

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Former Group Art Unit: 1747	§	Petitioner: NJOY, INC.
Former Examiner: Dionne Walls	§	
Mayes		
Patent Owner: Fontem Holdings 1		
B.V.		

For: ELECTRONIC ATOMIZATION CIGARETTE

MAIL STOP PATENT BOARD
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United States Patent and Trademark Office
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DECLARATION OF DR. JOHN M. COLLINS

I, Dr. John M. Collins, hereby declare the following under penalty of perjury:

I. QUALIFICATIONS

1. I am the Chief Operating Officer at the Consortia for Improving Medicine with Innovation and Technology (CIMIT), which is a non-profit consortium of Boston's leading teaching hospitals and universities along with a growing list of affiliates. I am also Chief Technology and Innovation Officer for Reed Collins, LLC. I have worked at CIMIT since 2008. Much of my responsibility is to facilitate collaboration among scientists, engineers, clinicians and entrepreneurs to speed the discovery, development and implementation process of medical innovations. I focus specifically on assisting investigators in moving technologies from the lab into products and services that improve patient care. For example, I assisted the transition of a simulation technology that helps in the training of Army medics to a leading international simulation company. That product is now being marketed under the name Caesar by CAE Healthcare.

2. I received a Ph.D. (1988) and M.S. (1982) in mechanical engineering from the Massachusetts Institute of Technology (MIT), as well as a B.S. (1980) in mechanical engineering, with a minor in economics, from Rensselaer Polytechnic Institute (RPI). At MIT, I worked in the Fluids Lab under the direction of Professors Asher Shapiro and Roger Kamm. My academic work focused on heat/mass transfer,

with my thesis work applying these principles to pulmonary dynamics. My Master's thesis was on high frequency ventilation: at the time a novel way to ventilate babies without over-pressurization of the lung, which avoids damage to the lung. My Ph.D. thesis was on analytical and numerical modeling of forced exhalation from the lung. The results were a model of the lung that allowed for more sophisticated diagnostics based on the simple Forced Expiration Pulmonary Function (FEPF) test.

3. I have over 30 years of product design, development and consulting expertise covering a wide range of industries and products. Over that time, I have had a consistent focus on medical devices and related technologies, which includes my particular expertise in design, fluid mechanics and heat/mass transfer. In addition to doing engineering work, my responsibilities have included assembling and managing teams to develop new consumer, industrial and professional products. I have extensive expert witness testimony experience in patent litigation. My CV is attached as Appendix A.

4. I have been engaged in a wide variety of product design projects since starting my professional career in 1982. My experiences cover a broad technology base across a diverse set of industries—from clean energy/tech to consumer durables, with a career-long focus on medical devices. By way of example, while at Arthur D. Little, I was responsible for a team working in support of a Fortune 100 consumer products company developing an e-cigarette in the late 1990's into the early 2000's.

Before 2004, while at Arthur D. Little and TIAX, I was also responsible for several related projects that utilized the e-cigarette capillary aerosol generator type technology to atomize liquid fuel. One application was for a low-power, fuel based electric power generator (*see, e.g.*, Ex. 1048 (Pellizzari)) and another was for a clean emission “cold-start” fuel injector for automobiles (*see, e.g.*, Ex. 1049 (Pellizzari II)).

5. I have also performed services in numerous patent disputes as an independent technical expert and consultant and as an expert witness. I have consulted as an expert in matters involving the design of a variety of medical devices. *See* Appendix B for a representative list of matters in which I have consulted.

6. I also have experience as an innovator and inventor. I am a named inventor on more than 20 U.S. patents, with foreign counterparts in addition, on new products and manufacturing processes. *See* Appendix C.

7. Prior to 2008, I held various leadership positions at technology and product development companies. From 1982-1986, I worked at Booz, Allen & Hamilton, where I developed products such as the Regina Rug Scrubber, which utilized a venturi sprayer to dispense a soap and water solution evenly over floor surfaces. After taking time to return to MIT and complete my PhD, I was then employed by Arthur D. Little (ADL) from 1988-2002. I joined ADL as a design engineer and helped to form its medical products business. I progressed to being

responsible for the Technology and Innovation (T&I) Directorate, with more than 250 staff. From 2002-2008, I worked in close collaboration with CEO and owner, Dr. Kenan Sahin, to form TIAX from the resources of the ADL T&I Directorate. TIAX is a privately held technology transformation organization focused on advancing and developing technologies for commercialization in several core technology areas, including clean energy and materials, health and wellness, appliances and HVAC systems, and enhanced security. During my tenure at TIAX, part of which I served as president, the World Economic Forum recognized TIAX as a Technology Pioneer in 2002 and as a New Champion in 2007. For a full list of my prior employment history, see my CV, Appendix A.

8. I have been retained on behalf of Petitioner and real party in interest, NJOY, INC. (“Petitioner” or “NJOY”) to offer statements and opinions generally regarding the validity, novelty, prior art, obviousness considerations, and understanding of a person of ordinary skill in the art in the industry as it relates to Ruyan Investment (Holdings) Limited’s (“Ruyan”) U.S. Patent No. 8,490,628 (the ‘628 Patent). I have never been retained or employed by NJOY, Inc. in any capacity before this assignment. In fact, I have never met any NJOY employees at the time of this declaration.

9. I am being compensated at a rate of \$400 per hour for my services. My compensation does not depend on the outcome of this Petition or on the pending

litigation between Petitioner and Fontem Holdings in the U.S. District Court for the Central District of California.

10. In developing my opinions below relating to the ‘628 Patent, I have considered the materials cited herein, including those itemized in Appendix D.

II. THE ‘628 PATENT

11. The ‘628 Patent, entitled “Electronic Atomization Cigarette,” states that it was filed on July 27, 2012 and issued July 23, 2013, with a priority claim to Chinese Patent Application No. 20040031182.0, filed April 14, 2004. The ‘628 Patent generally purports to disclose an electronic atomization cigarette that functions as “substitutes for quitting smoking and cigarette substitutes.” *See* Ex. 1001 (the ‘628 patent) at 1:56-57. According to the ‘628 Patent, its “cigarette substitutes” are intended to provide nicotine without harmful carcinogens from smoking; they are also included to enhance nicotine absorption by a smoker, as compared to other nicotine sources such as nicotine patches, nicotine mouthwash, nicotine chewing gum, and nicotine drinks. *See, e.g.*, Ex. 1001 (the ‘628 patent) at 1:42-49. The so-called “cigarette substitutes” of the ‘628 Patent are also intended to work by inhalation so as to “satisfy habitual smoking actions of a smoker.” *See Id.* at 1:49-52.

12. The Challenged Claims are specifically directed to an electronic cigarette device that includes a housing within which there is an inlet and outlet, an airflow

channel, an atomizer, and a liquid supply. The atomizer includes a porous body projecting into the liquid supply, and a heating wire. The central axis of the heating wire is “substantially perpendicular to the longitudinal axis of the housing.” *See* Ex. 1001 (the ‘628 patent) at Claims 1, 7 and 8, Fig. 1, Fig. 6. As explained below, in my opinion, the electronic cigarettes taught and claimed in the ‘628 Patent provide nothing new -- no technology that was not already known in the electronic cigarette industry long before April 14, 2004. In fact, they are nothing more than well-known electro-thermo-fluid components that have been applied in other, similar fluid-based aerosol delivery systems.

13. The application leading to the ‘628 patent was filed with claims 1-16 on June 27, 2012 as a continuation of the application leading to U.S. Patent No. 8,393,331 (filed on November 11, 2010), which claims priority from Chinese Patent Application No. 20040031182.0 (filed April 14, 2004). In prosecution, Applicant acknowledged that relative to the examination of claims 1 (the Challenged Claim 1), 10, and 13 (corresponding to the Challenged Claim 7) “Figs. 4-6 and Col. 10, lines 5-25 of Brooks et al.- US Patent No. 4,947,875 disclose a heating element 18 disposed across an air passageway 83.” Applicant also argued that “Brooks et al. [*sic*] does not suggest remaining elements of the independent claims.” *See* Ex. 1002 (File History) at pp. 28-29 (July 27, 2012 Preliminary Statement). Applicant’s Request for Prioritized Examination (Track I or After RCE), filed July 27, 2012, was granted on August 13,

2012. *See Id.* p. 49. On December 12, 2012, the Examiner issued a restriction requirement alleging that pending claims 1-7, and 13 (claiming an electronic cigarette comprising a heating wire in the atomizer oriented substantially perpendicular to the longitudinal axis), claims 8-12 (claiming an electronic cigarette comprising a heating wire in the atomizer surrounded by the porous body), and claims 14-16 (claiming an electronic cigarette comprising a liquid storage body downstream in the flow path from the atomizer wherein the liquid in the liquid storage body moving in an upstream direction to the atomizer via capillary action) are directed to distinct species. *See Id.* p. 1265 (December 12, 2012, Restriction Requirement pp. 1263-1267). In response, Applicant elected claim 1-7 (corresponding to the Challenged Claims 1-6), and 13 (corresponding to the Challenged Claim 7). *See Id.* p. 1274 (January 10, 2013, Response to Election pp. 1274).

14. In a first amendment Applicant cancelled claims 6, 8-12, 14-16, and added new claim 17 (corresponding to Challenged Claim 8). Applicant also acknowledged that the new claim 17 (corresponding to Challenged Claim 8) “is similar” to claim 13 (corresponding to Challenged Claim 7) without the sensor. Additionally, Applicant removed the recitation of “source” from “liquid supply source.” *See Id.* p. 1279-1281 (January 25, 2013, Preliminary Amendment pp. 1278-1281). In a second amendment Applicant amended pending claims to recite “body” instead of “section.” *See Id.* pp. 1292-1293 (January 31, 2013, Second Preliminary

Amendment pp. 1291-1294). On April 24, 2013, the Examiner proposed amendments, to which Applicant agreed, to independent claims to “more clearly define said claims over the prior art [Brooks et al.]” and place the application in condition for allowance. *See Id.* p. 1312, Examiner-initiated Interview Summary. Consequently, on May 10, 2013, the Examiner issued a Notice of Allowance stating “[t]he closest prior art or record, specifically the Brooks et al reference (US. Pat. No. 4,947,875) [Ex. 1018], teaches an electronic cigarette comprising a housing having a longitudinal axis, an inlet and an outlet; an airflow channel in the housing connecting the inlet to the outlet; and a liquid supply in the housing; however, said reference neither teaches nor reasonably suggests an atomizer assembly in the housing including a porous body projecting into the liquid supply and a heating wire in the atomizer having a central axis oriented substantially perpendicular to the longitudinal axis of the housing. Hence, the claims are allowable over the prior art of record.” *Id.* at pp. 1319-1320 (May 10, 2013, Notice of Allowance pp. 1313-1321).

III. ONE OF ORDINARY SKILL

15. I have been instructed for purposes of this Declaration, and unless otherwise noted, to opine on the knowledge and understanding of one of ordinary skill in the art as of at least April 14, 2004. I understand that the factors that may be considered in determining the ordinary level of skill in the art include: (1) the level of education and experience of persons working in the field; (2) the types of problems

encountered in the field; and (3) the sophistication of the technology. I understand that a person of ordinary skill in the art is not a specific individual, but rather is a hypothetical individual having the qualities reflected by the factors above.

16. The field of art relevant to the '628 Patent is electronic cigarettes, and more particularly, devices and systems that aerosolize liquids with pharmacologically active ingredients, such as nicotine or other drug, for delivery to the lung of a user. In my opinion, a person of ordinary skill in the aspects pertinent to the '628 Patent would represent an individual or a team of individuals, each with commercial experience of three to five years in designing and developing consumer products with thermal management and fluid handling technologies. The individual's capabilities would include at least that of a B.S in Mechanical Engineering. My opinions are based on my engineering experience and my experience in forming and managing development engineering design teams, including the team contributing to the development of an electronic cigarette for a Fortune 100 consumer products company in the year 2000 timeframe. I base this opinion on the level of technical training required to reduce to practice the electronic cigarette embodiment described in the '628 Patent and the relevant prior art; my reading of the '628 Patent, relevant prior art, and technical literature associated with electro- and mechanical engineering generally and thermo-fluid as well as inhalation technologies more specifically, my own commercial experience in designing and developing consumer products with thermo-

fluid management features by at least April 14, 2004; my commercial experience working with these types of systems at ADL and TIAX; and my commercial experience consulting and managing in many cases involving these types of systems.

17. For purposes of this Declaration, unless otherwise noted, my statements and opinions below, such as those regarding my experience and the understanding of a person of ordinary skill in the art generally (and specifically related to the references I consulted herein), reflect the knowledge that existed prior to April 14, 2004, at the latest. As of April 14, 2004, I would have qualified as one of skill in the art according to the above definition.

IV. CLAIM CONSTRUCTION

18. For purposes of this declaration, I have been asked to assume constructions for certain claim terms as presented below. For all remaining claim terms, I have assumed their plain and ordinary meaning under the broadest reasonable interpretation consistent with (1) the specification and prosecution history of the ‘628 patent, and (2) usage by designers in the relevant field:

19. “Electronic Cigarette” (Claims 1-8) is construed as “a device for electrically generating nicotine based liquid aerosols, without tar, for inhalation by a user.” *See, e.g.*, Ex. 1001 (the ‘628 patent) at 1:16-19, 1:30-35, 1:37-40, 1:45-52, 2:1-5.

20. “Longitudinal Axis” (Claims 1-8) is construed as “an axis along the functional length.” *See, e.g.*, Ex. 1001 (the ‘628 patent) at Figs. 1, and 2.

21. “Air Flow Channel” (Claims 1-8) is construed as “a path for air to flow.” *See, e.g.*, Ex. 1001 (the ‘628 patent) at 1:61-63, 3:5-6, 3:15-17, 3:45-49, 3:59-61.

22. “Atomizer” (Claims 1-8) is construed as “a part of the electronic cigarette that includes components that convert liquid into aerosols.” *See, e.g.*, Ex. 1001 (the ‘628 patent) at Figs. 6-8, 2:48-3:7, 3:45-65, 4:8-21.

23. “Projecting into” (Claims 1 and 6) is construed as “positioned within.” *See, e.g.*, Ex. 1001 (the ‘628 patent) at Figs. 1-3, 2:43-45, 3:60-63.

24. “Central Axis” (Claims 1-8) is construed as “an axis running through the center.” *See, e.g.*, Ex. 1001 (the ‘628 patent) at Figs. 1, 2, and 6.

25. “Cavity” (Claim 3) is construed as “a hollow space within the atomizer separate from air flow passage.” *See, e.g.*, Ex. 1001 (the ‘628 patent) at Fig. 1, Fig. 3, Fig. 6, 2:45-49, 3:46-52.

26. “Bulge Section” (Claim 6) is construed as “an extension section.” *See, e.g.*, Ex. 1001 (the ‘628 patent) at Figs. 1-3, 2:43-45, 3:60-63.

27. “Extending into” (Claims 7 and 8) is construed as “positioned within.” *See, e.g.*, Ex. 1001 (the ‘628 patent) at 2:43-45, 3:60-63, Fig. 1-3, 6, and 8.

V. STATE OF ART BY 2004¹

28. Electronic Cigarettes (“e-cigarettes”) were well-known before April 2004. In fact, they have been well-known since at least the mid-1990s, as demonstrated by, for example, the Takeuchi, Cox, and Voges references, discussed below. Moreover, the basics of the technology involved in e-cigarettes have been known since the 1930’s. *See, e.g.*, Ex. 1004 (Whittemore, a vaporizer patent).

29. By April 14, 2004, a great deal was known about e-cigarettes and the variety of ways they could be designed. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 2:12-15; Ex. 1003 (Takeuchi, a simulated smoking article patent) at 1:12-13; Ex. 1014 (Higgins, an electrical smoking article patent) at 1:13-17; Ex. 1008 (Susa, a simulated smoking article patent) at ¶ 2-7; Ex. 1009 (Gilbert, a smokeless non-tobacco cigarette patent) at 1:7-12; Ex. 1037 (Cox, an electrical smoking system patent) at 4:15-25. Based on my experience, a person of ordinary skill in the art

¹ All figures and passages in the references cited herein are to be considered and included, as relevant. Any citations specific passages or figures are merely exemplary, and are not intended to limit the applicability of any reference.

would have known at least the following about the broad field of e-cigarettes at the time the '628 patent was filed.²

30. An e-cigarette is generally designed to replicate the function and user experience of a conventional cigarette. As a consumer product, it generally allows a user to inhale an aerosol that contains the desired constituents, including nicotine, and particle size distribution of cigarette smoke, without some of the harmful side-products of cigarette smoke, such as those shown to be carcinogenic. A skilled person knew that e-cigarettes came in different shapes and sizes, and that it was well-known that conventional drug delivery devices, such as inhalers, vaporizers, nebulizers, *etc.*, could be used to deliver nicotine. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 3:7-15 and 9:53-10:21; Ex. 1045 (Karl, an aerosol spray device patent) at 1:10-16; Ex. 1047 (Fuisz, an inhalation therapy device patent) at 6:7-28; Ex. 1046 (Hodges, an inhalation delivery of aerosols patent) at 8:4-10; Ex. 1023 (Nicotine Microaerosol Inhaler); Ex. 1009 (Gilbert, a smokeless non-tobacco cigarette patent) at 1:7-12, Fig. 1-2; Ex. 1003 (Takeuchi, a simulated smoking article patent) at 1:4-10; Ex. 1037 (Cox, an electrical smoking system patent) at 4:10-25.

² At various points in this declaration I refer to my opinions about the knowledge or understanding of a person of ordinary skill in the art. All of these opinions should be understood to refer to the knowledge or understanding of a person of ordinary skill in the art as of April 14, 2004, unless specifically noted otherwise.

31. An aerosol generally refers to a colloidal system of solid or liquid particles in a gas (*e.g.*, air). *See, e.g.*, Ex. 1053 (Winberg, a chemiluminescent aerosols patent) at 2:1-5. It was known that in drug-delivery applications the aerosol is made up of particles that are to be transported through the pulmonary tract to the deep lung where they can be absorbed by the blood stream. Aerosol particles should have a certain size range to be effective. An average mass median diameter of less than about 2 microns has been found to facilitate delivery deep into the lung. *See, e.g.*, Ex. 1023 (Nicotine Microaerosol Inhaler). Larger diameter particles have higher mass to aerodynamic drag ratios, and hence tend to impact and be deposited on the walls of the mouth, throat and airways. Similar sized aerosols also effectively deliver nicotine to an e-cigarette user. *Id.* Mechanisms metering liquids into small particles streams to produce these aerosols have been well known in the drug-delivery industry, and have been regularly used in conventional drug inhalers, vaporizers, nebulizers, *etc.*, including e-cigarettes. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 3:7-15, 9:53-10:21; Ex. 1003 (Takeuchi, a simulated smoking article patent) at 40-55; Ex. 1037 (Cox, an electrical smoking system patent) at 1:10-35; Ex. 1045 (Karl, an aerosol spray device patent) at 1:10-16, Ex. 1047 (Fuisz, an inhalation therapy device patent) at 6:7-28; Ex. 1046 (Hodges, an inhalation delivery of aerosols patent) at 8:4-10; Ex. 1008 (Susa) at ¶¶6, 29; Ex. 1018 (Brooks) at ¶¶1, 17. Hence, a skilled person would have found it obvious to replace the drug in a handheld drug-delivery device with nicotine and use it as an e-cigarette. Mechanisms for producing aerosols were also known in

the ink printing industry, and a skilled person knew that the teachings of the ink printing industry were directly applicable to e-cigarettes. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 3:62-4:67; Ex. 1008 (Susa, a simulated smoking article patent) at ¶ 2-7, 36.

32. E-cigarettes differ from regular cigarettes in the way aerosols are formed. In conventional cigarettes, the aerosol formation process is driven by the heat created by the combustion of tobacco. An e-cigarette generally is a device for electrically generating nicotine based liquid aerosols, without tar, for inhalation by a user. The liquid contains nicotine and a carrier as well as any desired flavoring or other ingredients. The e-cigarette therefore includes a means to store the liquid, create droplets from the liquid of the proper particle size distribution, entrain and disperse them in an air stream to generate aerosols, and enable the user to inhale the aerosols on demand.

33. As of at least April 2004, there were several known means to store liquid nicotine in e-cigarettes, many of which adapted technologies that stored liquid drug in drug inhalers or applied ink storage mechanisms from the neighboring field of ink-jet technologies. Early cigarette substitutes employed a liquid reservoir that contained liquid nicotine or other liquid extracts from a cigarette. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 5:59-61; Ex. 1003 (Takeuchi, a simulated smoking article patent) at 4:35-38, 5:28-32; Ex. 1008 (Susa, a simulated smoking article patent) at ¶ 35;

Ex. 1037 (Cox, an electrical smoking system patent) at 3:63-4:1, and 9:51-65. Many early cigarette substitutes also employed a porous carrier impregnated with a liquid nicotine containing composition through which an air stream could be drawn to volatilize nicotine. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 2:33-35; Ex. 1009 (Gilbert, a smokeless non-tobacco cigarette patent) at 1:14-22, 3:22-25; Ex. 1006 (St. Charles, an aerosol-delivery smoking article patent) at 3:38-48. It was well-known in the field of e-cigarettes to store or transport liquid in porous/fibrous bodies positioned inside the device. *See, e.g.*, Ex. 1007 (Adiga, a non-combustible smoking device) at 2:44-48, 3:1-3; Ex. 1009 (Gilbert, a smokeless non-tobacco cigarette patent) at 1:14-22, 3:22-25; Ex. 1041 (Howell, an aerosol generator patent) at 2:66-3:35. It was also well-known in the neighboring field of ink-jet printers to store liquid ink in containers including porous/fibrous materials, such as foam or porous sponge. *See, e.g.*, Ex. 1039 (Baker, a thermal ink jet pen patent) at Abstract, 1:48-65; Ex. 1012 (Gehrer, an ink container patent) at 3:7-15, 8:63-67. The small pores of a sponge act as small capillaries, causing it to absorb a large amount of liquid in a relatively small space, while providing sufficient pressure to control the flow of ink through capillary action and communication with atmospheric pressure without liquid leaking, preventing a vacuum from building in the storage area as the fluid is removed. *See, e.g.*, Ex. 1039 (Baker, a thermal ink jet pen patent) at Abstract, 1:48-65, 2:44-66. A skilled person also knew that porous bodies were used to control the flow of liquid through a liquid flow path. *See, e.g.*, Ex. 1042 (Cox '02, a flow rate controlled capillary

aerosol generator patent) at 5:43-45, 6:25-30, 8:16-28. Similarly, it was well-known in the field of fountain pens, which also use wick and capillary mechanisms and would have been recognized by a skilled person to provide teachings useful and applicable to e-cigarettes, to store ink in porous and/or fibrous bodies with a hand-held liquid delivery device. *See, e.g.*, Ex. 1050 (Schreur, a handheld marking device patent) at 3:3-10. Additionally, it would have been obvious to a skilled person that foam or sponge-type materials prevent sloshing of the liquid in a device, such as a drug-delivery device or an e-cigarette, which were handheld and carried around by a consumer, and maintain liquid contact with a wick regardless of the orientation of the device. *See, e.g.*, Ex. 1007 (Adiga, a non-combustible smoking device) at 2:44-48, 3:1-3, Fig. 1. Porous bodies were also known to be used within a liquid supply to prevent it from drying out and thereby keeping operational. *See, e.g.*, Ex. 1012 (Gehrer, an ink container patent) at 5:15-30, 8:20-35.

