

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NJOY, LLC and NJOY HOLDINGS, INC.,
Petitioners,

v.

JUUL LABS, INC.,
Patent Owner

U.S. PATENT NO. 10,130,123

DECLARATION OF JOSEPH C. M^CALEXANDER ^{III}

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I, Joseph C. M^cAlexander ^{III}, hereby declare:

I. INTRODUCTION

1. I have been retained by Weil, Gotshal & Manges on behalf of Petitioners NJOY, LLC and NJOY Holdings, Inc. (collectively, “Petitioners” or “NJOY”) as an independent expert witness in the above-captioned *inter partes* review (“IPR”), in which NJOY has requested that the U.S. Patent and Trademark Office cancel as unpatentable claims 14–16, 18, 27–29, and 31–32 of U.S. Patent No. 10,130,123 (“‘123 Patent”).

2. I am being compensated on an hourly basis for my work on this case. I have received no additional compensation for my work on this case, and my compensation does not depend upon the contents of this declaration or the outcome of these proceedings.

3. This declaration sets forth my analyses and opinions based on my knowledge and experience and the materials I considered.

A. Qualifications and Compensation

4. I am a Registered Professional Engineer (#79454) and the President of M^cAlexander Sound, Inc. I hold a Bachelor of Science degree in Electrical Engineering from North Carolina State University. I am a member of a number of professional organizations, including the Institute of Electrical and Electronics Engineers, Inc. (IEEE) and the National Society of Professional Engineers. I have

been associated with the integrated circuit and electronics industry as a designer and consultant for the past fifty one (51) years. I am a named inventor on thirty one (31) U.S. patents and a number of foreign patents, including patents directed to current sensors, motion sensors, timing and voltage/current control, signal generation and detection, and conditional response circuits.

5. My skills and experience are in areas of circuit design and analysis, device fabrication and assembly, testing, marketing, control system design and analysis, manufacturing operations, and respective areas of quality, reliability, and defect/failure analysis. Specifically, I have:

designed and managed development, testing, and evaluation of devices including Dynamic Random Access Memories (DRAMs), Static Random Access Memories (SRAMs), Charge Coupled Devices (CCDs), Shift Registers (SRs), and functional circuits including I/O buffers for address and data, decoders, clocks, sense amplifiers, fault tolerant, parallel-to-serial data paths for video applications, level shifters, converters, pumps, and logic, as well as wireless communication systems and MEMs applications;

managed operations including engineering, training, and quality assurance for device fabrication, assembly, test, analysis, and reliability assessment, as well as manufacturing control, each of which involved both volatile and non-volatile memory;

performed testing, analysis, and control involving use of mechanical calibration and measuring equipment, including optical, scanning e-beam, IR, capacitive, and laser using phase contrast and Fast Fourier Transform (FFT) for High Aspect Ratio Inspection (HARI) applications; audio and video system design and installation;

taught courses in solid state device physics, integrated circuit design, integrated circuit fabrication, and statistical control;

provided expert services, investigating both process and design technologies of various devices (microprocessor and controller, memory, programmable logic, card, tag, module, mixed signal, custom, and other), systems (PC and peripheral, computer, control, laser measurement, switch, architecture, software, and other), and consumer products (medical, TV, telephone, VCR, facsimile, copier, lighting, game, and other);

provided nuclear radiation hardness testing services for military and space clients; and

managed the design and installation of audio sound and video systems for private and commercial enterprises.

6. I also have experience performing intellectual property valuation and patent portfolio work for companies. For example, as a Partner at RMC Management, I conducted numerous patent portfolio valuations and negotiated licenses. Also, I was part of a consultant team with ST Microelectronics that performed patent portfolio valuations and negotiated licenses on behalf of ST Microelectronics.

7. Because of my background, training, and experience, I am qualified to provide the expert opinions regarding the technology described and claimed in the '123 Patent. A more detailed account of my work experience and other qualifications is listed in my *Curriculum Vitae*, EX1027.

8. I am being compensated at the hourly rate of \$625.00. My compensation is not dependent on the substance of my statements in this Declaration.

B. Materials Considered

9. I reviewed all of the documents referenced in this declaration, including the following exhibits submitted with NJOY’s petition for *inter partes* review:

No.	Exhibit
1001	U.S. Patent No. 10,130,123 (“’123 Patent”)
1002	’123 Patent File History
1004	U.S. Patent Publication No. 2015/0245658 (“Worm”)
1005	U.S. Patent Publication No. 2016/0128389 (“Lamb”)
1006	U.S. Patent Publication No. 2015/0020831 (“Weigensberg”)
1007	U.S. Patent No. 8,528,569 (“Newton569”)
1008	U.S. Patent Publication No. 2014/0000638 (“Sebastian”)
1009	U.S. Patent No. 8,499,766 (“Newton766”)
1010	WO 2012/142293 (“Levitz”)
1011	U.S. Patent No. 8,375,957 (“Hon957”)
1012	U.S. Patent Publication No. 2014/0174458 (“Katz”)
1013	U.S. Patent Publication No. 2014/0261495 (“Novak”)
1014	U.S. Patent Publication No. 2017/0318861 (“Thorens II”)
1015	U.S. Patent No. 9,801,415 (“Tu”)
1016	U.S. Patent Publication No. 2014/0318559 (“Thorens”)
1017	EP0277519 (“Roberts”)
1018	EP2110034 (“Fernando”)

