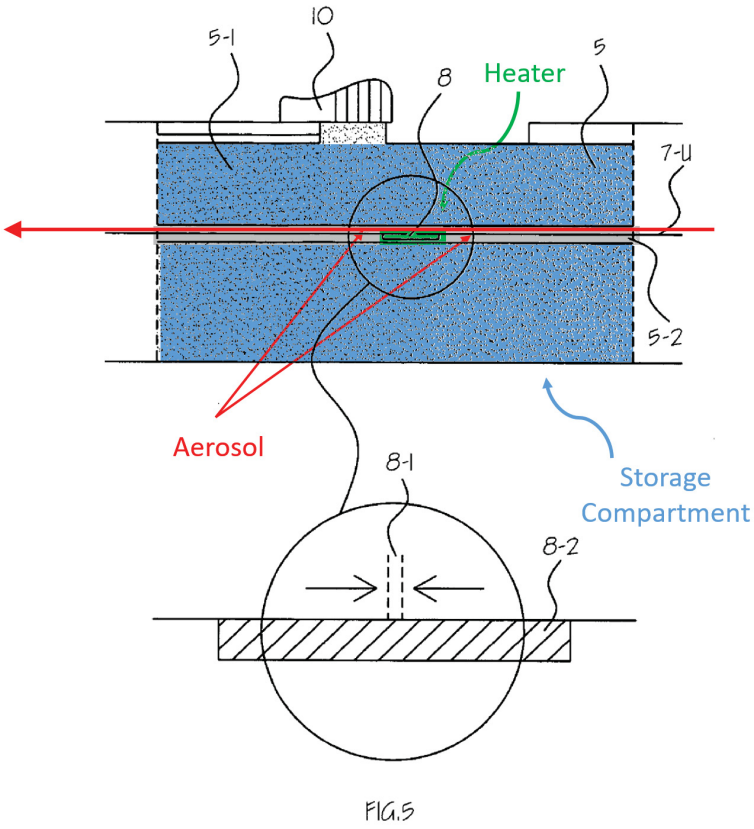
connector or coil (8) ("*heater*") heater is configured to allow airflow there through (e.g., via hole 5-2) to mix with the aerosol.



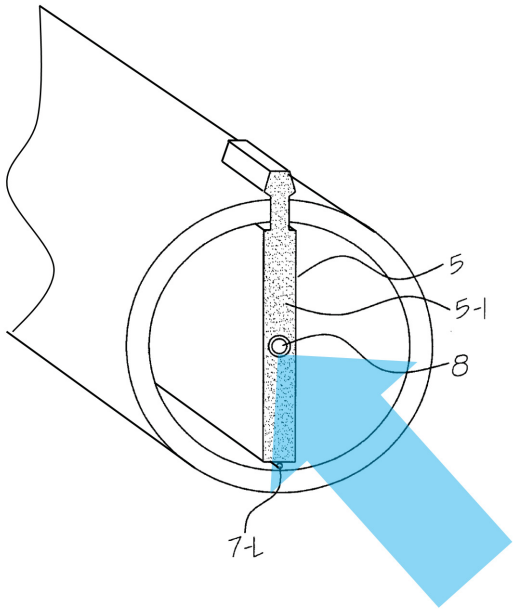
EX1007, FIG. 1 (annotated).



EX1007, FIG. 4 (annotated).



EX1007, FIG. 5 (annotated).



14. Dependent Claim 13

330. Pienemann discloses that "control can be carried out, for example, via a puff detector, which reacts to the pressure change when the user announces air and causes the power supply to one of the zones 13 or 15 via a switching device." EX1006, 11:10-13. For at least the reasons discussed in Section VIII.C.1 above, a POSA would have been motivated to implement Pienemann's puff detector in Kim. Thus, the Kim Pienemann combination, which includes the puff detector, discloses "a sensor adapted for sensing the draw by a user on the electrically-powered, aerosol-generating smoking article."

15. Dependent Claim 14

331. For at least the reasons discussed in Section VIII.C.1 above, it would have been obvious to modify Kim to incorporate Pienemann's puff detector and electronic circuit 32 and control functionality. The combination of Kim with Pienemann thus discloses this claim element.

16. Dependent Claim 15

332. Pienemann discloses that its inhaling device includes housing 50, which "has a screw-off cap 53 at the front end through which a battery or accumulator 51 can be replaced." EX1006, 10:18-20. For at least the reasons discussed in Section VIII.C.1(c) above, a POSA would have been motivated to implement the LED end of Kim's device 1 with Pienemann's removable end cap. Therefore, the combination of Takeuchi and Pienemann renders obvious claim 15.