34. In addition to preventing sloshing and spilling, porous and/or fibrous bodies storing liquid were also known to be used for pressure equilibrium within a liquid supply to properly control liquid transport. *See, e.g.*, Ex. 1012 (Gehrer, an ink container patent) at Abstract, 2:24-47, 3:7-15, 8:63-67; Ex. 1039 (Baker, a thermal ink jet pen patent) at Abstract, 1:7-10, 1:48-58. Besides porous bodies, it was well-known to store liquid drug in flexible containers or pouches in pressurized systems. *See, e.g.*, Ex. 1037 (Cox, an electrical smoking system patent) at 11:31-40. A skilled person

would have known that flexible containers deform according to pressure conditions and that this may help to get the last remaining liquid out of the container. *See, e.g.*, Ex. 1037 (Cox, an electrical smoking system patent) at 4:62-5:18. Therefore, in view of the ubiquitous disclosure of porous/fibrous/flexible materials to store liquid, it would have been obvious to a skilled person to use any of these materials to store liquid within an e-cigarette with predictable results.

35. There were also several known means to create, from a liquid, droplets of the proper particle size distribution, entrain, and disperse them in an air stream to generate aerosols. Techniques that can aerosolize a small volume of liquid from the liquid supply, on demand (rapidly and at high frequency), are particularly suited to e-cigarettes and had long been known by 2004. One common technique includes high-pressure liquid sprays that can be rapidly turned on and off. *See, e.g.*, Ex. 1037 (Cox, an electrical smoking system patent) at 1:62-2:6. Common technique atomized liquid drug or nicotine into aerosols on-demand. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 1:11-13; Ex. 1003 (Takeuchi, a simulated smoking article patent) at 1:39-43, 1:59-64; Ex. 1037 (Cox, an electrical smoking system patent) at 1:19-25; Ex. 1023 (Nicotine Microaerosol Inhaler); Ex. 1054 (Egilmex, a nicotine dispensing aerosol device patent) at 1:25-30, 2:38-45. An atomizer has components used to convert liquid into aerosols and generally includes a hollow space where liquid from the liquid supply is transported and aerosolized. Common techniques for converting

liquid into aerosols included using heating and/or piezoelectric elements. These components can be located in any part of the atomizer so as to contact the transported liquid directly or indirectly. It was also well known that these elements can be used independently or combined together to convert liquid into aerosols. *See, e.g.*, Ex. 1004 (Whittemore, a vaporizing unit patent) at Fig. 2,3; Ex. 1011 (Voges, an electronic cigarette patent) at 3:62-4:33, 10:51-65; Ex. 1008 (Susa, a simulated smoking article patent) at Figs. 8-16; Ex. 1003 (Takeuchi, a simulated smoking article patent) at Figs. 3-7; Ex. 1037 (Cox, an electrical smoking system patent) at Figs. 1, 4. In fact, the '628 specification acknowledges it by stating that these elements can be used in any combination, such as (1) piezoelectric and heating element together, (2) heating element alone, or (3) piezoelectric element alone, without offering any implementation details or any suggestion that one configuration is better than another. *See, e.g.*, Ex. 1001 (the '628 patent) at 4:7-20

36. One known method of creating aerosolized liquid particles was to use piezoelectric elements to generate high frequency standing waves on the fluid-gas interface that break liquid into very small droplets. *See, e.g.*, Ex. 1044 (Fang, an apparatus for depositing a low vapor pressure copper precursor onto a silicon wafer patent) at 4:52-65; Ex. 1038 (Sekiya, a bubble jet printer patent) at 1:41-53; Ex. 1008 (Susa, a simulated smoking article patent) at ¶¶7, 31, 44. The droplets can form the aerosol or they can be further conditioned to form an aerosol with smaller particles.

Another common approach was to utilize heaters, with low thermal mass and sufficient capacity to deliver the needed power, to rapidly vaporize the liquid. Such heaters were able to rapidly reach temperatures that vaporized the immediately surrounding liquid while the power is applied, and then rapidly cooled to stop the vaporization process once the power was removed. The high temperature vapor then condensed and consolidated into small particles to form an aerosol. *See, e.g.*, Ex. 1037 (Cox, an electrical smoking system patent) at 2:43-45, 2:58-3:9; Ex. 1003 (Takeuchi, a simulated smoking article patent) at 5:1-20. It was also well-known that the volumetric concentration of particles in the aerosol generated by these techniques can be too high for direct inhalation with an e-cigarette. Accordingly, mixing air was introduced into the e-cigarette housing to manage the volumetric concentration of the aerosolized particles and to convey them to the mouthpiece for inhalation. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 6:19-21, 7:4-14; Ex. 1008 (Susa, a simulated smoking article patent) at ¶¶37, 40, 51, 60; Ex. 1037 (Cox, an electrical smoking system patent) at 6:9-30.

37. On-demand formation of small droplets from a liquid supply was also well-known in the neighboring field of “ink-jet” printing, through either piezoelectric or thermal “bubble-jet” techniques, and were known to be applicable to e-cigarettes. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 3:66-4:5; Ex. 1008 (Susa, a simulated smoking article patent) at ¶¶35-36. Atomizers for piezoelectric ink-jet

printing included piezoelectric elements that act like a mini-pump to eject liquid from a contained volume by utilizing electrically induced change in shape of the contained volume. *See, e.g.*, Ex. 1008 (Susa, a simulated smoking article patent) at ¶¶7, 31, 35, 44. Atomizers for thermal “bubble-jet” printing included heaters that act like a mini-gun to eject a column of liquid by generating a momentary high-pressure bubble of gas at the base of the column, which is open at the top. Ex. 1011 (Voges, an electronic cigarette patent) at 4:5-35.

38. Commonly known atomizers included transport mechanisms to replenish the aerosolized liquid in the atomizer chamber or cavity. A well-known technique involved the use of a capillary flow path from the liquid supply to the atomizer. For example, using a porous wick as the capillary flow path has been known since as early 1930s. *See, e.g.*, Ex. 1004 (Whittemore, a vaporizing unit patent) at 1:50-2:25. 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. *See, e.g.*, Ex. 1055 (Mallonee, a liquid transfer wick patent) at 1:18-35. When one end of a capillary tube is placed in the liquid supply, a contact angle occurs between the liquid and an inner wall of the capillary tube, with surface tension pulling the liquid inside the tube until there is an opposing force overcoming the surface tension force. A well-known technique to aerosolize liquid transported in the capillary tube was to dispose

piezoelectric, heating elements, or a combination of piezoelectric and heating elements at the other end of the capillary tube, either surrounding the tube or inside the tube. *See, e.g.*, Ex. 1003 (Takeuchi, a simulated smoking article patent) at 2:13-16; Ex. 1037 (Cox, an electrical smoking system patent) at 2:28-43, 4:39-45; Ex. 1038 (Sekiya, a bubble jet printer patent) at Fig. 4A-4G. Capillary action draws liquid from the liquid supply to replenish the area within the tube vacated by the aerosolized liquid. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 4:11-17; Ex. 1038 (Sekiya, a bubble jet printer patent) at Fig. 4A-4G, 6:30-38; Ex. 1003 (Takeuchi, a simulated smoking article patent) at 5:47-52.

39. It was well-known that liquid drawn into a capillary tube by capillary action can be adjusted by properly selecting the material and pore size of the capillary tube according to the liquid's surface tension and wetting properties. *See, e.g.*, Ex. 1003 (Takeuchi, a simulated smoking article patent) at 2:17-25, 3:42-4:8; Ex. 1025 (Kaufman, a fluid dispensing utensil patent) at 11:23-37. It was also well-known to combine a pressurized system with the existing capillary action to further modulate the rate at which the liquid is being transported in the atomizer. *See, e.g.*, Ex. 1037 (Cox, an electrical smoking system patent) at 4:62-18. A skilled person would have understood that the net amount of liquid within the capillary tube would be determined by the sum total of the forces, such as external pressure, gravity, capillary force, *etc.*, acting on the liquid supply and the capillary tube. *See, e.g.*, Ex. 1003

(Takeuchi, a simulated smoking article patent) at 3:62-4:3. Similarly, capillary action has been used for decades to draw ink to the tips of fountain pen nibs from a reservoir or cartridge inside the pen, *see, e.g.*, Ex. 1030 (Daugherty, a fountain pen patent); Ex. 1050 (Schreur, a handheld marking device patent) at 4:42-45, or to transport ink from a liquid supply to printing heads in ink-jet printers, *see, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 4:6-34; Ex. 1012 (Gehrer, an ink container patent) at Abstract. As discussed earlier, a skilled person would have known that these teachings were applicable in the e-cigarette industry. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 3:62-4:65; Ex. 1008 (Susa, a simulated smoking article patent) at ¶2, 7, 36.

40. It was well-known that the piezoelectric or heating elements could advantageously be made from materials that would have been robust under the elevated operating temperatures; so that they would not be unduly oxidized and would not change their electrical resistance. In addition, a heating element could be selected such that its thermal expansion characteristics advantageously precluded undue mechanical stresses as the temperature cycles from hot to cool. Heating elements made of platinum, nickel chromium, iron chromium aluminum containing rare earth elements were well-known to be acceptable choices because these elements demonstrated such favorable properties. *See, e.g.*, Ex. 1041 (Howell, an aerosol generator patent) at 3:52-4:11; Ex. 1043 (Ims, a thermal ink jet printer patent) at 7:1-3,

7:42-44; Ex. 1014 (Higgins, an electrical smoking article patent) at 4:25-46. It would also have been well-known to a skilled person that heating and piezoelectric elements came in different shapes, such as coils, straight wires or rods, thin film wires, plates, *etc.* And, selecting any shape over another would have been an obvious design choice. *See, e.g.*, Ex. 1003 (Takeuchi, a simulated smoking article patent) at Figs. 3-7, Ex. 1018 (Brooks, an aerosol drug delivery article patent) at 1:19-32, 2:9-17, 2:42-3:4, 13:19-32; Ex. 1004 (Whittemore, a vaporizing unit patent) at Fig. 2,3; Ex. 1008 (Susa, a simulated smoking article patent) at Figs. 8-16; Ex. 1005 (Schuster, a portable device for delivering drugs patent) at 9:1-24.. It was also a common practice, for example, in the semiconductor industry, to implement thin film resistors using thin film wires. Furthermore, since metal wires have resistances, a skilled person would have understood that thin film resistors, necessarily, and thus inherently, include thin film wires which are necessarily wires. *See, e.g.*, Ex. 1034 (Kanke, a thin film resistor patent); Ex. 1035 (Dux, a method to fabricate thin film wiring structures patent); Ex. 1036 (Emmma, a semiconductor integrated circuit fabrication patent). Similarly, their location and orientation within an e-cigarette housing would also have been a well-known and obvious design choice. *See, e.g.*, Ex. 1004 (Whittemore, a vaporizing unit patent) at Fig. 2,3; Ex. 1008 (Susa, a simulated smoking article patent) at Figs. 8-16; Ex. 1003 (Takeuchi, a simulated smoking article patent) at Figs. 3-7; Ex. 1037 (Cox, an electrical smoking system patent) at Figs. 1, 4. Such elements can also be easily powered by simple DC sources, such as disposable or rechargeable consumer

batteries, making them ideal for a consumer product. Widespread availability and ubiquitous knowledge about the materials and shapes of the heating and/or piezoelectric elements would have advantageously allowed a skilled person to design and manufacture a low-cost and robust e-cigarette. Furthermore, a skilled person would have known that widely known orientation, location, and structure of these elements allowed most efficient design of an e-cigarette based on several criteria, such as maximizing the contact of the heating or piezoelectric element with the liquid material, maximizing efficiency of an e-cigarette, minimizing air flow obstruction, *etc.* Therefore, it would have been obvious to a skilled person to replace, combine, orient, or locate them in any manner that suits a particular e-cigarette design, and a skilled person would have recognized and found it obvious that each of these could be selected, utilized, and applied with straightforward, predictable results.

41. It was also well known that these elements can also be easily controlled by standard, low-cost electronic circuits. It was standard practice to use these elements with circuits coupled with simple electronic sensors, such as pressure actuated switches, *etc.* See, e.g., Ex. 1011 (Voges, an electronic cigarette patent) at 6:8-11; Ex. 1003 (Takeuchi, a simulated smoking article patent) at 6:23-6:25; Ex. 1037 (Cox, an electrical smoking system patent) at 5:51-54. It was well-known that, for example, sensors can detect conditions such as when negative pressure is generated within the device by the act of inhalation. When the user places the e-cigarette to

his/her lips and inhales, it draws air into the device. The airflow creates a pressure drop through the e-cigarette that is detected by the pressure sensor and signals to the electronic circuit the need to power the piezoelectric or heating elements and generate aerosol. The airflow entrains the generated aerosol to carry the particles into the mouth and pulmonary tract. Further, it was well-known that logic within the circuit can be applied to turn the power to the aerosol generator on and off as desired. *See, e.g.*, Ex. 1037 (Cox, an electrical smoking system patent) at 4:52-61; Ex. 1011 (Voges, an electronic cigarette patent) at 6:52-57; Ex. 1003 (Takeuchi, a simulated smoking article patent) at 6:55-59. A skilled person would have understood that any kind of control circuits, digital or analog, controlling sensors, LEDs, commonplace components of electronic circuits, such as microchips, microprocessors, Read Only Memory (ROM), Read and Write Memory (RAM), clocks, power supply and the like, or a combination of any of the above, are typically implemented on an electronic circuit board and thus necessarily, and inherently, include electronic circuit boards. *See, e.g.*, Ex. 1031 (Ghosh, a method of attaching a microchip to a circuit board patent); Ex. 1032 (Wood, an inhaler device patent); Ex. 1024 (Bremenour, a memory cartridge for a circuit board patent). In the alternative, these components are widely available and an ordinarily skilled person would have found it obvious to combine and use them in any way necessary.

42. Further, any person of ordinary skill would have known that electronic circuits were used to determine the state of a device, provide control functions and perform a variety of other functions such as providing feedback to the user on the state of the device via simple electronic indicators. “When the cigarette is not smoked, the valve plate is disconnected from the power source contactor, when the cigarette is smoked, the valve plate is sucked away from the gas inlet to contact the power source contactor for conduction, and the indicator lamp glows.” *See* Ex. 1022 (Hongbin, an electronic cigarette patent) at p.8. Indicator lamps, such as LEDs (light emitting diodes), were well-known in the art. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 7:47-50; Ex. 1003 (Takeuchi, a simulated smoking article patent) at 7:2-7; Ex. 1037 (Cox, an electrical smoking system patent) at 7:31-8:4. Therefore, it would have been obvious to a skilled person to use an LED not only to indicate the status of the liquid fill but also to simulate the lighted aspect of a cigarette. *See, e.g.*, Ex. 1022 (Hongbin, an electronic cigarette patent) at pp. 6, 8, element 8. Furthermore, it would have been obvious to a skilled person that LEDs could be attached to any part of the e-cigarette housing and would have been a straightforward design choice.

VI. INVALIDITY OF THE CHALLENGED CLAIMS OF THE '628 PATENT BASED ON PRIOR ART UNDER 35 U.S.C. § 103

43. I have been advised that if each and every element or step of a claim is disclosed within the “four corners” of a prior art reference, that claim is said to be

“anticipated” by that single prior art reference and is invalid under 35 U.S.C. § 102 because the claimed invention is not, in fact, new or novel.

44. I also have been advised that a prior art reference can disclose a claim feature because the feature is expressly described, or because the feature is inherent in the disclosure. I understand that something is inherent in a prior art reference if the missing descriptive matter must necessarily be present, and it would be so recognized by a person of ordinary skill in the art. I also understand that inherency cannot be established by probabilities or possibilities, and that the mere fact that something may result from a given set of circumstances is not sufficient to show inherency.

45. I also have been advised that a prior art document can disclose a claim feature, and anticipate a claimed invention, if that feature is described in another document that has been incorporated by reference. I understand that, to incorporate by reference, the host document must identify with detailed particularity what specific material it incorporates and clearly indicate where that material is found in the incorporated document. I also understand that, in making the determination of the extent to which material is incorporated into a host document, the standard of a person skilled in the art should be used to determine whether the host document describes the material to be incorporated by reference with sufficient particularity.

46. I understand that a claim may be invalid under § 103(a) if the subject matter described by the claim as a whole would have been obvious to a hypothetical person of ordinary skill in the art in view of a prior art reference or in view of a

combination of references at the time the claimed invention was made. Therefore, I understand that obviousness is determined from the perspective of a hypothetical skilled person and that the asserted claims of the patent should be read from the point of view of such a person at the time of claimed invention was made. I further understand that a hypothetical skilled person is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent in suit and all analogous prior art, *see* ¶48.

47. I also understand that an analysis of whether a claimed invention would have been obvious should be considered in light of the scope and content of the prior art, the differences (if any) between the prior art and the claimed invention, and the level of ordinary skill in the pertinent art involved. I understand as well that a prior art reference should be viewed as a whole.

48. I understand that in considering whether an invention for a claimed combination would have been obvious, I may assess whether there are apparent reasons to combine known elements in the prior art in the manner claimed in view of interrelated teachings of multiple prior art references, the effects of demands known to the design community or present in the market place, and/or the background knowledge possessed by a person having ordinary skill in the art. I also understand that other principles may be relied on in evaluating whether a claimed invention would have been obvious, and that these principles include the following:

- A combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results;
- When a device or technology is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or in a different one, so that if a person of ordinary skill can implement a predictable variation, the variation is likely obvious;
- If a technique has been used to improve one device, and a person of ordinary skill in the art would have recognized that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill;
- An explicit or implicit teaching, suggestion, or motivation to combine two prior art references to form the claimed combination may demonstrate obviousness, but proof of obviousness does not depend on or require showing a teaching, suggestion, or motivation to combine, *see, e.g.*, Manual of Patent Examining Procedure § 2143. G;

- Market demand, rather than scientific literature, can drive design trends and may show obviousness;
- In determining whether the subject matter of a patent claim would have been obvious, neither the particular motivation or the avowed purpose of the named inventor controls;
- One of the ways in which a patent's subject can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims;
- Any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed;
- "Common sense" teaches that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle;
- A person of ordinary skill in the art is also a person of ordinary creativity, and is not an automaton;

- A patent claim can be proved obvious by showing that the claimed combination of elements was “obvious to try,” particularly when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions such that a person of ordinary skill in the art would have had good reason to pursue the known options within his or her technical grasp; and
- One should be cautious of using hindsight in evaluating whether a claimed invention would have been obvious.

49. I have been asked to consider the validity of the challenged claims. I have concluded that each of the challenged claims is invalid at least under 35 U.S.C. §103 based on the references described below and as outlined in the claim charts, attached hereto as Appendices E-G.

A. TAKEUCHI

50. U.S. Patent 6,155,268 (“Takeuchi,” Ex. 1003), entitled “Flavor-Generating Device” was granted December 5, 2000 and was filed on July 23, 1998. I have analyzed the Takeuchi reference and understand it to be prior art under 35 U.S.C. §102(b), because it published more than one year before 2004. Takeuchi is assigned to Japan Tobacco Inc. which is one of the leading international cigarette

manufacturing companies. This further indicates that leading cigarette manufacturing companies fully understood that Takeuchi's invention could be used in the field of e-cigarettes. A skilled person reviewing Takeuchi would be familiar with the Gilbert and Adiga references, as discussed below, as well as with Susa (Ex. 1008), Whittemore (Ex. 1004), Voges (Ex. 1011) and Gehrler (Ex. 1012), the full range of teachings they contain, and any of the combinations involving Susa, Whittemore, Voges and Gehrler, as illustrated in this Declaration.

51. Takeuchi discloses a “flavor-generating device for enjoying simulated smoking.” This flavor is inhaled by a user after it has been volatilized from a heated liquid. In particular, the disclosed Takeuchi system includes “heating a liquid flavor source without relying on combustion.” *See, e.g.*, Ex. 1003 at 1:3-8. A skilled person would definitely have considered Takeuchi as highly relevant to the design of an e-cigarette in the early 2000's, because Takeuchi explicitly teaches a “flavor-generating device for enjoying simulated smoking”. *Id.* Takeuchi's simulated smoking inhalers include all the same standard components within the housing as recited in the '628 Patent, including a housing having a longitudinal axis with an inlet and an outlet, a liquid supply in the housing, an air flow channel in the housing connecting the inlet to the outlet, a battery, an electronic circuit board, a sensor, an atomizer assembly (*e.g.*, 121, 42, 36) with a porous body (*e.g.*, 36) projecting into the liquid supply (*e.g.*, 34) and a heating wire (*e.g.*, 42) having a central axis oriented substantially perpendicular to the longitudinal axis of the housing. *See e.g.*, Ex. 1003 at Fig. 1, 2B, 8 and related

discussion at 4:26 *et seq.* In view of Takeuchi's disclosure and common knowledge, a skilled person would have understood that the liquid supply could include a porous body, such as a foamed structure, or fibrous materials. A skilled person would also have understood that Takeuchi's mouthpiece could be detachably inserted into the housing using one of many well-known mechanisms, such as using screws. *See e.g.*, Ex. 1009 (Gilbert) at 3:4-8 and Fig. 9. The "liquid" delivered by the Takeuchi device "contain[s] tobacco components such as tobacco extracts and a tobacco smoke condensate." *See e.g.*, Ex. 1003 at 5:40-46. A skilled person would have understood that nicotine is a tobacco component and, for example, can be extracted from tobacco and delivered in liquid form as a cigarette substitute. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 2:12-14, generally 2:12-67; Ex. 1024 (Kuriyama, cigarette-like snuff patent) at 2:25-3:10. I have reviewed Takeuchi's reference and noticed that it contains a simple typographical error. Although the Figures 1, 2A, 2B, 2C, 6, and 7 show element 36b as the outlet port, Takeuchi's specification erroneously describes 36a as the outlet port, other than in Col. 8—line 50 where it is correctly described as the lower end of the capillary tube.

52. Takeuchi's Fig. 2B clearly shows liquid droplets along with liquid vapors are formed within outlet port 36b. Therefore, in view of Takeuchi's disclosure and Fig. 2b, a skilled person would have understood that aerosolization of the liquid flavor source 34 occurs inside the capillary tube 36, within the outlet port 36b of the capillary tube 36. *See, e.g.*, Ex. 1003 at Fig. 2b. Therefore, in its simplest embodiment,

a skilled person would have understood that, according to the definition discussed above (§22 of this declaration) and Takeuchi's Fig. 2B, atomizer could just include components 42, 36b, and 36 because these are the components of Takeuchi's device that convert liquid into aerosols. In the alternative, I consider that the atomizer disclosed in Takeuchi includes the capillary tube 36, including the outlet port 36b along with the upper chamber 121 where the aerosols are entrained in air and subsequently inhaled by a user through a mouthpiece. A skilled person would have understood that the entire upper chamber 121, starting from the inlet 18 and extending to the holder 14, is included in the atomizer because it is a part of Takeuchi's device that includes components, *e.g.*, 42, 36b, 36 that convert liquid into aerosols. In yet another alternative, a skilled person would also have recognized that the atomizer may only include part of the upper chamber 121, starting from the squeeze plate 24 instead of the inlet 18 and extending to the holder 14, and still includes components, *e.g.*, 42, 36b, 36 that convert liquid into aerosols.

53. As noted in §25 of this declaration, for the purpose of this declaration I have been asked to assume that a "cavity" is defined as a hollow space within the atomizer separate from the air flow passage. Therefore, a skilled person would have understood that at least the hollow space within the outlet port 36b in Takeuchi is a cavity. This cavity is arranged within the atomizer (see above) and is separate from the air flow passage. *See, e.g.*, Ex. 1003 at Fig. 1. Takeuchi's atomizer (*e.g.*, 121, 42, 36) includes a porous body, capillary tube 36, projecting into the liquid supply (*e.g.*,

32, 34) and the heating unit 42. Takeuchi teaches that the capillary tube 36 could be a pore structure, such as an open cell foamed structure or bundled fibers, through which the liquid may be transported by the capillary force. *See, e.g.*, Ex. 1003 at 3:36-49. The liquid from the liquid supply enters the capillary tube 36 through the projected part of the tube, *i.e.* inlet 36a. In fact, Takeuchi teaches that “the inlet of the liquid passageway reach[es] the *possible lowest level* of the liquid flavor source in the container.” *See, e.g.*, Ex. 1003 at 4:12-15. Therefore, a skilled person would have understood that the projected part, *i.e.* 36a, includes a bulge section, as defined in ¶26, at least because it is an extension of the atomizer. A skilled person would have further found it obvious and advantageous to vary the shape and orientation of the projecting section 36 in order to increase the contact area between the atomizer and the liquid supply allowing easier liquid transport.

54. In terms of the structure and function of the heater element 42 in Takeuchi, from Takeuchi’s disclosure, a skilled person would have understood that the functional length of Takeuchi’s device extends from intake port (18) to inhalation port (22) because air enters through the intake port (18), entrains aerosols in cooling chamber 21, and exits through the inhalation port 22. *See, e.g.*, Ex. 1003 at 4:48-5:20 and Fig. 1. Therefore, a skilled person would have recognized that the longitudinal axis of Takeuchi’s housing runs parallel to the functional length of the device, *i.e.* from the inlet (18) to the outlet (22). As discussed in ¶24 above, a skilled person would have further recognized that the axis running through the center would be a “central

axis.” A skilled person would also have recognized that the functional length of Takeuchi’s device (*e.g.*, intake port (18) to the inhalation port (22)) is perpendicular to the tube 36 of the atomizer and, accordingly, to the heater element (42) disposed on the tube’s upper end (36b). Takeuchi discloses that its heating element includes a “rod-like heater 74” inserted into the outlet port 36b of the capillary tube 36. *See, e.g.*, Ex. 1003 at 8:22-24, Fig. 4. In view of this teaching, a skilled person would have understood that the central axis of the rod-like heater 74 runs parallel to the capillary tube 36 and perpendicular to the functional length (*i.e.*, central axis) of Takeuchi’s device. Hence, to a skilled person, the central axis of the rod like heater 74 is perpendicular to the longitudinal axis of Takeuchi’s device. Furthermore, Takeuchi teaches that the placement of the heater element is an obvious design choice. For example, Takeuchi’s Fig. 1 depicts a heating element (*e.g.*, 42) disposed outside the capillary tube (*e.g.*, 36) whereas Figs. 4-5 depict a heating element 74 or 76 placed within the outlet port (36b). *See, e.g.*, Ex. 1003 at Fig. 4-7, 8:19-36. Takeuchi also teaches several possible design modifications of its simulated smoking article. One of these design modifications is shown in Figure 8 where the liquid supply is shown parallel to or alongside the air flow channel, *i.e.* from the inlet (18) to the mouthpiece (161).

55. I have reviewed Gilbert (Ex. 1009), a U.S. Patent titled “Smokeless Non-Tobacco Cigarette,” which was issued on August 17, 1965 and filed on April 17, 1963. Gilbert is prior art to ‘628 because it was published before April 14, 2004. Like

Takeuchi, Gilbert is generally directed to an article of manufacture “resembling a cigarette.” *See, e.g.*, Ex. 1009 at 1:14-22. Gilbert teaches that a mouthpiece is affixed, preferably detachably, to a proximal end of the smokeless cigarette using any appropriate method, such as screw threads. *See, e.g.*, Ex. 1009 at 2:16-20. Even apart from the express teachings of Gilbert, it was well-known to a skilled person to detachably connect two mechanical components using screw threads. Since Takeuchi suggests that its mouthpiece can be detachably inserted into its upper chamber, a skilled person would have found it obvious to use conventional screw threads, such as those taught in Gilbert, in implementing Takeuchi’s mouthpiece.

56. I have also reviewed Adiga (Ex. 1007), a U.S. Patent titled “Non-Combustible Smoking Device and Fuel Element,” which was filed on October 24, 2001 and issued on July 29, 2003. Adiga is prior art to ‘628 because it was filed before April 14, 2004. Adiga discloses a non-burning smoking article including a fuel element and a flavor-generating material. *See, e.g.*, Ex. 1007 at 2:38-43. The fuel element includes a porous/fibrous fuel cartridge, a wick, and a glow element. In use, the glow element is lit with a lighter, and liquid fuel is drawn into the glow element by capillary action along the wick and is then vaporized. *See, e.g., Id.* at 3:31-36. Adiga teaches: “The fuel cartridge 24 is generally a porous media, such as, cellulose acetate, low density polyethylene, ethyl vinyl acetate, carbon filters, *cotton, or other fabric materials.*” *See* Ex. 1007 at 3:1-3.

57. Takeuchi states that “[i]t is desirable for the opening 33 to be formed at the highest position of the container 32 during the ordinary operation of the flavor-generating device and to have a sufficiently small diameter so that the liquid flavor source 34 *may not leak* to the outside there through *even if the device is inadvertently turned upside down.*” See Ex. 1003 (Takeuchi) at 5:62-6:1. A skilled person would have recognized from this suggestion in Takeuchi’s express teachings that it would have been beneficial to prevent liquid flavor source from sloshing and leaking out of the opening in the liquid container of Takeuchi’s flavor generating device. Adiga teaches: “The fuel cartridge 24 is generally a porous media, such as, cellulose acetate, low density polyethylene, ethyl vinyl acetate, carbon filters, *cotton, or other fabric materials.*” See Ex. 1007 (Adiga) at 3:1-3. A skilled person would have recognized that the presence of Adiga’s fibrous/porous materials, such as carbon filters, cotton, or other fabric materials in Takeuchi’s liquid flavor source would have substantially reduced sloshing and leaking of Takeuchi’s liquid material. Although Adiga teaches storing liquid fuel instead of liquid drug, a skilled person would have understood that there are several similarities between the mechanism and structure of Adiga and Takeuchi. First, Takeuchi and Adiga are both directed to handheld devices. Second, Takeuchi and Adiga both use capillary action to transport liquid (Takeuchi’s drug or Adiga’s fuel) from a first end of a capillary tube, such as a wick projecting into a liquid supply, to a second end surrounded by a heating element, *see, e.g.*, Ex. 1003 at 2:17-40; Ex. 1007 at 2:44-66. Third, Takeuchi and Adiga both discuss heating the second end of

the tube to vaporize the liquid, *see, e.g.*, Ex. 1003 at 5:1-20; Ex. 1007 at 3:30-41.

Therefore, in part because of these similarities between Adiga and Takeuchi, a skilled person would have recognized the applicability of Adiga's teachings of a porous/fibrous cartridge, and would have found it obvious and straightforward to use them to store Takeuchi's liquid material to reduce sloshing and prevent spilling out of the opening in Takeuchi's liquid container.

58. I have reviewed, analyzed and endorse the claim charts attached to the IPR petition which show that the Takeuchi reference, alone or in combination with the cited teachings known to a skilled person, discloses each of the claimed limitations in the '628 patent. My opinion is based on, among other things, the knowledge of a person or ordinary skill in the art, as set forth in ¶¶ 28-49, 82, including the prior art teachings of Susa, Whittemore, and Adiga as set forth in ¶¶ 59-70, and the prior art teachings of Voges, Voges II, the "Thermal Ink-Jet Print Cartridge Designers Guide," and Gehrler as set forth in ¶¶ 71-81. I also agree with the combination of Takeuchi with the teachings of the prior art references, Gilbert and Adiga, because (1) a skilled person would have recognized that Gilbert discloses a mouthpiece in a cigarette like device that could be attached to the device housing using screws, and (2) Adiga discloses a porous body to store liquid which a skilled person would have recognized would be suitable to advantageously prevent spilling and sloshing of Takeuchi's liquid flavor source and liquid nicotine in an e-cigarette. Because the Takeuchi, Gilbert, and Adiga references are public prior art to the '628 patent, I agree that all the claims of

the ‘628 patent are invalid as at least being obvious. Further, to the extent it is argued that any limitation of these claims is not disclosed, expressly or inherently, in one or more of Takeuchi, Gilbert, and Adiga, it would at minimum have been obvious to include such a limitation based on the knowledge of a skilled person in light of the express teachings of these references.

B. SUSA

59. Susa (Ex. 1008), a European Patent Application titled “Flavor Producing Article,” was filed on June 9, 1997 and published on June 3, 1998. Susa is prior art to the ‘628 Patent because it was published more than a year before April 14, 2004. Susa discloses an electrically powered flavor generating device for “simulated smoking” which discharges a liquid material, such as tobacco smoke condensate, for inhalation by a user. *See, e.g.*, Ex. 1008 at ¶30. Susa’s invention is also assigned to Japan Tobacco—a major cigarette manufacturing company—and also includes Manabu Takeuchi as an inventor, the first named inventor of U.S. Patent 6,155,268 (Ex. 1003 (Takeuchi)). Susa’s flavor generating article includes a casing, a material container for storing the liquid material, a discharge head, an electrically powered ceramic heater, a sensor, and a control circuit. *See, e.g.*, Ex. 1008 at Abstract. A skilled person reviewing Susa would be familiar with the Whittemore and Adiga references, as discussed below, as well as with Takeuchi (Ex. 1003), Voges (Ex. 1011) and Gehrer

(Ex. 1012), the full range of teachings they contain, and any of the combinations involving Takeuchi, Voges and Gehrler, as illustrated in this Declaration.

60. Susa's device operates when the user inhales on a suction port (22) on the device. Susa's sensor generates a signal to the control circuit that the user is inhaling on the device. In response, the control circuit energizes the ceramic heater (42) and actuates a discharge drive. The discharge drive discharges droplets of the liquid material onto the ceramic heater, which in turn vaporizes the liquid material. *See, e.g.*, Ex. 1008 at ¶38. Air enters through air intake ports 24, entrains the vaporized liquid and the condensating droplet aerosol in a gas flow path (26), and is inhaled by a user at the suction port (22). *See, e.g.*, Ex. 1008 at ¶¶48,49. From the above discussed operation of Susa's device, a skilled person would have understood that it has a longitudinal axis extends along the functional length, *i.e.*, along the major axis of the device which is the gas flow path from the air intake ports (24) to the suction port (22). As shown in Susa's embodiment discussed in Fig. 9, a skilled person would have recognized that part of Susa's air flow channel (*e.g.*, 24, 26, 22) starts from inlet (*e.g.*, 24) and runs to the top edge of the liquid material container (*e.g.*, 32) alongside the liquid supply (*e.g.*, 32, 36). In fact, a skilled person would have known that many early cigarette substitutes employed a porous carrier impregnated with a liquid nicotine containing composition through which an air stream could be drawn to volatilize nicotine, thereby, making the airflow channel alongside the liquid supply. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 2:33-35; Ex. 1009 (Gilbert, a smokeless

non-tobacco cigarette patent) at 1:14-22, 3:22-25; Ex. 1006 (St. Charles, an aerosol-delivery smoking article patent) at 3:38-48. Therefore, a skilled person would also have found the placement of air flow channel anywhere in an e-cigarette housing to be an obvious implementation choice.

61. Susa teaches “[a] liquid reservoir 146 is formed under the discharge ports 35 to temporarily store the liquid material 36. The bottom plate of the liquid reservoir 146 is constituted by an electrode 138 that serves as a vibration plate.” *See* Ex. 1008 at ¶ 34, Fig. 3. Susa further teaches that “when the electrode 138 is operated to vibrate, the liquid material 36 is selectively discharged through the discharge ports 35 having a low resistance against the flow. The discharged liquid material 36 is supplied onto the ceramic heater 42 as a liquid drop LD.” *See* Ex. 1008 at ¶¶34-35, Fig. 3. Based on this teaching and the definition of atomizer discussed above (*see* ¶22), a skilled person would have understood that discharge drive portion 38, discharge drive head 34, and the heater 42 produce aerosols and therefore are included in Susa’s disclosed atomizer assembly. A skilled person would also have recognized that atomizer assembly, in the alternative, would also include the throttle plate 21 that regulates the flow of air to the heater and the cooling chamber 52 where the air is cooled because these components aid in the formation of aerosols. Furthermore, according to the definition of cavity discussed above (*see* ¶25), a skilled person would have recognized that the liquid reservoir 146 within Susa’s discharge head 34 is a hollow space filled with liquid material and therefore is a cavity filled with liquid.

62. Additionally, Susa teaches “[o]ther than this, as the discharge mechanism of the liquid material 36, a known printer ink discharge mechanism can be modified and employed, e.g., a method disclosed in Jpn. Pat. Appln. KOKOKU Publication No. 61-59911 and the like wherein the process liquid is injected by bubbles generated by heating it,” and discloses several possible modifications to its liquid discharge mechanisms, with the parallel and perpendicular heater orientations shown to be included among its expressly disclosed simple design choices. *See, e.g.*, Ex. 1008 at ¶36, Fig. 8-16. Therefore, a skilled person reading Susa would have found it obvious to modify and employ liquid discharge and storage mechanisms from the neighboring field of ink jet printers and use them with Susa without undue experimentation and with predictable results.

63. Long before April 2004, Whittemore (Ex. 1004), a U.S. patent titled “Vaporizing Unit for Therapeutic Apparatus,” was published on October 13, 1936. Whittemore discloses a handheld drug vaporizer that uses a simple mechanism of transforming volatile liquid medicament into vapors. Whittemore’s apparatus includes *a wick* of which a first portion is in contact with the heating element and a second portion extends into the medicament container “whereby said medicament will be carried by *capillary action* to a point where it will be vaporized by the heat from the filament.” *See* Ex. 1004 at 1:19-26, 1:50-2:7. Porous material is commonly used in liquid wicking technologies. *See, e.g.*, Ex. 1004 at claim 9; Ex. 1050 (Schreur, a handheld marking device patent) at 3:3-10; Ex. 1003 (Takeuchi, a simulated smoking

article patent) at 3:35-50. Whittemore teaches “a *porous* wick entwined within the filament for lifting the medicament by capillary attraction whereby the liquid becomes vaporized upon the filament becoming heated.” *See, e.g.*, Ex. 1004 at claim 9. A skilled person would have recognized that Whittemore’s wick is porous, or at least that it would have been obvious to make the wick out of porous material. A skilled person would have understood that Whittemore’s use of the term “medicament” is broad and would have included, among other things, nicotine as a possible medicament. *See* Ex. 1051 (Piskorz, a nicotine medicament patent) at Abstract. Furthermore, several “tobacco replacement therapies” involved providing various nicotine formulations that closely “[simulate] cigarette smoke” and may be “used with existing inhaler technology so as to improve the effectiveness of tobacco replacement or withdrawal therapies.” *See* Ex. 1051 (Piskorz, a nicotine medicament patent) at ¶ [0008]; *see also, e.g.*, Ex. 1052 (Slutsky, an inhaler patent) at Abstract, 1:7-15. Therefore, a skilled person would have considered Whittemore’s teachings to be pertinent to e-cigarettes.

64. In view of Susa’s disclosure, a skilled person would have recognized that Susa’s discharge drive portion (38) displaces the liquid out of the cavity 146 via the two openings (144 and 35). A skilled person would have further recognized that since the size of the opening 144 is smaller than that of 35, most of the liquid would be ejected out 35, but some would be ejected back out 144, thus, reducing the efficiency of Susa’s device. A skilled person would have been motivated to improve the

discharge efficiency of Susa's device and minimize the back-flow through orifice 146 while reducing costs. As discussed before, using capillary action in a capillary tube to transport liquid from a liquid supply to an atomizer chamber was well-known and common knowledge. Susa further cites International Publication No. WO 9501137 (corresponding to Voges, Ex. 1011) that discusses replacing ejected liquid in a thermal ejection device using capillary action. *See, e.g.*, Ex. 1011 (Voges, an electronic cigarette patent) at 4:15-20; Ex. 1008 (Susa) at ¶7. Susa further expressly teaches that "a known printer ink discharge mechanism can be modified and employed... wherein the process liquid is injected by bubbles generated by heating it." *See, e.g.*, Ex. 1008 at ¶36, Fig. 8-16. Another prior art reference, Sekiya (Ex. 1038), from the related field of ink-jet printers, describes a mechanism of producing ink droplets from a narrow passage (*i.e.* a capillary tube) by simply heating the passage and replacing the ejected fluid using capillary action. *See, e.g.*, Ex. 1038 (Sekiya, a bubble jet printer patent) at 5:57-6:38 and Fig. 4A-4G. Indeed, it was well known to use capillary flow to transport fluid from a reservoir to a vaporizer. Therefore, in order to improve the discharge efficiency of Susa's device and in view this common knowledge, along with Susa's express teachings, a skilled person would have found it obvious and advantageous to use a simple capillary tube to transport liquid from Susa's liquid material container 32 to liquid reservoir 146 where it can be metered out or directly applied to the ceramic heater (42). A skilled person would have understood that an efficient system uses less battery power, making it less expensive to purchase or operate over time. Therefore,

a skilled person would have been motivated and found it obvious and advantageous to implement Susa's flavor producing article, and in particular Susa's discharge drive, using Whittemore's capillary tube (e.g., D), to result in a simpler, more energy efficient, and less expensive device.

65. A skilled person would have recognized that in Susa and Whittemore's combination, Whittemore's wick (e.g., D) transports liquid from the liquid medicament container to the heating element where liquid in the tube gets heated and aerosolized. Furthermore, Whittemore expressly teaches that "the lower ends or free ends of the side pieces of the [Whittemore's] *wick projecting downwardly* into the medicament." *See, e.g.*, 1004 (Whittemore), at 2:14-16, Fig. 2. Hence, a skilled person would have understood that Whittemore's porous body (e.g., wick D) is explicitly projecting into Whittemore's liquid supply (e.g., x). Additionally, a skilled person would have understood that the projected part, *i.e.* part of Whittemore's D projecting into medicament container x, includes a bulge section, as defined in ¶26, at least because it is an extension of the atomizer D. A skilled person would have further found it obvious and advantageous to adjust the shape and orientation of that extension section in order to increase the contact area between the atomizer and the liquid supply, allowing easier liquid transport.

66. As discussed earlier in ¶40, widespread availability and ubiquitous knowledge about the materials and shapes of the heating and/or piezoelectric elements would have advantageously allowed a skilled person to design and

manufacture a low-cost and mechanically robust e-cigarette. It would have been obvious to a skilled person to replace, combine or locate them in any manner that suits a particular e-cigarette design, and a skilled person would have recognized and found it obvious that each of these could be selected, utilized, and applied with straightforward, predictable results. Susa teaches that “[t]he ceramic heater 42 is constituted by a ceramic plate and a coated resistance heater on the ceramic plate, and is accordingly an integral member of a catch pan for receiving the splash of the material and a heating means for heating the catch pan. However, the catch pan and the heating means can be disposed as separate components.” *See* Ex. 1008 (Susa) at ¶38. Therefore, in view of Susa’s express teachings and common knowledge, a skilled person would have been motivated and found it obvious to use a low cost and widely available heating means for heating the catch pan, such as Whittemore’s (Ex. 1004) wire, Sekiya’s (Ex. 1038) coils, *etc.*

67. In regard to the elements within Susa’s device, as discussed in ¶60 above, a skilled person would have recognized that the longitudinal axis is along the gas flow path from Susa’s air intake ports (24) to Susa’s suction port (22). As discussed in ¶24 above, a skilled person would have further recognized that an axis running through the center would be a central axis. Therefore, in light of this understanding, a skilled person would have recognized that Susa’s coated resistance heater on the ceramic plate 42, and Whittemore’s heating element 3 are substantially perpendicular to the longitudinal axis of the housing of either Susa, Whittemore, or Susa implemented with

the teachings of Whittemore. In the alternative, due to widespread availability and knowledge about the materials, functionality and shapes of heating and/or piezoelectric elements, it would have been a matter of obvious design choice for a skilled person to replace, combine, orient, or locate them in any manner that suits a particular e-cigarette design, and a skilled person would have recognized and found it obvious that each of these could be selected, utilized, and applied with straightforward, predictable results.

68. I have reviewed Adiga (Ex. 1007), a U.S. Patent titled “Non-Combustible Smoking Device and Fuel Element,” which was filed on October 24, 2001 and was issued on July 29, 2003. Adiga is prior art to ‘628 because it was filed before April 14, 2004. Adiga discloses a non-burning smoking article including a fuel element and a flavor-generating material. *See, e.g.*, Ex. 1007 (Adiga) at 2:38-43. The fuel element includes a porous/fibrous fuel cartridge, a wick, and a glow element. In use, the glow element is lit with a lighter, and liquid fuel is drawn into the glow element by the wick and is then vaporized. *Id.* at 3:31-36. Adiga teaches: “The fuel cartridge 24 is generally a porous media, such as, cellulose acetate, low density polyethylene, ethyl vinyl acetate, carbon filters, *cotton, or other fabric materials.*” *See* Ex. 1007 (Adiga) at 3:1-3.

69. A skilled person would have understood that Susa’s liquid flavor material would slosh around in the liquid material container if Susa’s smoking article or Whittemore’s vaporizing unit is shaken or tilted, which would give the simulated

smoking article a less cigarette-like feel. In addition, depending upon the orientation of Whittemore's vaporizing unit and the amount of liquid in the medicament container, the wick (D) may not be in contact with the liquid medicament, which would prevent the liquid from resupplying the wick as it is depleted. As such, a skilled person would have been motivated to look to prior art for possible design/material solutions. From Susa's disclosure, a skilled person would have recognized that Susa incorporates teachings from the neighboring field of ink jet printers to design and develop a simulated smoking article. *See, e.g.*, Ex. 1008 (Susa) ¶¶1, 7, 36.

Furthermore, from the common knowledge discussed in ¶¶33-34, it would have been obvious to a skilled person to advantageously use porous/fibrous/flexible materials to store liquid in the reservoir in order to prevent sloshing and to maintain liquid contact to the wick regardless of the orientation of the smoking article. Adiga discloses storing liquid material in fibrous materials. *See* Ex. 1007 (Adiga) at 3:1-3. Although Adiga teaches storing liquid fuel instead of liquid medicament, a skilled person would have understood that there are several similarities between the mechanism and structure of Adiga and Susa implemented with the teachings of Whittemore. First, Susa implemented with the teachings of Whittemore and Adiga are both directed to handheld devices. Second, Susa implemented with the teachings of Whittemore and Adiga both use capillary action to transport liquid (Susa's liquid material or Adiga's fuel) from a first end of a capillary tube, such as a wick, to a second end. *See, e.g.*, Ex. 1004 (Whittemore) at 1:19-26, 1:50-2:7; Ex. 1007 (Adiga) at 2:44-66. Third, Susa

implemented with the teachings of Whittemore and Adiga both discuss aerosolizing the liquid within a wick. *See, e.g.*, Ex. 1004 (Whittemore) at 1:19-26, 1:50-2:7; Ex. 1007 (Adiga) at 3:30-41. Therefore, in part because of these similarities between Adiga and Susa implemented with the teachings of Whittemore, a skilled person would have recognized the applicability of Adiga's teachings of a porous/fibrous cartridge, and would have found it obvious and straightforward to use them to store the liquid material in Susa implemented with the teachings of Whittemore to reduce sloshing and maintaining contact of the liquid in the liquid container with the wick or capillary tube.