17. Dependent Claim 16

333. Kim discloses that the device (1) includes batteries (6) that are proximate the LED end, as shown in Figure 1. EX1007, [0018]; FIG. 1. And for at least the reasons discussed in Section VIII.C.1(c) above, a POSA would have been motivated to implement the LED end of Kim's device 1 having Pienemann's removable end cap. Therefore, the combination of Takeuchi and Pienemann renders obvious claim 16.

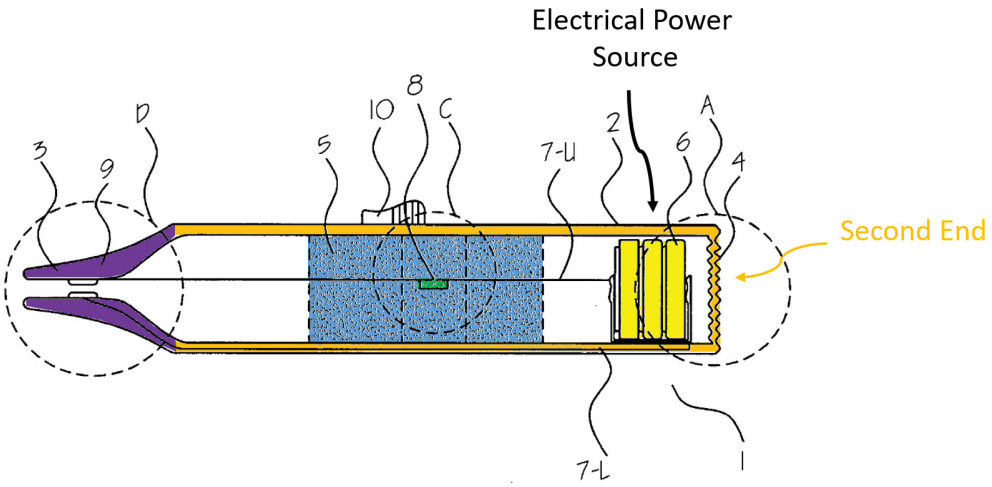


FIG.1

EX1007, FIG. 1.

18. Dependent Claim 17

334. Kim discloses claim 17. For example, Kim states that the "housing (2) is preferably manufactured of a stiff plastic sheet with a diameter, length and weight which approximate the size of a conventional combustible cigarette, and

with the appropriate color and texture, a white paper like look with proper commercial trade mark on it, to present the same appearance as a conventional combustible cigarette." EX1007, [0012].

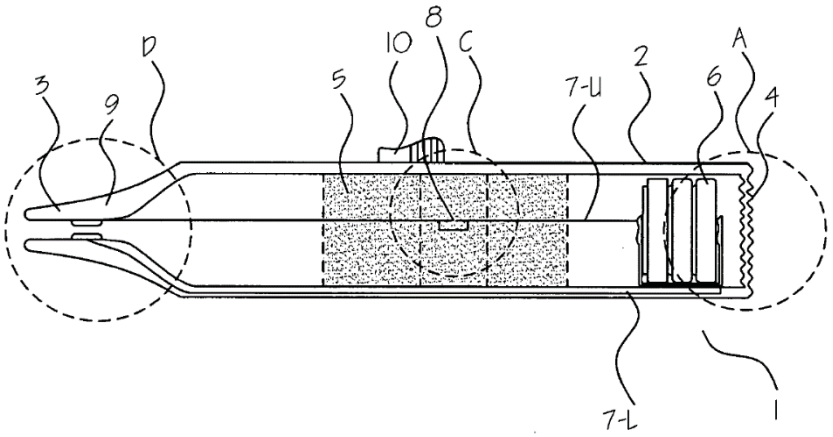


FIG.1

EX1007, FIG. 1.

19. Independent Claim 18

335. The combination of Kim and Pienemann discloses claim 18 for the same reasons discussed above for claims 1 and 14.

336. As explained above in Section VIII.A.15, claim 18 is nearly identical to claim 1, but with three minor differences, none of which impacts the patentability analysis set forth above for claim 1.

337. A POSA would understand that "regulat[ing] current flow through the electrical resistance heater during a draw…" (as recited in claim 18) is no different from "activat[ing] current flow through the electrical resistance heater in response

to a draw." But even if it was, Pienemann would still disclose this limitation for the same reasons discussed in Section VIII.C.1 above.

20. Dependent Claim 19

338. The combination of Kim and Pienemann discloses claim 19 for the same reasons as discussed above for claim 13.

21. Dependent Claim 20

339. The combination of Kim and Pienemann discloses claim 20.

340. Initially, the '202 patent does not describe what "additional control circuitry" is meant by "the puff-actuated controller comprises additional control circuitry."

341. Nonetheless, a POSA would have understood that Pienemann's puff detector and controller 32 ("the puff-actuated controller") can include several different control circuitry components, any number of which could represent the claimed "additional control circuitry." Additionally, Pienemann discloses that switch 23 is electrically coupled to the puff detector, and thus also constitutes "additional control circuitry." EX1006, 11:10-13 ("The control can be carried out, for example, via a puff detector, which reacts to the pressure change when the user announces air and causes the power supply to one of the zones 13 or 15 via a switching device").