70. I have reviewed, analyzed and endorse the claim charts attached to the IPR Petition which show that the Susa reference, alone or in combination with the cited teachings known to a skilled person, discloses each of the claimed limitations in the '628 patent. My opinion is based on, among other things, the knowledge of a person or ordinary skill in the art, as set forth in ¶¶ 28-49, 82, including the prior art teachings of Takeuchi, Gilbert, and Adiga as set forth in ¶¶ 50-58, and the prior art teachings of Voges, Voges II, the "Thermal Ink-Jet Print Cartridge Designers Guide," and Gehrler as set forth in ¶¶ 71-81. I also agree that the combination of Susa with the teachings of the prior art references, Whittemore, and Adiga, discloses each of the claimed limitations in the '628 patent. Because these references are prior art to the '628 patent, I agree that all the claims of the '628 patent are invalid as at least obvious. Further, to the extent it is argued that any combination of these claims is not expressly

disclosed, in one or more of Susa, Whittemore, and Adiga, it would at minimum have been obvious to include such a limitation based on the knowledge of a skilled person in light of the express teachings of these references.

C. VOGES

71. I have analyzed U.S. Patent No. 5,894,841 (“Voges,” Ex. 1011), entitled “Dispenser,” which was issued on April 20, 1999. I understand it to be prior art, because it was issued before April 14, 2004. A skilled person would have certainly considered Voges highly relevant to the design of an e-cigarette in the early 2000’s, because Voges expressly discloses an electronic “cigarette substitute.” Voges, as an e-cigarette, addresses the issue of delivering nicotine through vaporizing liquid nicotine so that it can be effectively introduced via the pulmonary system. Voges discusses systems for drug delivery via the respiratory tract, including drug inhalers and nebulizers, with particular applications of those technologies to cigarette substitutes that provide nicotine by inhalation as an alternative to burning tobacco. *See, e.g.*, Ex. 1011 (Voges) at 1:11-13, 2:12-14. A skilled person reviewing Voges would be familiar with the Gehrler reference, as discussed below, as well as with Susa (Ex. 1008), Whittemore (Ex. 1004), and Takeuchi (Ex. 1003), the full range of teachings they contain, and any of the combinations involving Susa, Whittemore, and Takeuchi, as illustrated in this Declaration.

72. The core elements of Voges' device include a hollow tubular body, a mouthpiece screwed onto the housing, LEDs, and air inlet slots in the side of the tubular body. Inside the hollow tubular body, Voges' device includes a battery, a microelectronic circuit or microprocessor, a sensor, a cavity, a liquid supply in physical contact with an atomizer, an air flow channel alongside the liquid supply connecting the inlet to the outlet, and a heating wire in the atomizer having a central axis substantially perpendicular to the longitudinal axis of the housing. *See, e.g.*, Ex. 1011 at 5:48-54, 3:66-4:5, 7:47-50, 5:66-6:9, 4:6-12, 5:58-61, and Fig. 2.

73. Voges confirms that it was a well-known method to heat liquid nicotine to vaporize it for inhalation. *See, e.g., Id.* at 2:52-54. Voges identifies that prior art e-cigarettes used porous carriers impregnated with liquid nicotine compositions. *See, e.g., Id.* 2:33-36. Voges discusses improving the precision and accuracy of the liquid nicotine dose delivered by its device, so that it can mimic the sensations obtained during smoking. *See, e.g., Id.* 3:1-6. A skilled person would have understood from these teachings that porous carriers can be used to hold liquids with active ingredients, including nicotine. Voges discusses that the performance of an e-cigarette is affected by the response time between a user's puff and nicotine release from the cigarette. *See, e.g., Id.* at 7:15-29. To improve performance, Voges adopted an inhaler modified with a droplet ejection device ("DED") to be used within an e-cigarette. Voges teaches using a piezoelectric device or a thermal bubble jet device as a DED from the neighboring field of ink jet printing, which Voges expressly indicates (and a skilled

person would readily have recognized) was applicable to the field of e-cigarettes. *See, e.g., Id.* 3:62-65. The DED approach taught in Voges and throughout the ink jet printing field (expressly taught by Voges to be analogous to e-cigarettes) operates using essentially the same resistive heaters and piezoelectric elements disclosed in the ‘628 Patent specification and discussed above. The ‘628 Patent’s teachings were already well understood at least as early as Voges’ publication. In fact, this adaptation of thermal bubble jet device from the ink jet printing technology to inhaler technologies is an example of a known combination of ubiquitous components to produce and improve an e-cigarette in a predictable known way. In my opinion, the results would readily have been understood as providing predictable, namely more controlled delivery of liquid nicotine doses to improve the function of e-cigarettes.

74. During prosecution of a related patent by the same inventor, U.S. Patent No. 6,196,218 (“Voges II,” Ex. 1020), was discussed. *See e.g.,* Ex. 1028 (‘331 File History) at pp. 69-73 (December 13, 2011 Non-Final OA at 4-9). A skilled person would have recognized that Voges II has a different disclosure than the U.S. Patent No. 5,894,841 (“Voges”) asserted in this Petition. Although, both of these patents have the same inventive entity and share some, but not all, figures and description of the specification, there are important details absent from Voges II’s disclosure that are relevant for the claims of the ‘628 patent. For example, Voges II does not discuss a “thermal bubble jet device,” “thin film resistors” for vaporizing liquid, that liquid in a chamber is being replaced from a reservoir by “capillary action” and also does not

incorporate “Thermal Ink-Jet Print Cartridge Designers Guide [Ex. 1013]” by reference, *etc.* *See, e.g.*, Ex. 1011 at 3:62-5:25. To the extent Voges and Ex. 1013 are argued to be separate references, a skilled person would have recognized that there is explicit motivation to use the teachings of Ex. 1013 with Voges. *See, e.g.*, Ex. 1011 at 3:62-4:5 (“In the preferred embodiments of the invention, the droplet ejection device (“DED”) device ...is a thermal “bubble jet” device of the kind used in ink jet printing. These devices are sometimes referred to as “droplet on demand” devices. By way of example...thermal devices are broadly described in “Thermal Ink-Jet Print Cartridge Designers Guide” (2nd Edition Hewlett Packard) both incorporated herein by reference.”).

75. This Designer’s Guide, Ex. 1013, describes, in detail, the operation of a thermal bubble jet device that is used by Voges. At Figs. 1 and 2, this guide illustrates the overall construction of a thermal ink-jet print cartridge. It teaches that the cartridge has a printhead and an ink reservoir. The printhead includes nozzles and thin film resistors on a substrate. These resistors are located directly behind each nozzle. The droplet ejection process begins by heating the corresponding resistor. Within a few microseconds, the ink in contact with the resistor is vaporized. The vapor bubble grows rapidly and imparts momentum to the ink above the bubble. Some of this ink is ejected through the nozzle. *See, e.g.*, Ex. 1013 at pp. 2-3. A skilled person would have recognized that this printhead corresponds to Voges’ element 14 and 15. *See, e.g.*, Ex. 1011 (Voges) at 5:58-61. A skilled person would have

understood that the printhead (Voges' element 14 and 15), according to the definition discussed above (see ¶22), is an atomizer because the heating elements within the printhead aerosolize the ink by vaporizing the ink and ejecting small droplets out of the nozzles. Fig. 2 of Ex. 1013 shows a cross section of the thin-film structure for a thermal ink-jet print cartridge. This figure shows a space between the printhead substrate and the nozzle which is filled with ink. This ink is ejected when the heating resistor forms a vapor bubble. Ex. 1013 further teaches that "[t]he nozzle is then automatically refilled with ink by capillary action." Therefore, according to the definition of a cavity discussed in ¶25, a skilled person would have understood that this space between the printhead substrate and the nozzle is a cavity because it is within Voges' atomizer and separate from the air flow channel. Since the heating elements, *i.e.* thin film resistors, are deposited on the printhead substrate and are facing the nozzle, a skilled person would have no trouble understanding that these heating elements are within the four walls of the above defined cavity and thus within the atomizer. It was also a common practice in the semiconductor industry to implement thin film resistors using thin film wires. *See, e.g.*, Ex. 1036 (Emmma, a semiconductor integrated circuit fabrication patent) at 5:55-6:10. Furthermore, since metal wires have resistances, a skilled person would have understood that thin film resistors would include thin film wires. *See, e.g.*, Ex. 1034 (Kanke, a thin film resistor patent); Ex. 1035 (Dux, a method to fabricate thin film wiring structures patent); Ex. 1036 (Emmma, a semiconductor integrated circuit fabrication patent).

76. Voges teaches that “[w]hen a user inhales at mouthpiece 5, a stream of air “A” is drawn into body 1 via slots 7, through body part 2, and mouthpiece 5 into the user's lungs.” In view of this operation, a skilled person would have understood that the longitudinal axis of Voges’ electronic cigarette runs parallel to the functional length, *i.e.* along the air flow path from the slots (7) to the mouthpiece (5). As shown in Voges’ Fig. 2, a skilled person would have understood that the nozzles (15) are along the above discussed longitudinal axis. Simultaneously, a skilled person would have understood that at least part of the airflow channel “A” runs parallel to the upper part of the container 10 and coupling 11. As discussed below, a skilled person would have understood that container 10 and coupling 11 are included within a liquid supply. Therefore, a skilled person would have understood that the airflow channel extends alongside the liquid supply. Voges incorporates Ex. 1013 (Jet Print Cartridge Designers Guide) by reference and therefore discloses that heating elements are located directly behind each nozzle as discussed above (see ¶¶74-75). As discussed in ¶24 above, a skilled person would have further recognized that an axis running through the center would be a central axis. In view of this and Fig. 2 of Ex. 1013, a skilled person would have understood that the central axis of the heating wire is substantially perpendicular to the nozzles and therefore perpendicular to the longitudinal axis of the Voges’ housing. To the extent Voges and Ex. 1013 are argued to be separate references, there is explicit motivation to use the teachings of Ex. 1013 with Voges. *See, e.g.,* Ex. 1011 (Voges) at 3:62-4:5 (“In the preferred

embodiments of the invention, the droplet ejection device (“DED”) device ...is a thermal “bubble jet” device of the kind used in ink jet printing. These devices are sometimes referred to as “droplet on demand” devices. By way of example, thermal devices are broadly described in “Thermal Ink-Jet Print Cartridge Designers Guide” (2nd Edition Hewlett Packard) both incorporated herein by reference.”). Hence, a skilled person would have found it obvious to use the teachings of Ex. 1013 when implementing Voges’ cigarette substitute.

77. Ex. 1013 teaches that “[t]he ink supply is contained in a synthetic rubber bladder located *immediately* behind the printhead substrate. The bladder is designed to maintain a relatively constant back pressure at the nozzle so the ink is only expelled when desired...Ink flow from the bladder to the nozzles is by capillary action, and is relatively independent of the print cartridge orientation.” *See* Ex. 1013 at p.2. In addition, it teaches that the “ejected volume of liquid is automatically replaced in the chamber from a reservoir by capillary action or by atmospheric pressure acting on collapsible reservoir bladder, a piston or the like.” *See* Ex. 1011 (Voges) at 4:17-22. Furthermore, as discussed in ¶74 above, the printhead substrate and nozzle is part of the atomizer. Therefore, a skilled person would have understood from Ex. 1013’s teachings that the liquid supply, *i.e.* bladder, is in physical contact with the atomizer. To the extent Voges and Ex. 1013 are argued to be separate references, there is explicit motivation to use the teachings of Ex. 1013 with Voges. *See, e.g.,* Ex. 1011 at 3:62-4:5 (“In the preferred embodiments of the invention, the droplet ejection device

(“DED”) device ...is a thermal “bubble jet” device of the kind used in ink jet printing. These devices are sometimes referred to as “droplet on demand” devices. By way of example...thermal devices are broadly described in “Thermal Ink-Jet Print Cartridge Designers Guide” (2nd Edition Hewlett Packard) both incorporated herein by reference.”). Hence, a skilled person would have found it obvious to use the teachings of Ex. 1013 while implementing Voges’ cigarette substitute.

78. Voges teaches adapting the ink jet bladder disclosed in Ex. 1013 (Jet Print Cartridge Designers Guide) for its nicotine dispenser device. Voges teaches providing nicotine in a “container 10 which is *adapted* by means of a spiggot shaped outlet and coupling 11, for fluid connection to an inlet port 12 of a droplet ejection device 14.” *See* Ex. 1011 (Voges) at 5:58-61. Voges also teaches that “[c]ontainer 10 is disposable or replaceable and may be adapted for fluid communication with inlet 12 of device 14 by means of a threaded, bayonet, or other suitably sealing connection.” *See* Ex. 1011 at 6:37-40. This would have indicated to a skilled person that Voges intended the nicotine container to be replaceable once consumed, and therefore is shaped in such a way that it can easily fit in a bayonet or threaded connection. As shown in Voges’ Fig. 2, the threads are close to inlet 12 of the DED device 14. Therefore, once container 10 was consumed, a skilled person would have removed entire container 10 and its coupling 11 and replace it with a new container with its coupling. Hence, a skilled person would have treated container 10 and its coupling 11 as a single liquid supply.

79. In addition to Voges, Gehrer (Ex. 1012), a U.S. Patent titled “Ink Container with a Capillary Action Member,” was issued on December 30, 1997 and filed on August 19, 1994. I have analyzed Gehrer and understand it to be prior art, because it was published more than one year prior to April 14, 2004. A skilled person would have recognized, and Gehrer expressly confirms, it was common knowledge that suitable pressure conditions are needed within liquid reservoirs, such as liquid reservoirs in fountain pens, ink-jet printer cartridges, *etc.*, to control the flow of liquid from the reservoir and prevent leaking and drying when a device is not in use. *See, e.g.*, Ex. 1025 (Kaufman, a fluid dispensing utensil patent) at 1:20-2:40; Ex. 1026 (Hsu, ink jet pen and pressure control device patent) at 1:12-2:30; Ex. 1027 (Cowger, a back pressure control in ink jet printing patent) at 1:24-65; Ex. 1012 (Gehrer, an ink container patent) at 1:23-45, 1:60-2:21, 2:60-3:15. A skilled person would have recognized that Gehrer discloses an ink delivery system for use with an ink jet printer, as does Voges similarly teach the use of a droplet ejection device “such as used in an ink jet print head.” *See, e.g.*, Ex. 1011 (Voges) at 10:52-54; Ex. 1012 at 1:5-11. To improve the liquid reservoirs used in an ink jet printer, writing tip, or the like, Gehrer teaches “an ink chamber with a capillary body so positioned inside the ink chamber that the open front face or first end of the capillary body is in direct contact with the ink while a back side of the capillary body communicates through a vent with the atmosphere. The chamber encloses the capillary body so that air can enter into the ink reservoir only through the capillary body to properly control the ink transport. For

this purpose the capillary body functions as a pressure equalizer.” *See* Ex. 1012 at Abstract. Additionally, Gehrer teaches that a coupling member covering the ink withdrawal port controls the exit of ink from the ink container. The coupling member is selected to be a wicking material with a greater capillarity than the capillary body to ensure that air does not enter the ink cartridge through the ink withdrawal opening. *See, e.g., Id* at 2:24-47. Gehrer teaches to advantageously connect “the ink facing surface of the capillary coupling through an ink conducting element such as a wick to the bottom of the ink reservoir so as to avoid a dry out of the ink facing surfaces.” *See, e.g., Id* at 2:17-21. Gehrer teaches “the capillary coupling member and the capillary body can be constructed, arranged, and configured completely independently of each other.” *See, e.g., Id* at 2:57-59. A skilled person would have understood that Gehrer’s capillary coupling member projecting into the liquid reservoir can be independently used to reliably and economically feed liquid to a liquid consuming device. A skilled person would, therefore, have found it obvious and beneficial to, at least, use Gehrer’s teachings of capillary coupling member and the connected wick to modify Voges’ liquid supply to include a porous body projecting into the liquid supply. Additionally, a skilled person would have recognized that Gehrer’s capillary body and coupling member together function to equalize pressure while controlling the exit of ink and the entry of air. Hence, to control the flow of liquid from the reservoir and prevent unwanted leaking when a device is not in use, a skilled person would have been motivated and found it obvious and straightforward

to implement Voges' liquid container and coupling using the beneficial teachings of Gehrler.

80. A skilled person would have found it obvious to replace Voges's liquid assembly (e.g., 10, 11) with Gehrler's chamber 14 and connect Voges's atomizer (e.g., 12, 14, 15) to the socket 11 provided in Gehrler's chamber 14. *See, e.g., Id.* at Fig. 1, 3. A skilled person would have further recognized that in Voges and Gehrler's combined device, Gehrler's capillary coupling member 20 will act as Voges' inlet port 12 and therefore coupling member 20 would be a part of the atomizer in the Voges' device, thereby providing a capillary body that would permit better control over the flow of liquid. Gehrler teaches that "in Fig. 3, each of the capillary components, namely the capillary coupling member 20A and the capillary body 18 are provided with their respective ink conducting elements 38 and 37 such as a wick connected at one end to the coupling 20A or to the body 18 while the other end reaches to the lowest point in the reservoir 8 to keep the coupling member 20A and the front end or facing end 21 wetted with ink." *See* Ex. 1012 at 8:19-26, Fig. 3. Therefore, a skilled person would have recognized that coupling member 20 (part of the atomizer in the combined device) includes a porous ink conducting element (e.g., Gehrler's 38) projecting into Gehrler's liquid supply 8, and that the projection ink conducting element 38 would be "so arranged that it will transport or conduct ink in any position of the container." *See Id.* at 8:32-34. Thus, a skilled person would have been motivated and found it obvious to use Gehrler's porous ink conducting elements with Voges' device because,

as Gehrер expressly teaches, the porous conducting elements would have advantageously prevented the Voges' atomizer from drying. The projected conducting element 38 provides a bulge section at least because it is an extension section of the atomizer (e.g., Gehrер's 20; Voges' 12, 14, 15). Additionally, a skilled person would have known that adjusting the size, shape or orientation of the extension section would increase the contact area between the atomizer and the liquid supply allowing better liquid transport. Gehrер's liquid supply (e.g., 8) includes a capillary body (e.g. 18) which is "constructed of a wicking material including foam materials, felts, and fibrous materials, especially and linear fibers." *See* Ex. 1012 at claim 2. Therefore, a skilled person would have understood that the liquid supply of the Voges' device implemented with the teachings of Gehrер includes fiber material, as claimed in '628's claim 5. In the alternative, in light of the common knowledge discussed earlier, it would have been obvious to a skilled person that by including porous/fibrous materials in the liquid supply would have advantageously prevented sloshing and spilling of the liquid.

81. I have reviewed, analyzed and endorse the claim charts attached to the IPR petition which show that Voges, alone or in combination with the cited teachings known to a skilled person, discloses each of the claimed limitations in the '628 patent. My opinion is based on, among other things, the knowledge of a person or ordinary skill in the art, as set forth in ¶¶ 28-49, 82, including the prior art teachings of Takeuchi, Gilbert, and Adiga as set forth in ¶¶ 50-58, and the prior art teachings of

Susa, Whittemore, and Adiga as set forth in ¶¶ 59-70. I also agree with the combination of Voges with the teachings of the prior art reference Gehrer, because they are all related to improving the thermal bubble jet device used by Voges to design its electronic cigarette. Concerns such as inadvertent leaking of liquid, and enabling better control over the release of liquid droplets are some of the issues for which a skilled person would have looked to the related art. Because the Voges references are public prior art to the '628 patent, I agree that all the claims of the '628 patent are invalid as at least obvious. Further, to the extent it is argued that any combination of these claims is not disclosed, expressly or inherently, in one or more of Voges, and Gehrer, it would at minimum have been obvious to include such a limitation based on the knowledge of a skilled person in light of the express teachings of these references.

82. A number of prior art references, including those discussed above, show that the various claim elements of the challenged claims of the '628 patent were well known, as outlined above and as provided in Appendix D. To the extent any of the claim limitations are not explicitly disclosed in one reference, such limitations would have been well-known to a skilled person and combinable to produce predictable results. As such, in my opinion, the challenged claims would have been in the possession of or obvious to one of ordinary skill in the art from the disclosures in one or more of certain prior art references. In summary, a person of ordinary skill in the art would not only be familiar with each of these commonplace elements through multiple reference (including those cited herein) but would also easily be able to

combine such elements into working electronic cigarettes (including those combinations claimed in the '628 patent). In my opinion all the prior art references discussed in this declaration should be considered by the Board while determining invalidity of the '628 patent.

83. I reserve the right to supplement my opinions in the future to respond to any arguments that Fontem or its expert(s) may raise and to take into account new information as it becomes available to me.

I declare under the penalty of perjury that the foregoing is true and correct.

DATED this 15th day of August, 2014 in Lexington, MA.



JOHN M. COLLINS

Appendix A

12 Cutler Farm Road, Lexington, MA 02421 • 617/899-3364 • john.m.collins@alum.mit.edu

John M. Collins, Ph.D.

Summary

A tested leader in technology-driven businesses with more than 25 years of international experience focused on the accelerated design, development and commercialization of innovative technologies, products and services. Experiences integrate a broad geographic and technology base across industries from clean energy/tech to consumer durables, with a career long focus on medical devices. A proven ability to form and lead high performance project and operational teams, create and manage strong intellectual property portfolios, as well as develop, structure, and drive collaborative business relationships with companies ranging from start-ups to premier multi-national organizations. Maintains a hands-on approach and an intimate working knowledge of technologies, operations, and user needs.

Experience

2008 to Present	CIMIT: Consortia for Improving Medicine with Innovation & Technology	Boston, MA
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Chief Operating Officer

CIMIT is a consortium of the greater Boston area's premier clinical, research and academic institutions, based at the Mass General Hospital (www.CIMIT.org). Its mission is to improve patient care by facilitating collaboration among scientists, engineers and clinicians to catalyze the discovery, development and implementation of innovative technologies and procedures/systems. As COO, responsible for ensuring CIMIT's Finding, Funding and Facilitation functions are effective. A particular focus is to assist investigators move technologies from the lab into products and services that improve patient care and scale the CIMIT process through the web-based CIMIT CoLab® platform.

2008 to Present	Reed Collins LLC	Lexington, MA
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Chief Technology & Innovation Officer

Technology, intellectual property, commercialization and business development consulting services for research teams, start-ups, venture capital and private equity firms. In addition, strategic consulting to non-profits with a focus on education and healthcare.

Dr. Collins has also served as a non-paid technical and commercial advisor to non-profits. Examples include being a member of the Scientific Advisory Board of Mass Life Science Center, Boston, MA and an Advisory Board member for the Moebio and MIHealth programs, Barcelona, Spain.

2002 to 2008	TIAX LLC	Cambridge, MA
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President

In close collaboration with CEO and owner, Dr. Kenan Sahin, formed TIAX from the Arthur D. Little T&I group. Established TIAX as a 150-person strong, privately held technology development and commercialization business, successfully blending services work for government and commercial clients with technology development and licensing. TIAX (www.TIAXLLC.com) is a unique technology "transformation" organization focused in several core technology areas, including clean energy and materials, health and wellness, appliances and HVAC systems, and enhanced security. TIAX has one of the most successful records in SBIR wins, with more than 40 Phase I grants, most of which proceed to subsequent phases and collaborative commercial relationships. The World Economic Forum recognized TIAX as a Technology Pioneer in 2002 and as a New Champion in 2007.

John M. Collins, Ph.D.

Promoted to President in 2005 after having served as Executive Vice President since the company founding in 2002. In addition to an integral role in managing the transition and building a new business infrastructure, key accomplishments include attracting and hiring over 60 exceptionally qualified staff members, developing key technology platforms and intellectual property portfolios, and establishing several significant collaborative business relationships and licensing agreements.

1999 to 2002

Arthur D Little, Inc

Cambridge, MA

Senior Vice President, Technology & Innovation (T&I) Directorate

Reporting to the President and serving on the company's Executive Leadership Team, reestablished Arthur D. Little, Inc. (ADL) as a leader in technology consulting, linking strategy, innovation, and technology development. Architected and drove the turnaround of the technology business, reversing a declining revenue trend that persisted over several years to generate an average of ~20% annual growth. Successfully built a strong leadership team and focused the business on the integrated services of technology-based consulting, technology and product development, and intellectual property management. Grew the business to about 300 staff members and operated above target profitability levels (20% contribution margin). Drove a number of large commercial relationships that created significant success for clients. Board member of Cambridge Consultants Ltd. (a wholly owned subsidiary based in Cambridge U.K.), Nuvera Fuel Cells (an ADL spin-out with interests held by Gruppo De Nora and Amerada Hess, based in Cambridge, MA) and Strategic Food Solutions (a joint venture between ADL and TNO, the Netherlands research organization).

1996 to 1999

Arthur D Little, Inc

Sydney, Australia

Managing Director, Asia Pacific Management Consulting Directorate

Reporting to the President and serving on the company's Executive Leadership Team, restructured Arthur D. Little's Management Consulting business in Asia during the currency crisis of the late 90's. Aligned the offices in Sydney, Melbourne, Singapore, Tokyo, Seoul, Kuala Lumpur and Hong Kong to achieve services revenues of about \$30mm. Enabled the growth of ADL's three lines of business (Technology, Environment and Management Consulting) by expanding/extending relationships with multi-national corporations based in the US and Europe.

Initially, served as the Managing Director of the Sydney office and a member of the Asia Pacific Leadership team for two years before being promoted. In that time, opened an office in Melbourne and doubled the in-country revenues, returning the Australian operation to profitability, while also leading the expansion of the Technology & Innovation Management and the Organizational Learning practice across Asia Pacific.

1988 to 1996

Arthur D Little, Inc

Cambridge, MA

Vice President, Technology and Product Development

Joined Arthur D. Little, Inc. after completing Ph.D. to help establish the medical products group. Held a variety of positions of increasing responsibility while also maintaining an active hand in creating and managing engagements with clients. Created and implemented ADL's Product Development Process.

John M. Collins, Ph.D.

1982 to 1986

Booz, Allen & Hamilton

Cleveland, Ohio

Senior Consultant

Held a variety of positions of increasing responsibility, transitioning from being a contributor in technology and strategy assignments to being a project leader.

Education

Ph.D. – MIT

1987 to 1988

Doctorate in Mechanical Engineering from Massachusetts Institute of Technology, with a concentration in fluid mechanics and heat/mass transfer. Minor concentration in Technology & Innovation Management.

M.S. – MIT

1980 to 1982

Masters in Mechanical Engineering from Massachusetts Institute of Technology, with a concentration in fluids mechanics and heat/mass transfer. Minor concentration in Technology & Innovation Management.

B.S. – RPI

1976 to 1980

Bachelors in Mechanical Engineering from Rensselaer Polytechnic Institute, with a minor in Economics. General Motors Scholar/Intern.

Other

Patents

Over 20 US patents, with numerous corresponding international patents (attached below)

Security Clearance

DoD Top Secret (no longer active)

Appendix B

Prior Cases in which Dr. Collins served as an Expert Witness

#	Parties	Case	Subject	Firm
1	Deknatel v. Atrium Medical	(Reference # ...? ... early 90's)	Chest Drainage Device	Hale & Door (BOS)
2	Ethicon v. United States Surgical Corp.	D. Conn., C.A. No. B89-386 (RNC).	Surgical Stapler	Kaye Scholer (NY)
3	Johnson & Johnson Interventional Systems v. Cook, Inc	D. Ind., No. IP95-1262-C-T/G	Coronary and Vascular Stents	Patterson Belknap (NY)
4	Greenburg v. Ethicon Endo-Surgery, Inc.,	Civil Case No. CV-92-5721	Surgical Stapler	Kaye Scholer (NY)
5	Medtronic AVE v. Cordis	D. Del., 99-833-SLR	Coronary and Vascular Stents	Patterson Belknap (NY)
6	Cordis v. Advanced Cardiovascular Systems (ACS), et al.	D. Del. C.A. No. 97-550-SLR	Coronary and Vascular Stents	Patterson Belknap (NY)
7	Cordis Corp. v. Boston Scientific Corp. (BSC) et al.	D. Del. C.A. No. 98-197-SLR	Coronary and Vascular Stents	Patterson Belknap (NY)
8	Scimed, et al. v. Johnson & Johnson, et al.	D. Del. C.A. No. 99-904-SLR.	Coronary and Vascular Stents	Patterson Belknap (NY)
9	Cordis Corp. v. BSC et al.	D. Del., C.A. No. 03-27-SLR	Coronary and Vascular Stents	Patterson Belknap (NY)
10	Cordis Corp. v. ACS, et al.	Arbitration	Coronary and Vascular Stents	Patterson Belknap (NY)
11	BSC et al. v. Cordis Corp	C 02 1474 JW (N.D Cal.)	Neurologic Embolic Coil	Sidley Austin (CHI)
Cases with Expert Reports or Testimony in the Last 4 Years				
12	COVIDIEN/Tyco v. APPLIED MEDICAL	Civil Action No. 9:09-CV-176	Trocar Seal Mechanisms	Quinn Emanuel (NY)
13	APPLIED MEDICAL v. COVIDIEN/Tyco	Civil Action No.: CV 11-4203 VBF (AJWx)	Trocar Seal Mechanisms	Quinn Emanuel (NY)
14	Stat Medical Devices, Inc. v. CanAm Care, LLC et. al.	Civil Action. No. 11-cv-741-LPS	Lancet Devices	Choate (Bos)
15	APPLIED MEDICAL v. COVIDIEN/Tyco	Civil CASE NO. 11-CV-1406 JVS (ANx)	MIS Access Devices	Kenyon & Kenyon (NY)
16	EXERGEN Corp v. Brooklands, Kaz,	Civil Action No. 1: 12-cv-12243 DPW,	Non-contact Human Body	Sunstein (Bos)

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	Sanomedics and Thermo medics	1: 13-cv-10628 RGS, 1: 13-cv-11243, and 08-CV -11416-DPW	Thermometers	
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Appendix C

US Patents – John M Collins

Patent Number	Date Issued	Title
Trocars		
US05350364	09/27/1994	Universal seal for trocar assembly
US05342315	08/30/1994	Trocar seal/protector assemblies
US05314417	05/24/1994	Safety trocar
US05209736	05/11/1993	Trocar method and apparatus
US05197955	03/30/1993	Universal seal for trocar assembly
Automated Fryer		
US05319939	06/14/1994	Frozen food storage and dispensing system
US05230279	07/27/1993	Frying apparatus
US05224415	07/06/1993	Frozen food storage and dispensing system
US05305615	04/26/1994	Frozen food storage & dispensing system
Blood/Fluid Warmer		
US06047108	04/04/2000	Blood warming apparatus
US05846224	12/08/1998	Container for use with blood warming apparatus
US05142968	09/01/1992	Automated deep fat fryer
Rug Cleaner		
US04712740	12/15/1987	Venturi spray nozzle for a cleaning device
US04570856	02/18/1986	Liquid and detergent mixing chamber and valves
Catalytic Coating Process		
US04550034	10/29/1985	Method of impregnating ceramic monolithic structures with predetermined amounts of catalyst
US04609563	09/02/1986	Metered charge system for catalytic coating of a substrate
Ergonomic Table		
US04637322	01/20/1987	Adjustable computer work table
US04890561	01/02/1990	Extendable keyboard support assembly
Tendon/ Ligament Repair		
US06106556	08/22/2000	Tendon and ligament repair system
US06080192	06/27/2000	Tendon and ligament repair system
US05800544	09/01/1998	Tendon and ligament repair system

Appendix D

Exhibit	Description
Ex. 1001	U.S. Patent No. 8,490,628 (“the ‘628 patent”)
Ex. 1002	U.S. Patent No. 8,490,628 File History (“File History”)
Ex. 1003	U.S. Patent No. 6,155,268 (“Takeuchi”)
Ex. 1004	U.S. Patent No. 2,057,353 (“Whittemore”)
Ex. 1005	U.S. Patent No. 7,143,766 (“Schuster”)
Ex. 1006	U.S. Patent No. 5,996,589 (“St. Charles”)
Ex. 1007	U.S. Patent No. 6,598,607 (“Adiga”)
Ex. 1008	European Patent Application No. EP0845220 B1 (“Susa”)
Ex. 1009	U.S. Patent No. 3,200,819 (“Gilbert”)
Ex. 1010	U.S. Patent No. 3,060,429 (“Winston”)
Ex. 1011	U.S. Patent Pub. No. 5,894,841 (“Voges”)
Ex. 1012	U.S. Patent No. 5,703,633 (“Gehrer”)
Ex. 1013	Thermal Ink—Jet Print Cartridge Designers Guide (2nd Edition Hewlett Packard) (“Jet Print Cartridge Designers Guide”)
Ex. 1014	U.S. Patent No. 5,666,977 (“Higgins”)
Ex. 1015	U.S. Patent No. 6,701,921 (“Sprinkel”)
Ex. 1016	U.S. Patent No. 4,848,374 (“Chard”)
Ex. 1017	U.S. Patent No. 5,060,671 (“Counts”)
Ex. 1018	European Patent No. 0,358,114 (“Brooks”)
Ex. 1019	International Publication No. WO 98/17131 (“Fleischhauer”)
Ex. 1020	U.S. Patent No. 6,196,218 (“Voges II”)
Ex. 1021	U.S. Patent No. 3,431,393 (“Katsuda”)
Ex. 1022	Certified English Translation of Chinese Publication No. CN 1233436 (“Hongbin”)
Ex. 1023	Canadian Respiratory Journal 1999 Nov-Dec;6(6), p. 509 (“Nicotine Microaerosol Inhaler”)
Ex. 1024	U.S. Patent No. 4,972,855 (“Kuriyama”)

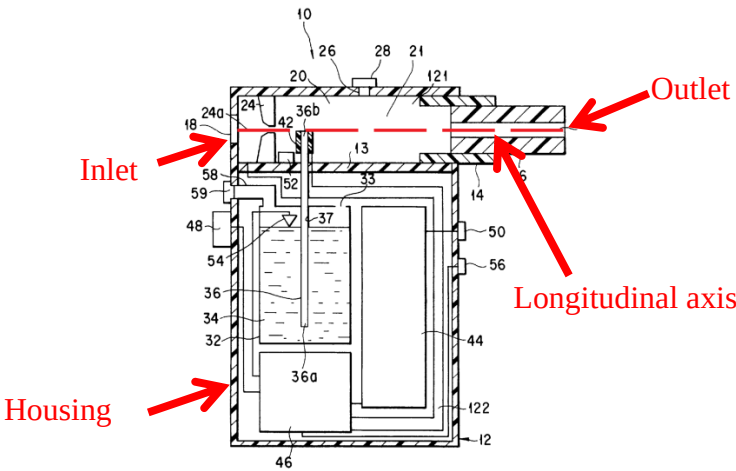
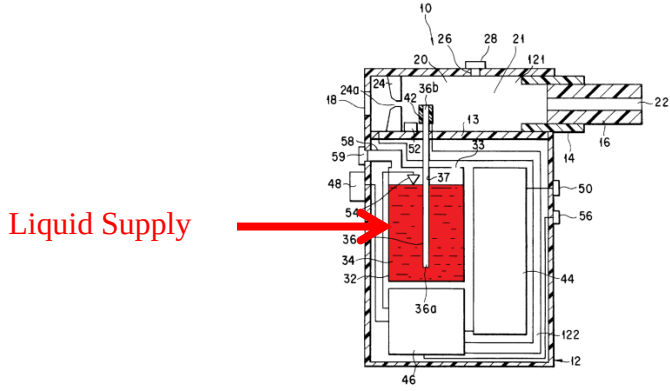
Exhibit	Description
Ex. 1025	U.S. Patent No. 6,322,268 (“Kaufman”)
Ex. 1026	US Patent No. 6,722,763 (“Hsu”)
Ex. 1027	US Patent No. 5,646,666 (“Cowger”)
Ex. 1028	US Patent No. 8,393,331 File History (“331 FileHistory”)
Ex. 1029	U.S. Patent No. 4,945,448 (“Bremenour”)
Ex. 1030	U.S. Patent No. 3,400,998 (“Daugherty”)
Ex. 1031	U.S. Patent No. 5,745,985 (“Ghosh”)
Ex. 1032	U.S. Patent No. 4,676,237 (“Wood”)
Ex. 1033	U.S. Patent No. 5,327,915 (“Porenski”)
Ex. 1034	U.S. Patent No. 7,284,424 (“Kanke”)
Ex. 1035	U.S. Patent No. 5,224,265 (“Dux”)
Ex. 1036	U.S. Patent No. 6,620,659 (“Emmma”)
Ex. 1037	U.S. Patent No. 6,234,167 (“Cox”)
Ex. 1038	U.S. Patent No. 4,990,939 (“Sekiya”)
Ex. 1039	U.S. Patent No. 4,771,295 (“Baker”)
Ex. 1041	U.S. Patent No. 5,743,251 (“Howell”)
Ex. 1042	U.S. Patent No. 6,501,052 (“Cox ‘02”)
Ex. 1043	U.S. Patent No. 4,797,692 (“Ims”)
Ex. 1044	U.S. Patent No. 6,471,782 (“Fang”)
Ex. 1045	International Publication No. WO 2003000324 A1 (“Karl”)
Ex. 1046	International Publication No. WO 2002098390 A2 (“Hodges”)
Ex. 1047	U.S. Patent No. 6,062,213 (“Fuisz”)
Ex. 1048	U.S. Application Publication Patent No.2006/0093977 A1 (“Pellizzari”)
Ex. 1049	U.S. Patent No. 7,059,307 B2 (“Pellizzari II”)
Ex. 1050	U.S. Patent No. 3,203,025 (“Schreur”)
Ex. 1051	U.S. Application Publication Patent No. 2001/0026788 (“Piskorz”)
Ex. 1052	U.S. Patent No. 6,102,036 (“Slutsky”)

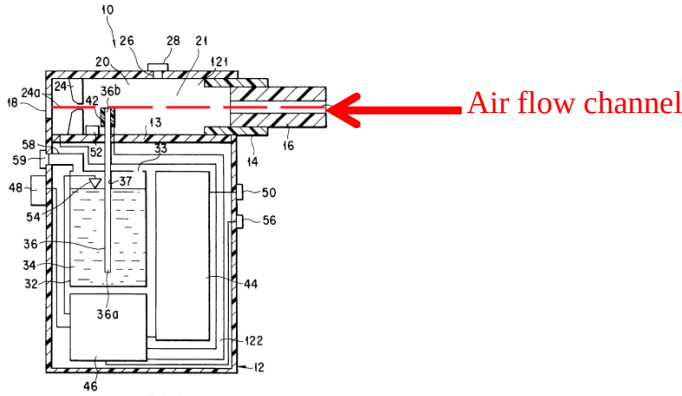
Exhibit	Description
Ex. 1053	U.S. Patent No. 3,502,588 (“Winberg”)
Ex. 1054	U.S. Patent No. 4,945,929 (“Egilmex”)
Ex. 1055	U.S. Patent No. 5,124,200 (“Mallonee”)
Ex. 1056	Declaration of Dr. Saurabh Gupta

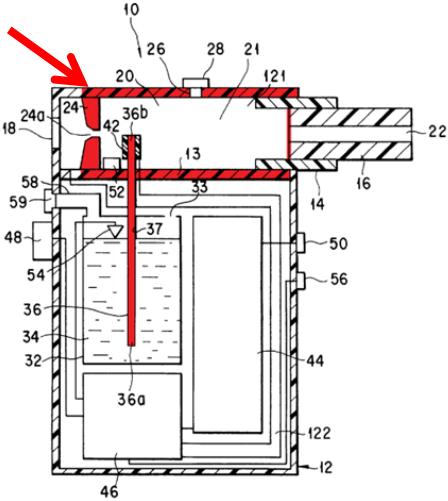
Appendix E

Claims 1, 2, 3, 6, 7, and 8 Are Obvious Over Takeuchi (Ground 1); Claim 4 Is Obvious Over Takeuchi in View of Gilbert (Ground 2); Claim 5 Is Obvious Over Takeuchi in View of Adiga (Ground 3)

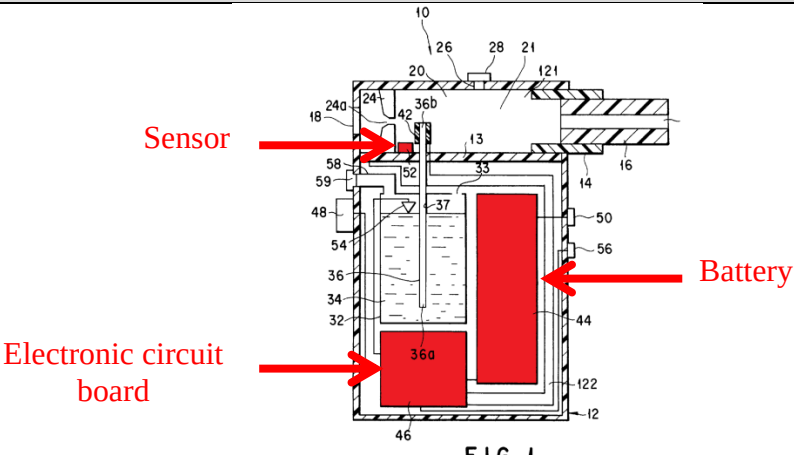
'628 Claim	U.S. Patent No. 6,155,268 ("Takeuchi")
1. [Preamble] An electronic cigarette, comprising:	To the extent that the preamble is considered a claim limitation, Takeuchi discloses an electronic cigarette (<i>e.g.</i>, "simulated smoking article") at, <i>e.g.</i>, Ex. 1003 at 1:1-8, 5:40-46. "The present invention relates to a flavor-generating device for enjoying inhalation of flavor or for enjoying <i>simulated smoking</i> , and more particularly, to a flavor-generating device for generating flavor which is to be inhaled by a user by heating a liquid. flavor [sic] source without relying on combustion." Ex. 1003 at 1:1-8. "To be more specific, it is possible for the liquid flavor source 34 to contain extracts from various natural products and/or components thereof depending on the use of the flavor-generating device. For example, where the device is used as a <i>simulated smoking</i> article, it is possible for the liquid flavor source 34 to contain <i>tobacco components</i> such as tobacco extracts and a tobacco smoke condensate." <i>Id.</i> at 5:40-46.
[1.1] a housing having a longitudinal axis, an inlet and an outlet;	Takeuchi discloses a housing (<i>e.g.</i>, 12) having a longitudinal axis, an inlet (<i>e.g.</i>, 18) and an outlet (<i>e.g.</i>, 22) at, <i>e.g.</i>, Ex. 1003 at 4:29-32, 4:41-52, 8:5-15, Fig. 1 (in red below). "As shown in FIG. 1, the flavor-generating device 10 includes a <i>casing</i> 12 made of plastic, metal, ceramic, wood, etc." Ex. 1003 at 4:29-32.

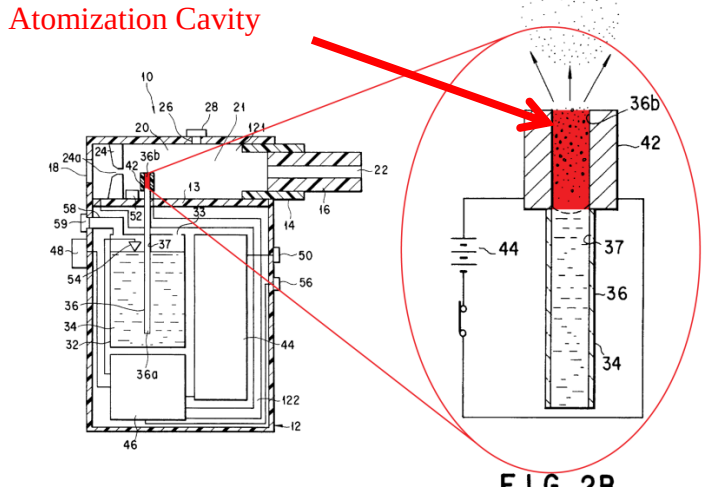
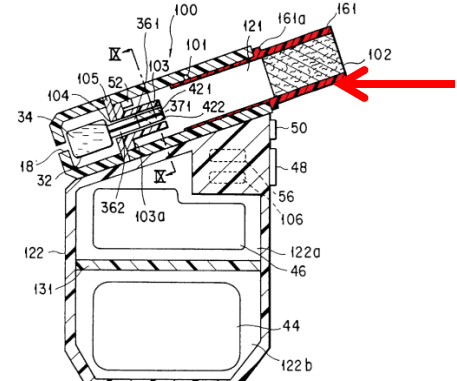
'628 Claim	U.S. Patent No. 6,155,268 ("Takeuchi")
	 FIG. 1 “A mouth piece 16 having an <i>inhalation port</i> 22 through which a user inhales a flavor is detachably inserted into the holder 14...On the other hand, an <i>air intake port</i> 18 for introducing the air into the upper chamber 121 is formed on the other side portion of the upper chamber 121. The gas passageway 20 is defined within the upper chamber 121 of the casing 12, between the <i>air intake port</i> 18 and the <i>inhalation port</i> 22.” Ex. 1003 at 4:41-52. See also, e.g., Ex. 1003 8:5-15.
[1.2] a liquid supply in the housing;	Takeuchi discloses a liquid supply (e.g., 32, 34) in the housing (e.g., 12) at, e.g., Ex. 1003 at 5:28-33, Fig. 1 (in red below).  FIG. 1 “On the other hand, the <i>liquid container</i> 32 housing a liquid flavor source 34 is fixed within the lower chamber 122 of the casing 12. The liquid flavor source 34 is housed in the container 32 in an amount conforming with a plurality of puffs of a user. The liquid flavor source 34 contains at least a flavor substance.” Ex. 1003 at 5:28-33.
[1.3] an air flow channel	Takeuchi discloses an air flow channel (e.g., 20, 21) in the housing (e.g., 12) connecting the inlet (e.g., 18) to the outlet (e.g.,

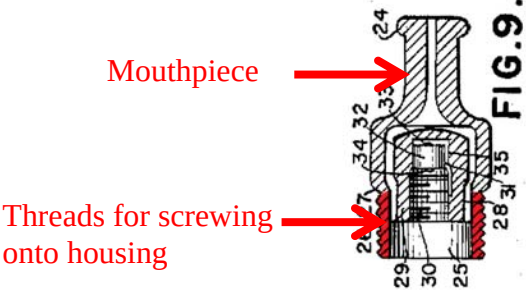
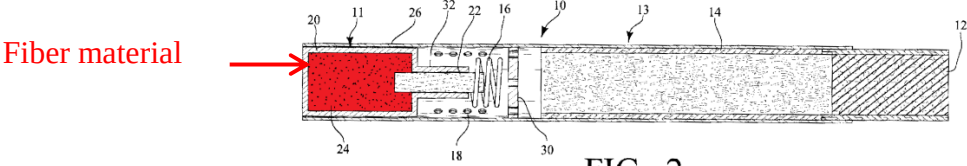
'628 Claim	U.S. Patent No. 6,155,268 ("Takeuchi")
in the housing connecting the inlet to the outlet; and	22) at, <i>e.g.</i>, Ex. 1003 at 4:50-52, Fig. 1 (in red below).  FIG. 1 "The gas passageway 20 is defined within the upper chamber 121 of the casing 12, between the <i>air intake port</i> 18 and the <i>inhalation port</i> 22." Ex. 1003 at 4:50-52.
[1.4] an atomizer assembly in the housing between the inlet and the outlet, including:	Takeuchi discloses an atomizer assembly (<i>e.g.</i>, 121, 36) in the housing (<i>e.g.</i>, 12) between the inlet (<i>e.g.</i>, 18) and the outlet (<i>e.g.</i>, 22) at, <i>e.g.</i>, Ex. 1003 at 4:32-35, 6:55-59, 7:57-63, 5:32-37, Fig. 1 (in red below). "The inner space of the casing 12 is partitioned into an <i>upper chamber</i> 121 and a lower chamber 122 by a partition wall 13. As will be described herein later, the upper chamber 121 is used as a gas passageway 20 for forming a gaseous stream of a flavor which is to be inhaled by a user." Ex. 1003 at 4:32-35 "The upper end portion of the <i>capillary tube</i> 36 protrudes into the upper chamber 121 of the casing 12 somewhat downstream of the squeeze plate 24 and is equipped with the heater 42 serving to gasify the liquid flavor source 34. In the embodiment shown in FIG. 1, the heater 42 consists of a tubular body mounted to the <i>capillary tube</i> 36 and having an inner diameter equal to that of the capillary tube 36." Ex. 1003 at 6:4-10. <i>See also, e.g.</i>, Ex. 1003 at 6:55-59.