342. For at least the reasons discussed in Section VIII.C.1 above, it would have been obvious to modify Kim to incorporate Pienemann's puff detector and electronic circuit 32 and control functionality.

22. Dependent Claim 21

343. The combination of Kim and Pienemann discloses claim 21 for the same reasons as discussed above for limitation [1.b] and as described above, a POSA would have made Kim's mouthpiece attachable to the outer housing.

23. Dependent Claim 22

344. The combination of Kim and Pienemann discloses claim 22 for the same reasons as discussed above for claim 8.

24. Dependent Claim 23

345. The combination of Kim and Pienemann discloses claim 23 for the same reasons as discussed above for claim 3.

25. Dependent Claim 24

346. The combination of Kim and Pienemann discloses claim 24 for the same reasons as discussed above for claim 4.

26. Dependent Claim 25

347. The combination of Kim and Pienemann discloses claim 25 for the same reasons as discussed above for claim 9.

27. Dependent Claim 26

348. The combination of Kim and Pienemann discloses claim 26 for the same reasons as discussed above for claim 10.

28. Dependent Claim 27

349. The combination of Kim and Pienemann discloses claim 27 for the same reasons as discussed above for claim 11.

29. Dependent Claim 28

350. The combination of Kim and Pienemann discloses claim 28 for the same reasons as discussed above for claim 12.

30. Dependent Claim 29

351. The combination of Kim and Pienemann discloses claim 29 for the same reasons as discussed above for limitation [1.b] and claim 15.

31. Dependent Claim 30

352. The combination of Kim and Pienemann discloses claim 30 for the same reasons as discussed above for claim 17.

D. Ground 4: The combination of Kim, Pienemann, and Susa renders obvious claims 1-30.

1. A POSA would have been motivated to combine Kim, Pienemann, and Susa

353. To the extent that the term "*smoking article*" is construed to mean "tobacco containing smoking article" (as discussed in Section V.E.2), then a POSA

would have been motivated to incorporate a tobacco component in the Kim-Pienemann device, as taught by Susa.

354. As noted above, Kim's porous chip (5) has "absorbed therein the volatile liquid composition of mixture of nicotine and volatile palatability enhancing agents." EX1007, [0015], [0004], [0014], [0017], [0019], Abstract. However, Kim does not provide additional detail regarding the liquid mixture (e.g., how to achieve a desired nicotine concertation or flavor agents, or a source of the nicotine in the mixture). A POSA would have thus looked to the prior art for guidance on this issue. Susa is such a prior art reference.

355. Like Kim, Susa discloses a container 32 for storing a liquid material 36 for generating a flavor to be inhaled but further explains that "a tobacco component, e.g., a tobacco extracted component or a tobacco smoke condensate component, may be contained in the liquid material 36." EX1018, 6:18-25. A POSA would have therefore recognized that Susa fills in additional details about the volatile liquid composition absorbed into Kim's liquid containing chip (5) (e.g., nicotine concentration and/or flavor agents, and nicotine source). And based on the teachings of Susa, it would have been obvious for the volatile liquid composition absorbed into Kim's liquid containing chip (5) to contain a tobacco component.

356. A POSA would not have experienced any unreasonable technical hurdles in combining Susa's teaching of a liquid containing a tobacco component

with Kim's volatile liquid composition. Indeed, a POSA would have known from Kim alone that the nicotine in the volatile liquid composition could come from tobacco. A POSA would have understood that implementing Kim's liquid containing chip (5) with a tobacco component would merely amount to combining prior art elements (Kim's liquid containing chip (5) and Susa's teaching of a liquid containing a tobacco component for nicotine) according to known methods (including a tobacco component in Kim's volatile liquid composition) to yield predictable results (e.g., a liquid containing nicotine and tobacco).

2. Independent Claim 1

(a) [1.P]

357. The combination of Kim, Pienemann, and Susa discloses the claimed "smoking article" because it would have been obvious for Kim's volatile liquid composition to include a tobacco component as taught by Susa. *See above* Section VIII.D.1.

(b) [1.a]-[1.g]

358. The combination of Kim, Pienemann, and Susa disclose the remainder of claim 1 for the same reasons discussed above for claim 1 in Ground 3.

3. Claims 2-30

359. The combination of Kim, Pienemann, and Susa disclose the remainder of claims 2-30 for the same reasons discussed above for claim 1 above and claims 2-30 in Ground 3, respectively.

In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed this 13th day of August, 2024.

Respectfully submitted,

Seetharama C. Deevi

Dr. Seetharama Deevi, Ph.D.