'628 Claim	U.S. Patent No. 6,155,268 ("Takeuchi")
	 FIG. 1 “In this step, the liquid flavor source 34 is already transported to the <i>outlet port [36b]</i> of the capillary tube 36 by the capillary force of the capillary tube 36 as shown in FIG. 2A. If the heater 42 is turned on under this condition, <i>the liquid flavor source 34 within the outlet port [36b] is instantly gasified</i> by the heat generated from the heater 42 as shown in FIG. 2B so as to be supplied into the gas passageway 20.” Ex. 1003 at 7:57-63. “[I]n order to add smoke to the flavor, it is possible for the liquid flavor source 34 to contain a substance forming <i>aerosol when heated</i>. As a substance for forming an aerosol, it is possible to use alcohols, sugars, water and a mixture of at least two of these materials.” <i>Id.</i> at 5:33-37.
[1.5] a porous body projecting into the liquid supply; and	Takeuchi discloses an atomizer (e.g., 121, 36) including a porous body (e.g., 36) projecting into the liquid supply (e.g., 32, 34) at, e.g., Ex. 1003 at 5:47-52, 3:36-50, 10:51-55, Fig. 1, Fig. 14 (in red below). “The <i>capillary tube 36</i> for transporting the liquid flavor source by the capillary force is <i>inserted within the liquid container</i>. 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.” Ex. 1003 at 5:47-52.

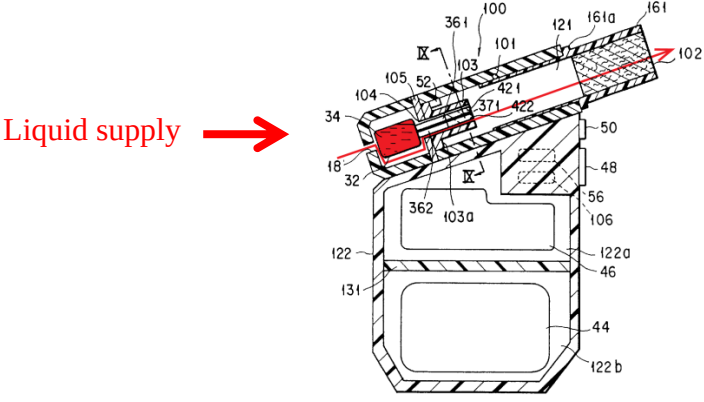
'628 Claim	U.S. Patent No. 6,155,268 ("Takeuchi")
in the atomizer having a central axis oriented substantially perpendicular to the longitudinal axis of the housing.	to the longitudinal axis of the housing (<i>e.g.</i>, 12) at, <i>e.g.</i>, Ex. 1003 at 8:22-23, 5:53-57, Fig. 1 (in red below), Fig. 4 (in red below). <i>See supra</i> element 1.11 of this Section. FIG. 1 “In the embodiment shown in FIG. 1, the <i>heater 42</i> consists of a tubular body mounted to the capillary tube 36 and having an inner diameter equal to that of the capillary tube 36.” Ex. 1003 at 6:7-10 “<i>In the modification shown in FIG. 4, a rod-like heater 74 is inserted into the outlet port 36a of the capillary tube 36. Further, in the modification shown in FIG. 5, a plate-like heater 76 is inserted into the outlet port 36a of the capillary tube 36.</i>” Ex. 1003 at 8:22-26. <i>See also, e.g., Id.</i> at 6:4-12.
2. The electronic cigarette of claim 1 further including a battery, a sensor and an electronic circuit board within the housing, with the circuit board electrically connected to	As discussed above, Takeuchi discloses the system of claim 1. Takeuchi further discloses a sensor (<i>e.g.</i>, 52) and an electronic circuit board (<i>e.g.</i>, 46) within the housing (<i>e.g.</i>, 12), with the circuit board electrically connected to the battery (<i>e.g.</i>, 44), the sensor (<i>e.g.</i>, 52) and the heating wire (<i>e.g.</i>, 42, 74 in Fig. 4) at, <i>e.g.</i>, Ex. 1003 at Fig. 1 (in red below), 6:23-6:28, 6:55-62, 7:51-56, 9:1-5. “The <i>heater 42</i> and the <i>power source 44</i> are driven. under the control of the <i>control circuit 46</i> fixed within the lower chamber 122. To the control circuit 46, a switch 48 for the heater 42 which can independently turn the heater on, and a <i>sensor 52</i> for detecting the inhalation action of a use are connected.” Ex. 1003 at 6:23-6:28. <i>See also, e.g., Ex. 1003</i> at 6:55-62, 7:51-56, 9:1-5.

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the battery, the sensor and the heating wire.	 FIG. 1
3. The electronic cigarette of claim 1 further including an atomization cavity within the atomizer.	As discussed above, Takeuchi discloses the system of claim 1. Takeuchi further discloses an atomization cavity (<i>e.g.</i>, 36b) within the atomizer (<i>e.g.</i>, 121, 36) at, <i>e.g.</i>, Ex. 1003 at 1-11, <i>see also</i> Fig. 2A, 2B (in red below), 2C, 6-7. "The <i>free space</i> between the outlet portion 36b of the capillary tube 36 and the inhalation port 22 can act as a <i>cooling chamber</i> 21 which constitutes a part of the gas passageway. Corresponding to the cooling chamber 21, an outer air introduction hole 26 is formed through the ceiling of the upper chamber 121 to permit the outer air to be introduced into the cooling chamber 21. A gas containing a flavor, which is formed by the heating of the liquid flavor source with a heater 42, is mixed with the outer air within the cooling chamber 21 so as to be cooled and, then, flows to reach the inhalation port 22." Ex. 1003 at 5:1-11 "In this step, the liquid flavor source 34 is already 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. If the heater 42 is turned on under this condition, 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 of the liquid flavor source 34 within the outlet port 36[b] by the heating with the heater 42, the liquid flavor source 34 is newly supplied from the liquid container 32 into the outlet port 36[b] of the capillary tube 36 by the capillary force of the capillary tube 36, as shown in FIG. 2C. In this fashion, supply and gasification of the liquid flavor source 34 are repeated within the outlet port 36a of the capillary tube 36." <i>Id.</i> at 7:57-8:5

'628 Claim	U.S. Patent No. 6,155,268 ("Takeuchi")
	Atomization Cavity  FIG. 1 FIG. 2B
4. The electronic cigarette of claim 1 with the outlet within a mouthpiece that is screwed onto the housing.	As discussed above, Takeuchi discloses the system of claim 1. Takeuchi combined with Gilbert further discloses a mouthpiece (e.g., 24 in Gilbert) that is screwed onto the housing at, e.g., Ex. 1003 at 9:9-15, Fig. 8 (in red below); Ex. 1009 at 2:16-20, 3:4-8, Fig. 9 (in red below). <i>"A mouthpiece 161 may be detachably inserted directly, i.e., without through a holder, into the open end portion (upper end portion) of the upper chamber 121. The mouthpiece 161 has on its periphery a protrusion 161a for engaging with the open end edge so as to prevent a further insertion thereof into the upper chamber 121."</i> Ex. 1003 at 9:9-15.  FIG. 8 <i>"A mouthpiece 24 is affixed to the inner end portion 17 of the tube 15 in any appropriate manner, preferably detachably as by external threads 25 on the hollow shank 25 of the mouthpiece which mate with the internal threads 19 in the inner end portion of the outer tube 15."</i> Ex. 1009 at 2:16-20.

'628 Claim	U.S. Patent No. 6,155,268 ("Takeuchi")
	 "The battery 32 is removable so that when exhausted, a fresh dry battery may be substituted, access to the same being had by first <i>unscrewing the mouthpiece</i> 24 and withdrawing the bulb 36 and subsequently removing the bulb 36 from its socket 30." Ex. 1009 at 3:4-8.
5. The electronic cigarette of claim 1 with the liquid supply comprising a fiber material.	As discussed above, Takeuchi discloses the system of claim 1. Adiga further discloses a liquid supply (e.g., 20) comprising a fiber material (e.g., 24) at, e.g., Ex. 1007 at 2:44-48, 3:1-3, Fig. 2 (in red below); Ex. 1003 at 5:58-6:1.  "The fuel element 11 includes a fuel tank 20 filled with a <i>porous fuel cartridge</i> 24, including usually a carbonaceous liquid fuel, such as ethanol or other low molecular weight hydrocarbon oils which saturates porous fuel cartridge 24, an extended wick 22 and a glow element or filament 16." Ex. 1007 at 2:44-48. "The fuel cartridge 24 is generally a porous media, such as, cellulose acetate, low density polyethylene, ethyl vinyl acetate, <i>carbon filters, cotton, or other fabric materials.</i>" Ex. 1007 at 3:1-3. "In order to ensure the transfer of the liquid flavor source 34 by the capillary force, the liquid container 32 is provided with an opening 33 communicating with the outer atmosphere so as to maintain the inner pressure of the liquid container 32 at an atmospheric pressure. It is desirable for the opening 33 to be formed at the highest position of the container 32 during the ordinary operation of the flavor-generating device and to have a sufficiently small diameter <i>so that the liquid flavor source 34 may not leak to the outside therethrough even if the device is inadvertently turned upside down.</i>" Ex. 1003 at 5:58-6:1; See also Ex. 1006 at 3:38-48.
6. The electronic	Takeuchi discloses the porous body (e.g. 36) of atomizer projecting into the liquid supply comprises a porous bulge

'628 Claim	U.S. Patent No. 6,155,268 ("Takeuchi")
cigarette of claim 1 with the porous body of atomizer projecting into the liquid supply comprising a porous bulge section.	section at, <i>e.g.</i>, Ex. 1003 at 5:47-52, 3:36-50, 10:51-55, Fig. 1 (in red below). "The <i>capillary tube 36</i> 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." Ex. 1003 at 5:47-52. FIG. 1 "In the present invention, the liquid passageway through which the liquid flavor source is transported by the capillary force can be constituted by the inner region of at least one capillary tube, a gap or space between at least two plates spaced apart from each other in substantially parallel, or an <i>inter-communicating void or pore structure filled in an enclosure</i>. The intercommunicating pore structure 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. Representative examples of the structure include open-cell foamed structure, and bundled fibers, but should not be limited thereto." Ex. 1003 at 3:36-50.
7. An electronic cigarette, comprising:	Takeuchi discloses an electronic cigarette (<i>e.g.</i>, 10, "simulated smoking article"). See <i>supra</i> discussion of claim 1 [Preamble] in this Section.
[7.1] a housing having an	Takeuchi discloses a housing (<i>e.g.</i>, 12) having an inlet (<i>e.g.</i>, 18) and an outlet (<i>e.g.</i>, 22). See <i>supra</i> discussion of claim [1.1] in this Section.

'628 Claim	U.S. Patent No. 6,155,268 ("Takeuchi")
inlet and an outlet;	
[7.2] a liquid supply in the housing;	Takeuchi discloses a liquid supply (<i>e.g.</i> , 32, 34) in the housing (<i>e.g.</i> , 12). <i>See supra</i> discussion of claim [1.2] in this Section.
[7.3] an air flow channel through the housing connecting the inlet to the outlet, with part of the air flow channel extending alongside of the liquid supply; and	Takeuchi discloses an air flow channel (<i>e.g.</i>, 20, 21) through the housing (<i>e.g.</i>, 12) connecting the inlet (<i>e.g.</i>, 18) to the outlet (<i>e.g.</i>, 22), with part of the air flow channel extending alongside of the liquid supply. <i>See supra</i> discussion of claim [1.3] in this Section. <u>"with part of the air flow channel extending alongside of the liquid supply"</u> at, <i>e.g.</i>, Ex. 1003 at Fig. 8 (in red below).  FIG. 8
[7.4] an atomizer in the housing between the inlet and the outlet, the atomizer including:	Takeuchi discloses an atomizer (<i>e.g.</i> , 121, 36) in the housing (<i>e.g.</i> , 12) between the inlet (<i>e.g.</i> , 18) and the outlet (<i>e.g.</i> , 22). <i>See supra</i> discussion of claim [1.4] in this Section.
[7.5] a porous body extending into the liquid supply;	Takeuchi discloses a porous body (<i>e.g.</i> , 36) extending into the liquid supply (<i>e.g.</i> , 32, 34). <i>See supra</i> discussion of claim [1.5] in this Section.
[7.6] a heating wire in the atomizer	Takeuchi discloses a heating wire (<i>e.g.</i> , 42, 74) in the atomizer having a central axis oriented substantially perpendicular to a longitudinal axis of the housing (<i>e.g.</i> , 12). <i>See supra</i> discussion of claim [1.6] in this Section.

‘628 Claim	U.S. Patent No. 6,155,268 (“Takeuchi”)
having a central axis oriented substantially perpendicular to a longitudinal axis of the housing; and	
[7.7] a battery, a sensor and an electronic circuit board within the housing, with the circuit board electrically connected to the battery, the sensor and the heating wire.	Takeuchi discloses a battery (<i>e.g.</i>, 44), a sensor (<i>e.g.</i>, 52) and an electronic circuit board (<i>e.g.</i>, 46) within the housing (<i>e.g.</i>, 12), with the circuit board (<i>e.g.</i>, 46) electrically connected to the battery (<i>e.g.</i>, 44), the sensor (<i>e.g.</i>, 52) and the heating wire (<i>e.g.</i>, 42, 74 in Fig. 4). <i>See supra</i> discussion of claim 2 in this Section.
8. An electronic cigarette, comprising:	Takeuchi discloses an electronic cigarette (<i>e.g.</i>, 10, “simulated smoking article”). <i>See supra</i> discussion of claim 1 [Preamble] in this Section.
[8.1] a housing having an inlet and an outlet ;	Takeuchi discloses a housing (<i>e.g.</i>, 12) having an inlet (<i>e.g.</i>, 18) and an outlet (<i>e.g.</i>, 22). <i>See supra</i> discussion of claim [1.1] in this Section.
[8.2] a liquid supply, a battery, and an electronic circuit board in the	Takeuchi discloses a liquid supply (<i>e.g.</i>, 32, 34), a battery (<i>e.g.</i>, 44), and an electronic circuit board (<i>e.g.</i>, 46) in the housing (<i>e.g.</i>, 12). <i>See supra</i> discussion of claims [1.1] and 2 in this Section.

'628 Claim	U.S. Patent No. 6,155,268 ("Takeuchi")
housing;	
[8.3] an air flow channel in the housing between the inlet and the outlet; and	Takeuchi discloses an air flow channel (<i>e.g.</i> , 20, 21) in the housing (<i>e.g.</i> , 12) between the inlet (18) to the outlet (22). <i>See supra</i> discussion of claim [1.3] in this Section.
[8.4] an atomizer in the housing including: a porous body extending into the liquid supply; a heating wire having a central axis generally perpendicular to a longitudinal axis of the housing; and with the circuit board electrically connected to the battery and the heating wire.	Takeuchi discloses an atomizer (<i>e.g.</i> , 121, 36) in the housing (<i>e.g.</i> , 12) including: a porous body (<i>e.g.</i> , 36) extending into the liquid supply (<i>e.g.</i> , 32), a heating wire (<i>e.g.</i> , 42, 74) having a central axis generally perpendicular to a longitudinal axis of the housing (<i>e.g.</i> , 12), and with the circuit board electrically connected to the battery (<i>e.g.</i> , 44) and the heating wire (<i>e.g.</i> , 42, 74). <i>See supra</i> discussion of claims [1.4], [1.5], [1.6] and 2 in this Section.

Appendix F

Claims 1, 2, 3, 4, 6, 7, and 8 Are Obvious Over Susa in View of Whittemore
(Ground 4); Claim 5 Is Obvious Over Susa in View of Whittemore Further in
View of Adiga (Ground 5)

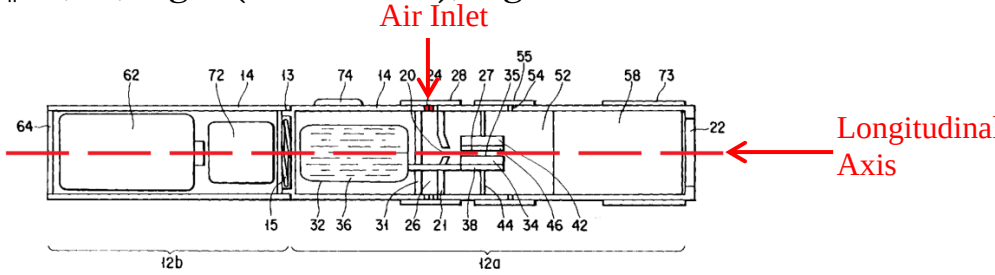
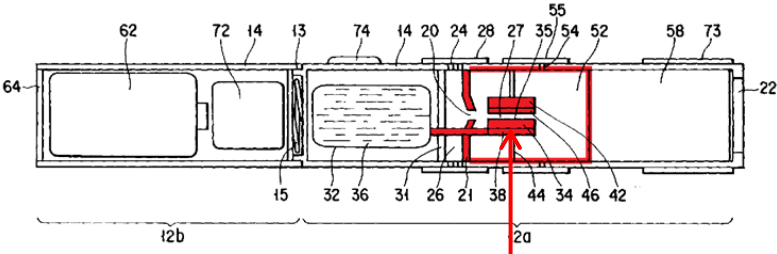
'628 Claim	European Patent No. 0,845,220 ("Susa")
1. [Preamble] An electronic cigarette, comprising:	To the extent that the preamble is considered a claim limitation, Susa discloses an electronic cigarette (<i>e.g.</i>, "simulated smoking article") at, <i>e.g.</i>, Ex. 1008 at ¶¶ 1, 2, 29, 30, 79, Abstract. "A <i>simulated smoking article</i> employed for enjoying the flavor and smoke of tobacco without burning tobacco is already known, and various types of simulated smoking articles have been proposed." Ex. 1008 at ¶ 2.
[1.1] a housing having a longitudinal axis, an inlet and an outlet;	Susa discloses a housing (<i>e.g.</i>, 12) having a longitudinal axis, an inlet (<i>e.g.</i>, 24) and an outlet (<i>e.g.</i>, 22) at, <i>e.g.</i>, Ex. 1008 at Abstract, ¶¶ 26, 27, Fig. 1 (in red below), Fig. 8-16.  FIG. 1 "A <i>suction port</i> 22 through which the user inhales the flavor is formed in the end portion of the first portion 12a of the casing 12. In contrast to this, a plurality of <i>air intake ports</i> 24 for taking in air into the casing 12 are formed in the intermediate portion of the first portion 12a. A gas flow path 26 is defined in the casing 12 between the air intake ports 24 and the suction port 22. The air intake ports 24 can be formed to have an open area corresponding to a predetermined air intake amount." Ex. 1008 at ¶ 26.
[1.2] a liquid supply in the housing;	Susa discloses a liquid supply (<i>e.g.</i>, 32, 36) in the housing (<i>e.g.</i>, 12) at, <i>e.g.</i>, Ex. 1008 at Abstract, ¶¶ 28, 29, 30, Fig. 1 (in red below), Fig. 8-16.

	FIG. 1 “The <i>liquid material 36</i> contains at least a flavor substance. For example, if the liquid material 36 is an article used for enjoying only the flavor, <i>e.g.</i>, menthol or caffeine, it can be a material that generates only the flavor. Also, in order to add smoke to the flavor, the liquid material 36 can contain a material which generates aerosol when heated.” <i>Id.</i> at ¶ 29 “For example, if this article is used as a simulated smoking article, <i>a tobacco component, e.g.</i>, a tobacco extracted component or a tobacco smoke condensate component, may be contained in the <i>liquid material 36.</i>” Ex. 1008 at ¶ 30. “A <i>material container 32</i> for storing a liquid material 36 for generating a flavor or the like to be inhaled by the user is detachably fixed in a space which is deep in the first portion 12a of the case and partitioned from the gas flow path 26 by a wall 31.” Ex. 1008 at ¶ 28
[1.3] an air flow channel in the housing connecting the inlet to the outlet; and	Susa discloses an air flow channel (<i>e.g.</i>, 24, 26, 22) in the housing (<i>e.g.</i>, 12) connecting the inlet (<i>e.g.</i>, 24) to the outlet (<i>e.g.</i>, 22) at, <i>e.g.</i>, Ex. 1008 at ¶¶ 26, 27, 28, 40, Fig. 1, Fig. 8, Fig. 9 (in red below), Fig. 10-16. FIG. 9 “A <i>gas flow path 26</i> is defined in the casing 12 between the air intake ports 24 and the suction port 22.” <i>Id.</i> at ¶ 26
[1.4] an atomizer assembly in the housing between the inlet and the	Susa discloses an atomizer assembly (<i>e.g.</i>, 38, 34, 42, 46) in the housing (<i>e.g.</i>, 12) between the inlet (<i>e.g.</i>, 24) and the outlet (<i>e.g.</i>, 22) at, <i>e.g.</i>, Ex. 1008 at ¶¶ Fig. 2 (in red below), ¶¶27, 31-40, 49. “The <i>ceramic heater 42</i> is disposed in the gas flow path 26 to oppose the discharge ports 35.” Ex. 1008 at ¶ 37 “A material corresponding to one puffing operation, which is driven by

outlet, including:	the <i>discharge drive portion 38</i> and emitted from the discharge ports 35 is <i>supplied onto the ceramic heater 42 in the form of a liquid splash or liquid drop.</i>” Ex. 1008 at ¶ 38.  F I G . 1 “The ceramic heater 42 is disposed in the gas flow path 26 to oppose the discharge ports 35. The ceramic heater 42 is fixed on the inner surface of the casing main body 14 through a support member 44. A gap 27 between the discharge ports 35 of the discharge head 34 and the ceramic heater 42 is set such that air from the throttle hole 20 can flow through it.” Ex. 1008 at ¶ 37. “The liquid material 36 is then discharged from the discharge ports 35 and <i>gasified as it is heated by the ceramic heater 42</i>. As the user performs an inhaling operation, the gasified material is mixed with main suction air which has been taken in from the air intake ports 24, passed through the throttle hole 20, and guided to a portion between the discharge ports 35 and ceramic heater 42, and is guided to the suction port 22.” Ex. 1008 at ¶ 49.
[1.5] a porous body projecting into the liquid supply; and	Susa discloses an atomizer assembly (e.g., 38, 34, 42, 46) and the liquid supply (e.g., 32, 36) at, e.g., Ex. 1008 at ¶¶ 31, 36, Fig. 9. Whittemore discloses an atomizer assembly (e.g., A, D) including a porous body (e.g., D) projecting into the liquid supply (e.g., x) at, e.g., Ex. 1004 at 1:18-27, 1:50-2:8, 3:38-52, Fig. 2 (in red below). “A <i>discharge drive portion 38</i> is disposed adjacent to the discharge ports 35 to discharge the liquid material 36 from the material container 32 through the discharge ports 35.” Ex. 1008 at ¶ 31 “Other than this, as the discharge mechanism of the liquid material 36, a known printer ink <i>discharge mechanism can be modified and employed, e.g., a method disclosed in Jpn. Pat. Appln. KOKOKU Publication No. 61-59911 and the like wherein the process liquid is injected by bubbles generated by heating it, or a method disclosed in U.S.P. No. 3,060,429 [Ex. 1010] and the like wherein the particles of the process liquid are electrified to perform electric field control.</i>” Ex. 1008 at ¶ 36

	Porous Body Projecting into Liquid Supply <i>Fig. 2.</i> <i>A</i> designates the vaporizing vessel of my improved unit, said vessel being preferably constructed in the form of a hollow glass container adapted to hold a liquid <i>medicament x</i> and provided with an electrically-operated heating means comprising two electrical conductors 1 and 2 and a filament or heating element 3 combined in such a way that when said conductors are energized by an electric current, the filament 3 will become heated.” Ex. 1004 at 1:18-27. “In order that the unit will function properly, even though the heating element or filament 3 is spaced a considerable distance above or away from the <i>medicament x</i>, the unit is equipped with a <i>wick D</i> made of any suitable material and combined with the heating element or filament 3 in such a way that a portion of said wick is always in contact or approximate contact with the heating element or filament 3, and a <i>portion of said wick is always in contact with the medicament in the vaporizing vessel</i>, whereby said medicament will be carried by <i>capillary action</i> to a point where it will be vaporized by the heat from the filament 3.” Ex. 1004 at 1:50-2:8. “9. A therapeutic vaporizing unit adapted to be plugged into a conventional socket terminal of 40 an electric circuit, comprising... <i>a porous wick</i> entwined within the filament for lifting the medicament by capillary attraction whereby the liquid becomes vaporized upon the filament becoming heated.” Ex. 1004 at 3:38-52
[1.6] a heating wire in the atomizer having a central axis oriented substantially	Susa discloses an atomizer assembly (e.g., 38, 34, 42, 46) including a heating wire (e.g., coated resistance heater in 42) in the atomizer having a central axis oriented substantially perpendicular (e.g., 42 in Fig. 8) to the longitudinal axis of the housing (e.g., 12) at, e.g., Ex. 1008 at ¶¶ 63, 64, Fig. 8(in red below)-15. Whittemore also discloses an atomizer assembly (e.g., A, D) including a heating wire (e.g., 3) in the atomizer having a central axis oriented substantially perpendicular (e.g., 3 in Fig. 2)

perpendicular to the longitudinal axis of the housing.

to the longitudinal axis of the housing (e.g., A, 7) at, e.g., Ex. 1004 at Figs. 1 and 2 (in red below), 1:19-28, 3:38-52

“The ceramic heater 42 is constituted by a ceramic plate and a *coated resistance heater* on the ceramic plate, and is accordingly an integral member of a catch pan for receiving the splash of the material and a heating means for heating the catch pan. However, the catch pan and the heating means can be disposed as separate components.” Ex. 1008 ¶ 38

Heating Wire Perpendicular to the Longitudinal Axis

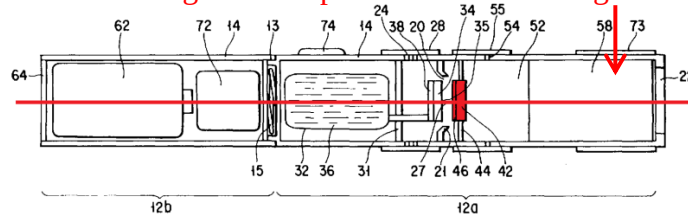
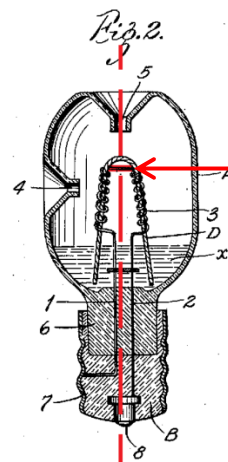


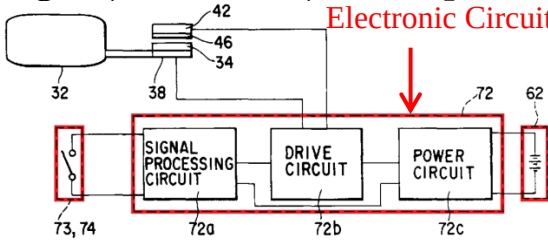
FIG. 8

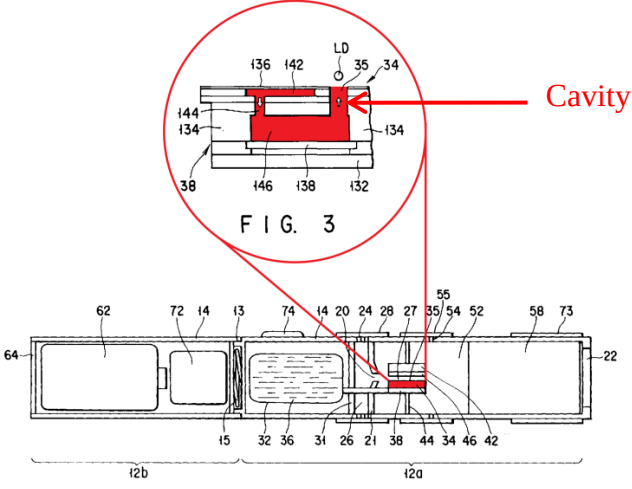
The flavor generation article of this embodiment is similar to the flavor generation article shown in FIG. 1, but the orientation of discharge ports 35 of a discharge head 34 is different from that of the structure shown in FIG. 1 by 90°, so that the discharge ports 35 may be directed to a suction port 22. Accordingly, a ceramic heater 42 opposing the discharge ports 35 is set such that its direction is different from that of the structure shown in FIG. 1 by 90°” Ex. 1008 at ¶ 64.

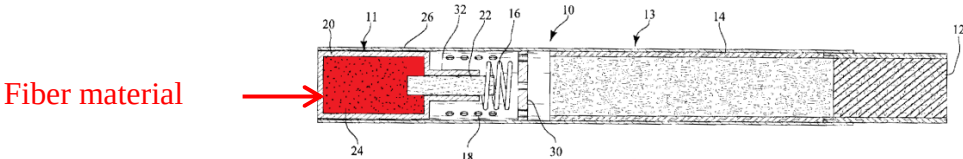
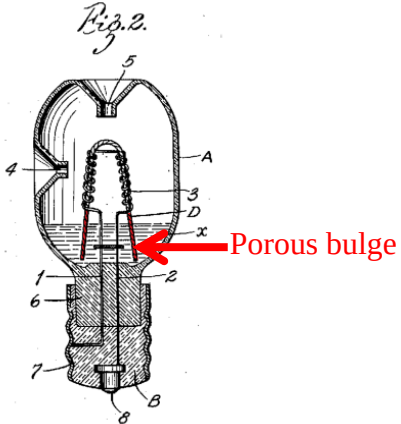
“In the drawing A designates the vaporizing vessel of my improved unit, said vessel being preferably constructed in the form of a hollow glass container adapted to hold a liquid medicament x and provided with an electrically-operated heating means comprising two electrical conductors 1 and 2 and a filament or heating element 3 combined in such a way that when said conductors are energized by an electric current, the filament 3 will become heated.” Ex. 1004 at 1:19-28.

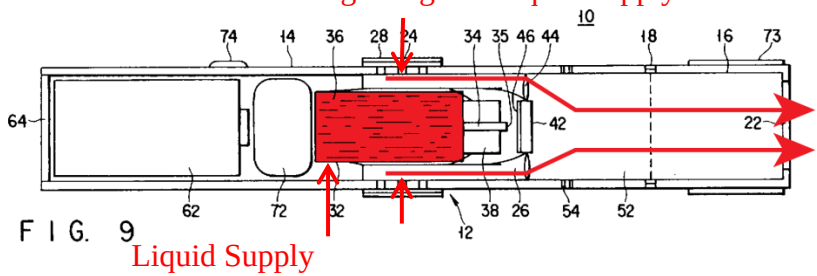


Heating Wire Perpendicular to the Longitudinal Axis

	“11. As a new article of manufacture, a vaporizing unit for therapeutic use, comprising...<i>filament wires</i> extending from the plug through the bottom of the vessel and terminating therein, portions of the <i>filament wires</i> extending from the plug being located in that part of the vessel adapted to contain the medicament and other portions extending above the level thereof, and a wick carried by the filament wires for lifting the medicament by capillary attraction to those portions of the wires extending above the liquid level of the vessel.” Ex. 1004 at 4:12-28.
2. The electronic cigarette of claim 1 further including a battery, a sensor and an electronic circuit board within the housing, with the circuit board electrically connected to the battery, the sensor and the heating wire.	As discussed above, Susa and Whittemore disclose the system of claim 1. Susa further discloses a battery (e.g., 62), a sensor (e.g., 73 in Fig. 4) and an electronic circuit board (e.g., 72 in Fig. 4) within the housing (e.g., 12), with the circuit board electrically connected to the battery, the sensor and the heating wire (e.g., coated resistance heater in 42) at, e.g., Ex. 1008 at ¶¶ 42, 43, 44, Fig. 4 (in red below). See <i>supra</i> element 1.5, 1.6 of this Section.  FIG. 4 “The <i>control circuit 72</i> for controlling the driving operation of the discharge drive portion 38 and the <i>ceramic heater 42</i> is arranged between the power supply 62 and material container 32. As shown in FIG. 4, the control circuit 72 has a signal processing circuit 72a, a drive circuit 72b, and a power circuit 72c. The signal processing circuit 72a is <i>connected to a sensor 73</i> for detecting the inhaling operation of the user and a manual ON/OFF switch 74. The drive circuit 72b is connected to the discharge drive portion 38 and the ceramic heater 42. <i>The power circuit 72c is connected to the power supply 62.</i>” Ex. 1008 at 8:50-9:3. See also Ex. 1008 at ¶ 43.
3. The electronic cigarette of claim 1 further including an atomization cavity within the	As discussed above, Susa and Whittemore disclose the system of claim 1. Susa further discloses an atomization cavity (e.g., 146) within the atomizer (e.g., 38, 34, 42, 46) at, e.g. Ex. 1008 at ¶¶ 26, 27, 35, 40, 49 Fig. 1, Fig. 3 (in red below); Ex. 1004 at 1:18-28. See <i>supra</i> element 1.5 of this Section.

atomizer.	 FIG. 1 “The liquid material 36 from the material container 32 is supplied first through a narrow flow path 142, and flows from a plurality of suction holes 144, having a smaller diameter than that of the discharge ports 35, to reach the liquid reservoir 146. Under the control of a control circuit 72, when the electrode 138 is operated to vibrate, the liquid material 36 is selectively discharged through the discharge ports 35 having a low resistance against the flow. The discharged liquid material 36 is supplied onto the ceramic heater 42 as a liquid drop LD.” Ex. 1008 at ¶35.
4. The electronic cigarette of claim 1 with the outlet within a mouthpiece that is screwed onto the housing.	As discussed above, Susa and Whittemore disclose the system of claim 1. Susa further discloses the outlet (22) within a mouthpiece (e.g., 12a) that is screwed (e.g., 13) onto the housing (e.g., 12) at, e.g., Ex. 1008 at ¶¶ 25, 66, Fig. 9. See supra element 1.5 of this Section. “However, a mouthpiece 16 is detachably mounted on the casing main body 14 through a connecting portion 18, and a suction port 22 is formed in the mouthpiece 16. The mouthpiece 16 is made of a material, e.g., a plastic or wood. As the connecting portion 18, a known structure, e.g., a screw or a fitting pair can be employed. In place of the mouthpiece 16, a filter may be inserted in the casing main body 14 and served for use.” Ex. 1008 at ¶ 66.
5. The electronic cigarette of claim 1 with the liquid supply comprising	As discussed above, Susa and Whittemore disclose the system of claim 1. Either the combination of Susa and Adiga or Susa, Whittemore, and Adiga further discloses the liquid supply (Adiga’s 20) comprising a fiber material (e.g., Adiga’s 24) at, e.g., Ex. 1007 at 2:44-48, 3:1-3, Fig. 2 (in red below); Ex. 1004 at 5:58-6:1. See supra element 1.5 of this Section. See also Ex. 1006 at 3:38-48.

a fiber material.	“The fuel element 11 includes a fuel tank 20 filled with a <i>porous fuel cartridge 24</i>, including usually a carbonaceous liquid fuel, such as ethanol or other low molecular weight hydrocarbon oils which saturates porous fuel cartridge 24, an extended wick 22 and a glow element or filament 16.” Ex. 1007 at 2:44-48.  FIG. 2 “The fuel cartridge 24 is generally a porous media, such as, cellulose acetate, low density polyethylene, ethyl vinyl acetate, <i>carbon filters, cotton, or other fabric materials.</i>” Ex. 1007 at 3:1-3.
6. The electronic cigarette of claim 1 with the porous body of atomizer projecting into the liquid supply comprising a porous bulge section.	As discussed above, Susa and Whittemore discloses the system of claim 1. Whittemore further discloses the porous body (<i>e.g.</i>, D) of atomizer projecting (<i>e.g.</i>, D) into the liquid supply (<i>e.g.</i>, x) comprising a porous bulge section at, <i>e.g.</i>, Ex. 1004 at 2:8-18 (in red below). See <i>supra</i> element 1.5 of this Section.  “In the form of my invention shown in Figure 2, the wick D consists of a thread, string or stand of some suitable wick material doubled intermediate its ends so as to form a substantially inverted V-shaped device whose side portions are encased in and surrounded by coiled or looped portions of the filament 3, the lower ends or free ends of the side 15 pieces of the <i>wick projecting downwardly into the medicament</i> and terminating at or in close proximity to the closed bottom 6 of the vessel A.” Ex. 1004 at 2:8-18.

7. [Preamble] An electronic cigarette, comprising:	Susa discloses an electronic cigarette (<i>e.g.</i> , “simulated smoking article”). <i>See supra</i> discussion of claim 1 [Preamble] in this Section.
[7.1] a housing having an inlet and an outlet;	Susa discloses a housing (<i>e.g.</i> , 12) having an inlet (<i>e.g.</i> , 24) and an outlet (<i>e.g.</i> , 22). <i>See supra</i> discussion of claim [1.1] in this Section.
[7.2] a liquid supply in the housing;	Susa discloses a liquid supply (<i>e.g.</i> , 32, 36) in the housing (<i>e.g.</i> , 12). <i>See supra</i> discussion of claim [1.2] in this Section.
[7.3] an air flow channel through the housing connecting the inlet to the outlet, with part of the air flow channel extending alongside of the liquid supply;	Susa discloses an air flow channel (<i>e.g.</i>, 24, 26, 22) through the housing (<i>e.g.</i>, 12) connecting the inlet (<i>e.g.</i>, 24) to the outlet (<i>e.g.</i>, 22), with part of the air flow channel extending alongside of the liquid supply (<i>e.g.</i>, 32, 36) at, <i>e.g.</i>, Ex. 1008 at Fig. 9 (in red below). <i>See supra</i> discussion of claim [1.3] in this Section. Air Flow Channel extending alongside Liquid Supply  F I G. 9 Liquid Supply
[7.4] an atomizer in the housing between the inlet and the outlet, the atomizer including:	Susa discloses an atomizer (<i>e.g.</i> , 38, 34, 42, 46) in the housing (<i>e.g.</i> , 12) between the inlet (<i>e.g.</i> , 24) and the outlet (<i>e.g.</i> , 22). <i>See supra</i> discussion of claim [1.4] in this Section.
[7.5] a porous body extending	Susa discloses an atomizer (<i>e.g.</i> , 38, 34, 42, 46) including a porous body (<i>e.g.</i> , 38) projecting into the liquid supply (<i>e.g.</i> , 32, 36). Whittemore discloses an atomizer assembly (<i>e.g.</i> , A, D) including

into the liquid supply;	a porous body (<i>e.g.</i> , D) projecting into the liquid supply (<i>e.g.</i> , x). <i>See supra</i> discussion of claim [1.5] in this Section.
[7.6] a heating wire in the atomizer having a central axis oriented substantially perpendicular to a longitudinal axis of the housing; and	Susa discloses an atomizer assembly (<i>e.g.</i> , 38, 34, 42, 46) including a heating wire (<i>e.g.</i> , coated resistance heater in 42) in the atomizer having a central axis oriented substantially perpendicular (<i>e.g.</i> , 42 in Fig. 8) to the longitudinal axis of the housing (<i>e.g.</i> , 12). Whittemore discloses an atomizer assembly (<i>e.g.</i> , A, D) including a heating wire (<i>e.g.</i> , 3) in the atomizer having a central axis oriented substantially perpendicular (<i>e.g.</i> , 3 in Fig. 2) to the longitudinal axis of the housing (<i>e.g.</i> , A). <i>See supra</i> discussion of claim [1.6] in this Section.
[7.7] a battery, a sensor and an electronic circuit board within the housing, with the circuit board electrically connected to the battery, the sensor and the heating wire.	Susa discloses a battery (<i>e.g.</i> , 62), a sensor (<i>e.g.</i> , 73 in Fig. 4) and an electronic circuit board (<i>e.g.</i> , 72 in Fig. 4) within the housing (<i>e.g.</i> , 12), with the circuit board electrically connected to the battery, the sensor and the heating wire. <i>See supra</i> discussion of claim 2 in this Section.
8. [Preamble] An electronic cigarette, comprising:	Susa discloses an electronic cigarette (<i>e.g.</i> , “simulated smoking article”). <i>See supra</i> discussion of claim 1 [Preamble] in this Section.

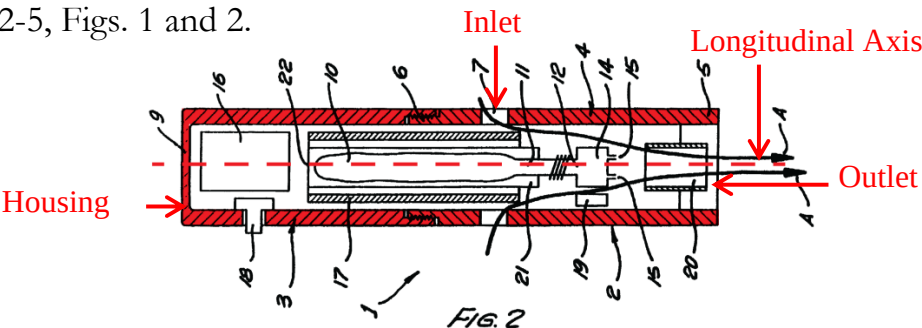
[8.1] a housing having an inlet and an outlet ;	Susa discloses a housing (<i>e.g.</i> , 12) having an inlet (<i>e.g.</i> , 24) and an outlet (<i>e.g.</i> , 22). <i>See supra</i> discussion of claim [1.1] in this Section.
[8.2] a liquid supply, a battery, and an electronic circuit board in the housing;	Susa discloses a liquid supply (<i>e.g.</i> , 32, 36), a battery (<i>e.g.</i> , 62), and an electronic circuit board (<i>e.g.</i> , 72 in Fig. 4) in the housing (<i>e.g.</i> , 12). <i>See supra</i> discussion of claims [1.2] and 2 in this Section.
[8.3] an air flow channel in the housing between the inlet and the outlet; and	Susa discloses an air flow channel (<i>e.g.</i> , 24, 26, 22) in the housing (<i>e.g.</i> , 12) between the inlet (<i>e.g.</i> , 24) and the outlet (<i>e.g.</i> , 22). <i>See supra</i> discussion of claim [1.3] in this Section.
[8.4] an atomizer in the housing including: a porous body extending into the liquid supply; a heating wire having a central axis generally perpendicular to a longitudinal axis of the housing; and with the circuit board	Susa discloses an atomizer (<i>e.g.</i> , 38, 34, 42, 46) in the housing (<i>e.g.</i> , 12) including: a porous body (<i>e.g.</i> , 38) extending into the liquid supply (<i>e.g.</i> , 32, 36); a heating wire (<i>e.g.</i> , coated resistance heater in 42) having a central axis generally perpendicular (<i>e.g.</i> , 42 in Fig. 8) to a longitudinal axis of the housing (<i>e.g.</i> , 12); and with the circuit board (<i>e.g.</i> , 72 in Fig. 4) electrically connected to the battery (<i>e.g.</i> , 72 in Fig. 4) and the heating wire (<i>e.g.</i> , 42). <i>See supra</i> discussion of claims [1.4], [1.5], [1.6] and 2 in this Section.

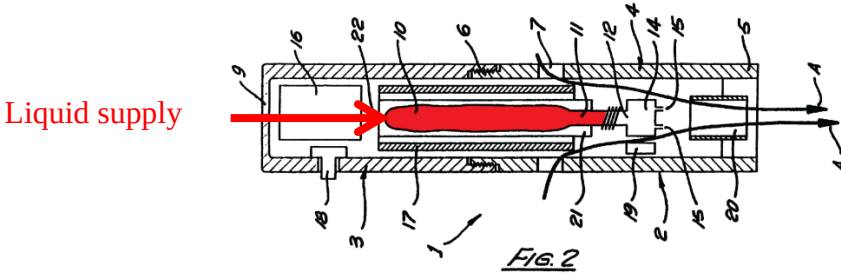
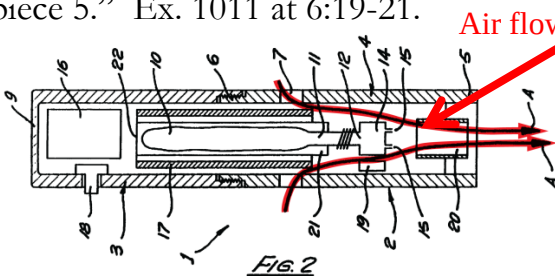
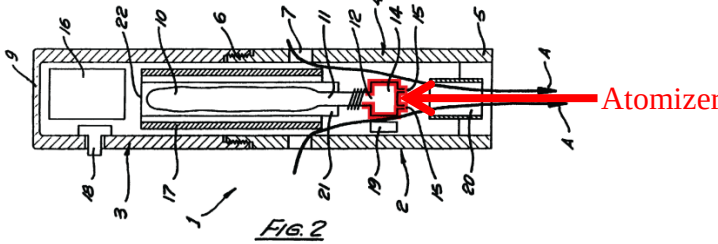
electrically connected to the battery and the heating wire.	
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Appendix G

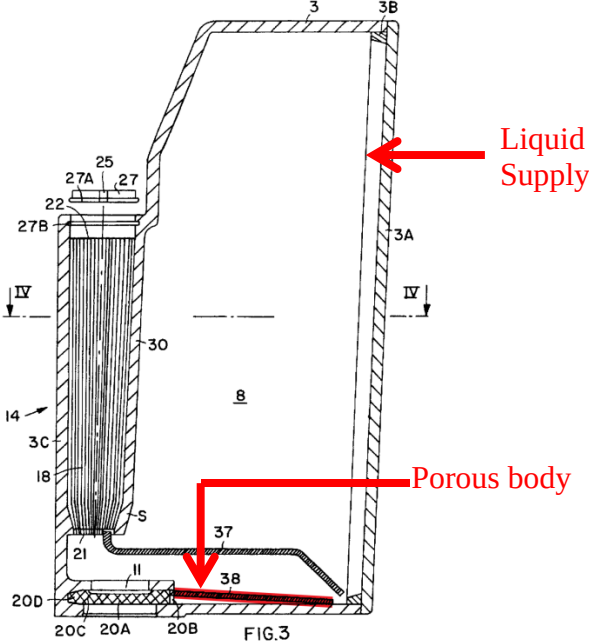
Claims 1, 2, 3, 4, 5, 6, 7, and 8 Are Obvious Over Voges in view of Gehrer

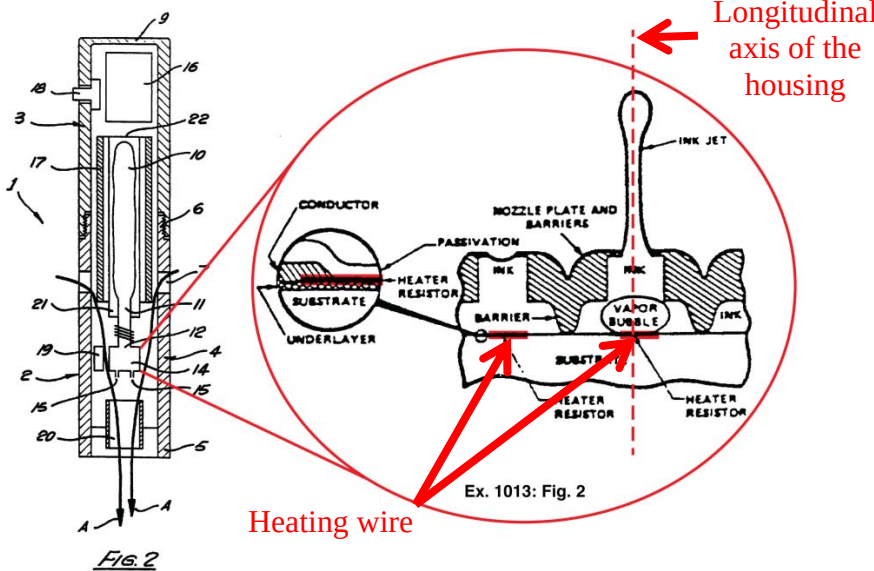
Under 35 U.S.C. § 103 (Ground 6)

'628 Claim	U.S. Patent No. 5,894,841 ("Voges")
1. [Preamble] An electronic cigarette, comprising:	To the extent that the preamble is considered a claim limitation, Voges discloses an electronic cigarette at, e.g., Ex. 1011 at Fig. 1, 2, 2:31-34, 3:7-15, 5:48-53: "It is an object of other preferred embodiments of the invention to provide a <i>cigarette substitute</i>." Ex. 1011 at 3:29-30. "With reference to FIGS. 1 and 2 there is shown a first embodiment of the invention consisting of a <i>nicotine dispenser</i> comprising a <i>cigarette-shaped</i> hollow tubular body 1 comprising connected body parts 2, 3." <i>Id.</i> at 5:48-53.
[1.1] a housing having a longitudinal axis, an inlet and an outlet;	Voges discloses a housing (e.g., 2, 3) having a longitudinal axis, an inlet (e.g., 7), and an outlet (e.g., through hole in 5) at, e.g., Ex. 1011 at 5:48-53, 10:43-45, 8:28-32, 6:2-5, Figs. 1 and 2 (in red below). "With reference to FIGS. 1 and 2 there is shown a first embodiment of the invention consisting of a nicotine dispenser comprising a cigarette-shaped <i>hollow tubular body</i> 1 comprising connected body parts 2, 3. Body part 2 has a sidewall 4, a <i>mouthpiece</i> 5 at or adjacent one end and a threaded other end 6. A <i>plurality of axially extending slots</i> 7 penetrate side wall 4." Ex. 1011 at 5:48-53. <i>See also</i> Ex. 1011 at 10:43-45, 8:28-32, 6:2-5, Figs. 1 and 2.  <i>FIG. 2</i>
[1.2] a liquid supply in the housing;	Voges discloses a liquid supply (e.g., 10, 11) in the housing (e.g., 2, 3) at, e.g., Ex. 1011 at 5:58-61, 6:31-41, Fig. 2 (in red below).

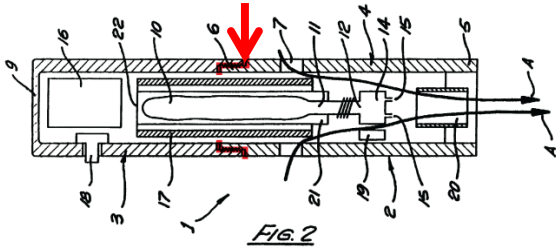
'628 Claim	U.S. Patent No. 5,894,841 ("Voges")
	 Fig. 2 "Nicotine in a suitable solvent (for example water) is provided in a container 10 which is adapted by means of a spiggot shaped outlet and coupling 11, for fluid connection to an inlet port 12 of a droplet ejection device 14." Ex. 1011 at 5:58-61. <i>See also, e.g.,</i> Ex. 1011 at 6:31-41.
[1.3] an air flow channel in the housing connecting the inlet to the outlet; and	Voges discloses an air flow channel (e.g., "A" in Fig. 2 (in red below)) in the housing (e.g., 2, 3) connecting the inlet (e.g., 7) to the outlet (e.g., through hole in 5) at, e.g., Ex. 1011 at 6:2-5, 6:19-21, Fig. 2 (in red below). "The liquid containing nicotine issues from device 14 as a fine spray of droplets which are entrained in the inhalation airflow from slots 7 towards mouthpiece 5." Ex. 1011 at 6:19-21.  Fig. 2 "When a user inhales at mouthpiece 5, a stream of air "A" is drawn into body 1 via slots 7, through body part 2, and mouthpiece 5 into the user's lungs." Ex. 1011 at 6:2-5.
[1.4] an atomizer assembly in the housing between the inlet and the outlet, including:	Voges discloses an atomizer assembly (e.g., 12, 14, 15) in the housing (e.g., 2, 3) between the inlet (e.g., 7) and the outlet (e.g., through hole in 5) at, e.g., Ex. 1011 at 5:58-61, 6:19-23, Fig. 2 (in red below). "droplet ejection device 14." Ex. 1011 at 5:58-61.  Fig. 2 "Device 14 responds to the output signal or signals by issuing a

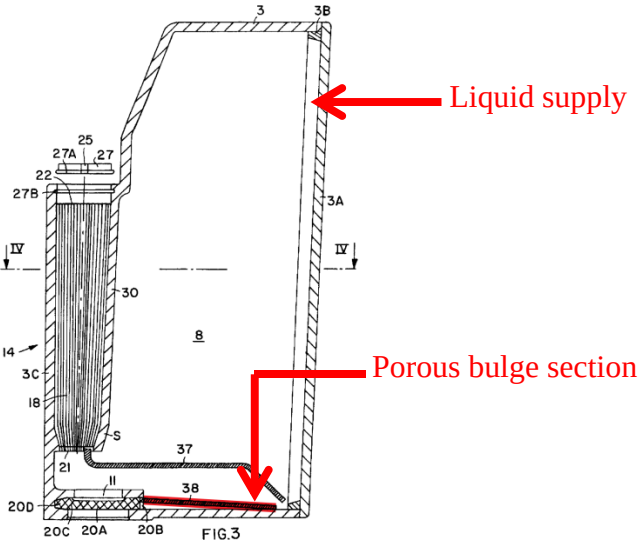
'628 Claim	U.S. Patent No. 5,894,841 (“Voges”)
	plurality of droplets of nicotine solution from <i>orifices 15 of device 14</i>. The liquid containing nicotine issues from device 14 as a fine spray of droplets which are entrained in the inhalation airflow from slots 7 towards mouthpiece 5. <i>The spray typically comprises fine droplets which tend to vaporise in the airflow.</i>” Ex. 1011 at 6:17-23. <i>See also</i> Ex. 1011 at 3:44-46, 3:62-4:12, 6:17-19.
[1.5] a porous body projecting into the liquid supply; and	As discussed above, Voges discloses an atomizer (e.g., 12, 14, 15). Gehrer discloses a porous body (e.g., 38 connected to 20A in Fig. 3) projecting into the liquid supply (e.g., 8 in Fig. 3) at, e.g., Ex. 1012 at 6:11-24, 1:59-2:21, 5:14-23, Figs. 1, 3 (in red below). “All eight figures illustrate the basic construction of the present ink pot or ink container. In all embodiments the ink container 1 or 2 or 3 or 4 or 5 encloses an ink reservoir 6 or 7 or 8 or 9 or 10. Each container comprises an ink withdrawal opening or port 11 which is closed by a <i>capillary coupling member</i> 20, 20A, 20E. These coupling members may have different configurations and they may be made of different <i>wicking materials</i>. In all instances the function is the same, namely to supply ink out of the reservoir into <i>a printing head not shown but connected to the socket 11A shown for example in FIG. 1</i>, or the coupling member may be constructed as a writing tip or for cooperation with a writing tip 42 as shown in FIG. 1A.” Ex. 1012 at 6:11-24. <i>See also</i> Ex. 1012 at Fig. 1. “In view of the above it is the aim of the invention to achieve the following objects singly or in combination:... to make the capillary body and a capillary coupling member of readily available inexpensive capillary <i>wicking materials such as open cell foam materials, felts, fibers, especially linear fiber materials</i>;... to connect the ink facing end of the capillary body and/or the ink facing surface of the capillary coupling through an ink conducting element such as a wick to the bottom of the ink reservoir so as to avoid a dry out of the ink facing surfaces.” Ex. 1012 at 1:59-2:21.

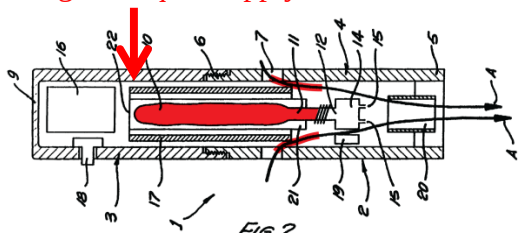
'628 Claim	U.S. Patent No. 5,894,841 ("Voges")
	 FIG. 3 “Further, in FIG. 3 each of the capillary components, namely the capillary coupling member 20A and the capillary body 18 are provided with their respective <i>ink conducting elements 38 and 37 such as a wick connected at one end to the coupling 20A or to the body 18 while the other end reaches to the lowest point in the reservoir 8 to keep the coupling member 20A and the front end or facing end 21 wetted with ink.</i>” Ex. 1012 at 8:20-27; <i>see also Id., e.g., at 5:14-23, Fig. 3.</i>
[1.6] a heating wire in the atomizer having a central axis oriented substantially perpendicular to the longitudinal axis of the housing.	Voges discloses an atomizer (e.g., 12, 14, 15) including a heating wire (e.g., heater resistor) in the atomizer having a central axis oriented substantially perpendicular to the longitudinal axis of the housing at, e.g., Ex. 1011 at 3:62-3:65, 4:6-4:14, 10:52-54, 3:66-4:5; Ex. 1013 at pp. 2-3, Fig. 2 (in red below). “In the present example DED 14 is a piezoelectric crystal or <i>thermal resistor bubble jet device</i> such as used in an ink jet print head.” Ex. 1011 at 10:52-54. “Briefly, a typical thermal device consists of a liquid-containing chamber provided with an array of twelve coaxially divided nozzles and has twelve <i>thin film resistors</i>, a resistor being located directly behind each nozzle. Each nozzle supplies a droplet of liquid from the chamber if and when <i>the corresponding resistor is energized by a short electrical pulse</i>. The resistors thus function as ejection means. Within a few microseconds <i>liquid in contact with the resistor is vapourised</i> and forms a bubble.” Ex. 1011 at 4:6-4:14.

'628 Claim	U.S. Patent No. 5,894,841 ("Voges")
	 Voges also cites to known devices, including a Hewlett Packard design guide, for thermal ink jet printing: "These devices are sometimes referred to as "droplet on demand" devices. By way of example piezoelectric devices are broadly described in "Ink-Jet Printing" [M. Doring Philips Tech Rev 40, 192-198, 1982 No. 7], while thermal devices are broadly described in "Thermal Ink—Jet PrintCartridge Designers Guide" (2nd Edition Hewlett Packard), both incorporated herein by reference." Ex. 1011 at 3:66-4:5. "The resistors are located directly behind each nozzle as shown in figure 2. Each nozzle can supply a droplet of ink on demand by energizing the corresponding resistor...Within a few microseconds the ink above the resistor is vaporized. The vapor bubble grows rapidly and imparts momentum to the ink above the bubble." (reproduced above) Ex. 1013 at p. 2.
2. The electronic cigarette of claim 1 further including a battery, a sensor and an electronic circuit board	As discussed above, Voges and Gehrer disclose the system of claim 1. Voges further discloses a battery (e.g., 17), a sensor (e.g., 19) and an electronic circuit board (e.g., 16) within the housing (e.g., 2, 3), with the circuit board (e.g., 16) electrically connected to the battery (e.g., 17), the sensor (e.g., 19) and the heating wire (e.g., heater resistor) at, e.g., Ex. 1011 at 6:8-11, 5:64-6:2, Fig. 2, 6:2-5. See <i>supra</i> element 1.5 of this Section. "A <i>pressure sensor 19</i> detects a change in pressure in the device due to inhalation or suction at mouthpiece 5 and issues an actuation signal via cables (not illustrated) to <i>control means 16</i>." Ex. 1011 at 6:8-11.

'628 Claim	U.S. Patent No. 5,894,841 ("Voges")
within the housing, with the circuit board electrically connected to the battery, the sensor and the heating wire.	"Device 14 is controlled by control means 16, for example a microelectronic circuit or microprocessor means. Device 14 and <i>control means 16</i> as well as other electrically-powered parts are energised by means of a <i>hollow cylindrical battery 17</i> via an on-off switch 18 extending through side wall 14 and operable by the user." Ex. 1011 at 5:64-6:2.
3. The electronic cigarette of claim 1 further including an atomization cavity within the atomizer.	As discussed above, Voges and Gehrer disclose the system of claim 1. Voges further discloses an atomization cavity (<i>e.g.</i>, liquid containing chamber in 14, 4:5-10) within the atomizer (<i>e.g.</i>, 12, 14, 15) at, <i>e.g.</i>, Ex. 1011 at 4:17-20, 5:58-64, Fig. 2 (in red below). See <i>supra</i> element 1.5 of this Section. Ex. 1013: Fig. 2 Atomization cavity Fig. 2 "Briefly, a typical thermal device consists of a <i>liquid containing chamber</i> provided with an array of twelve coaxially divided nozzles and has twelve thin film resistors, a resistor being located directly behind each nozzle. Each nozzle supplies a droplet of liquid from the <i>chamber</i> if and when the corresponding resistor is energized by a short electrical pulse." Ex. 1011 at 4:6-12.
4. The electronic cigarette of claim 1 with the outlet	As discussed above, Voges and Gehrer disclose the system of claim 1. Voges further discloses the outlet (<i>e.g.</i>, through hole in 5) within a mouth piece (<i>e.g.</i>, 5, 6) that is screwed onto the housing at, <i>e.g.</i>, Ex. 1011 at 5:48-53, 10:43-45, 8:27-32, 6:2-5, Figs. 1 and 2 (in red below). See <i>supra</i> element 1.5 of this Section.

'628 Claim	U.S. Patent No. 5,894,841 ("Voges")
within a mouthpiece that is screwed onto the housing.	"With reference to FIGS. 1 and 2 there is shown a first embodiment of the invention consisting of a nicotine dispenser comprising a cigarette-shaped <i>hollow tubular body 1</i> comprising connected body parts 2, 3. Body part 2 has a sidewall 4, a <i>mouthpiece 5</i> at or adjacent one end and a <i>threaded other end 6</i>. A plurality of axially extending slots 7 penetrate side wall 4. Body part 3 is <i>screw threaded</i> at one end for connection with <i>threaded end 6 of body part 2</i>. Body part 3 is closed or constricted at the end 9 remote from mouthpiece 5." Ex. 1011 at 5:48-53. <i>See also</i> Ex. 1011 at 10:43-45, 6:2-5, Figs. 1 and 2. Threading  FIG. 2 "Mouthpiece 5 may be integral or may be soft-tip, for example of rubber or plastics cardboard, or paper and may be <i>independently disposable</i>. Ex. 1011 at 8:28-32.
5. The electronic cigarette of claim 1 with the liquid supply comprising a fiber material.	As discussed above, Voges and Gehrer disclose the system of claim 1. Gehrer further discloses the liquid supply (e.g., 8 in Fig. 3) comprising a fiber material (e.g., 18) at, e.g., Ex. 1012 at 3:7:-15, 4:11-13, Fig. 3 (in red below). See supra element 1.5 of this Section. "In all embodiments according to the invention the chamber for the capillary body is arranged inside the ink container." Ex. 1012 at 4:11-13. "The <i>capillary body</i> may be advantageously made of any suitable wicking material such as <i>foam materials, felts, or fibrous materials</i>, especially linear or <i>elongated fiber material</i> to form a storage for ink. Such a capillary body can be simply cut from commercially available half finished materials as mentioned above. These materials are relatively inexpensive, yet their intended wicking function by capillary action is assured with certainty." Ex. 1012 at 3:7:-15.

'628 Claim	U.S. Patent No. 5,894,841 ("Voges")
	 “The <i>capillary coupling member</i> may have different configurations. For example, in FIG. 3 the coupling member 20A has a disk shape with a slight depression 20C in its center facing into the container and with a tapered edge 20D fitting into a respective groove in the housing wall.” <i>Id.</i> at 8:44-49.
7. [Preamble] An electronic cigarette, comprising:	Voges discloses an electronic cigarette. <i>See supra</i> discussion of claim 1 [Preamble] in this Section.
[7.1] a housing having an inlet and an outlet;	Voges discloses a housing (<i>e.g.</i>, 2, 3) having a longitudinal axis, an inlet (<i>e.g.</i>, 7), and an outlet (<i>e.g.</i>, through hole in 5). <i>See supra</i> discussion of claim [1.1] in this Section.
[7.2] a liquid supply in the housing;	Voges discloses a liquid supply (<i>e.g.</i>, 10, 11) in the housing (<i>e.g.</i>, 2, 3). <i>See supra</i> discussion of claim [1.2] in this Section.
[7.3] an air flow channel through the housing connecting the inlet to the outlet, with part of the air flow	Voges discloses an air flow channel (<i>e.g.</i>, “A” in Fig. 2) through the housing (<i>e.g.</i>, 2, 3) connecting the inlet (<i>e.g.</i>, 7) to the outlet (<i>e.g.</i>, through hole in 5), with part of the air flow channel extending alongside of the liquid supply (<i>e.g.</i>, 10, 11) at, <i>e.g.</i>, Ex. 1011 at Fig. 2 (in red below). <i>See supra</i> discussion of claim [1.3] in this Section.

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channel extending alongside of the liquid supply; and	air flow channel alongside liquid supply Liquid supply →  FIG. 2
[7.4] an atomizer in the housing between the inlet and the outlet, the atomizer including:	Voges discloses an atomizer (e.g., 12, 14, 15) in the housing (e.g., 1) between the inlet (e.g., 7) and the outlet (e.g., through hole in 5). See <i>supra</i> discussion of claim [1.4] in this Section.
[7.5] a porous body extending into the liquid supply;	Voges and Gehrer disclose a porous body (e.g., Gehrer's 38 connected to 20A in Fig. 3) extending into the liquid supply (e.g., 8 in Fig. 3). See <i>supra</i> discussion of claim [1.5] in this Section.
[7.6] a heating wire in the atomizer having a central axis oriented substantially perpendicular to a longitudinal axis of the housing; and	Voges discloses a heating wire (e.g., heater resistor in Ex. 1013) in the atomizer (e.g., 12, 14, 15) having a central axis oriented substantially perpendicular to a longitudinal axis of the housing. See <i>supra</i> discussion of claim [1.6] in this Section.
[7.7] a battery, a sensor and an electronic circuit board	Voges discloses a battery (e.g., 17), a sensor (e.g., 19) and an electronic circuit board (e.g., 16) within the housing (e.g., 2, 3), with the circuit board (e.g., 16) electrically connected to the battery (e.g., 17), the sensor (e.g., 19) and the heating wire (e.g., heater resistor in Ex. 1013). See <i>supra</i> discussion of claim 2 in

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within the housing, with the circuit board electrically connected to the battery, the sensor and the heating wire.	this Section.
8. [Preamble] An electronic cigarette, comprising:	Voges discloses an electronic cigarette. <i>See supra</i> discussion of claim 1 [Preamble] in this Section.
[8.1] a housing having an inlet and an outlet ;	Voges discloses a housing (<i>e.g.</i>, 2, 3) having a longitudinal axis, an inlet (<i>e.g.</i>, 7), and an outlet (<i>e.g.</i>, through hole in 5). <i>See supra</i> discussion of claim [1.1] in this Section.
[8.2] a liquid supply, a battery, and an electronic circuit board in the housing;	Voges discloses a liquid supply (<i>e.g.</i>, 10, 11), a battery (<i>e.g.</i>, 17), and an electronic circuit board (<i>e.g.</i>, 16) within the housing (<i>e.g.</i>, 2, 3). <i>See supra</i> discussion of claims [1.2] and 2 in this Section.
[8.3] an air flow channel in the housing between the inlet and the outlet; and	Voges discloses an air flow channel (<i>e.g.</i>, "A" in Fig. 2) in the housing (<i>e.g.</i>, 2, 3) between the inlet (<i>e.g.</i>, 7) and the outlet (<i>e.g.</i>, through hole in 5). <i>See supra</i> discussion of claim [1.3] in this Section.
[8.4] an atomizer in the housing including: a porous body extending	Voges combined with Gehrer discloses an atomizer (<i>e.g.</i>, 14 in Voges) in the housing (<i>e.g.</i>, 2, 3 in Voges) including a porous body (<i>e.g.</i>, 38 in Gehrer) extending into the liquid supply (<i>e.g.</i>, 8 in Gehrer; 10, 11 in Voges); a heating wire (<i>e.g.</i>, heater resistor in Ex. 1013) having a central axis generally perpendicular to a longitudinal axis of the housing (<i>e.g.</i>, 2, 3 in Voges); and with the

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into the liquid supply; a heating wire having a central axis generally perpendicular to a longitudinal axis of the housing; and with the circuit board electrically connected to the battery and the heating wire.	circuit board (<i>e.g.</i>, 16 in Voges) electrically connected to the battery (<i>e.g.</i>, 17 in Voges) and the heating wire (<i>e.g.</i>, heater resistor in Voges). <i>See supra</i> discussion of claims [1.4], [1.5], [1.6] and 2 in this Section.