No.	Exhibit
1019	U.S.I.T.C. Investigation No. 337-TA-1368, Joint Claim Construction Chart
1020	MS5637-02BA03 Data Sheet
1021	WO 2015/153443 (“Henry”)
1022	U.S. Patent Publication No. 2016/0374397 (“Jordan”)
1023	U.S. Provisional Pat. No. 62/184,569
1024	EP1736065 (“Hon065”)
1025	<i>Reserved</i>
1026	Honeywell 160PC Low Pressure Sensor Datasheet
1028	U.S. Patent Publication No. 2014/0150810 (“Hon810”)
1029	Screen shots of Internet Archives webpages for Honeywell website on November 27, 2004 with Model 163PC01D36 datasheet
1030	Screen shots of Internet Archives webpages for Measurement Specialties website on August 12, 2013 with MS5637-02BA03 datasheet, dated May 22, 2013
1031	<i>JUUL Labs, Inc. v. NJOY, LLC</i> , No. 23-cv-01204 (D. Ariz.) Docket (retrieved Nov. 13, 2023)

10. In forming my opinions, I considered the documents listed above and my education, training, experience, and knowledge of the field encompassing the ’123 Patent.

II. RELEVANT LEGAL STANDARDS

11. I am not an attorney, so my understanding of patent law is based on explanations thereof provided to me by counsel. The legal standards set forth below

are based on the guidance provided by counsel, and I have applied these standards to my analysis.

A. Claim Construction

12. I understand that the numbered paragraphs at the end of a U.S. patent specification are the patent “claims” that define the metes and bounds of the alleged invention. I further understand that certain of the ’123 Patent claims are being challenged in the present IPR proceeding.

13. I understand that, in this proceeding, the Board must determine the scope of the claims by giving the claims their ordinary and customary meaning in light of the specification, as the claims would be interpreted by one of ordinary skill in the art.

14. I understand that patent claims generally include a “transitional” term or phrase between the claim’s preamble and body, such as “consisting of,” “consisting essentially of,” and “comprising,” which vary in inclusiveness. I understand “consisting of” is closed, meaning the claim is limited to the elements following the transitional phrase and nothing else. I understand “consisting essentially of” is semi-closed, meaning the claim is limited to the elements following the transitional phrase and other unrecited elements that do not materially affect the basic and novel characteristics of the claimed invention. I understand that “comprising” is open, meaning the claim is not limited to elements following the

transitional phrase and can encompass other unrecited elements.

B. Invalidity

15. I understand that NJOY bears the burden of proving the challenged '123 Patent claims are invalid. I further understand that NJOY must prove this by a preponderance of the evidence, which means that invalidity must be shown to be more likely than not.

16. I understand that a claim may be invalid as anticipated by prior art. I was informed that prior art anticipates a claim when the prior art discloses each and every claim element.

17. I understand that a claim may be invalid as obvious when, as a whole, it would have been obvious to a POSA at the time of the alleged invention. Thus, I understand I must analyze obviousness from the perspective of a POSA, and I further understand I must analyze obviousness based on four factual inquiries: (1) the scope and content of the prior art; (2) the differences between the claimed invention and the prior art; (3) the level of ordinary skill in the art; and (4) secondary considerations of nonobviousness. I have been instructed that I cannot rely on hindsight and that, instead, I should consider what a POSA had reason to pursue further and routine steps a POSA would have taken, such as in response to known problems, situations, or obstacles.

18. I understand that the following non-exhaustive list of rationales may

support a conclusion that a claim is obvious: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to obtain predictable results; use of a known technique to improve a similar device (method, or product) in the same way; applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and some teaching, suggestion, or motivation in the prior art that would have led a POSA to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

19. I was informed that in addition to explicit motivation, motivation to combine prior art references may be implicit, and may be found in the knowledge of a POSA or in the nature of the problem to be solved. I understand that an implicit motivation to combine exists not only when a suggestion may be gleaned from the prior art as a whole, but when an “improvement” is technology-independent and the combination of references results in a product or process that is more desirable, for example because it is stronger, cheaper, cleaner, faster, lighter, smaller, more durable, or more efficient. I further understand that motivation to combine references may be found in the nature of the problem to be solved where prior art references are directed to the same problem.

20. I understand that prior art may be relied on for its express disclosures and teachings. I also understand that prior art may be relied on as teaching features that are necessarily present in the prior art even if those specific feature are not expressly or explicitly disclosed.

21. I understand that before reaching any final conclusion on obviousness, I must consider objective indicia of nonobviousness, if any such indicia are offered. I was informed that I must consider these indicia to ensure that, for example, there were not unanticipated problems, obstacles, or hurdles that may seem easy to overcome in hindsight but were not readily overcome before the challenged claims' priority date. I understand that these objective indicia are also known as "secondary considerations of nonobviousness" and may include long-felt but unmet needs and unexpected results, among others.

22. I also understand that any alleged evidence of secondary considerations of nonobviousness must relate to the scope of the challenged claims. I understand that for any offered secondary considerations evidence to be given substantial weight, the proponent of that evidence must establish a "nexus," meaning a sufficient connection or tie between that evidence and the "merits," meaning any novel elements of the claimed invention. Accordingly, I understand that if the offered secondary considerations evidence is the result of something other than the merits of the claim, there is no nexus to the claimed invention. I also understand that the

Patent Owner bears the burden to prove a nexus exists.

23. I understand that secondary considerations do not overcome a strong showing of obviousness.

C. Priority Date

24. I understand that for patent claims to be entitled to the priority date of an earlier application (*i.e.*, to benefit from the earlier application's filing date), the claims of the later patent must be fully supported by the earlier patent application's disclosures. I understand that for the claims to be supported, the earlier application's disclosures must be sufficient to allow a person of ordinary skill in the art to reasonably conclude that the inventors were in possession of the claimed invention. I further understand that, for purposes of this earlier priority claim, the sufficiency of disclosure must be supported by each intervening patent application within the continuation chain.

25. I understand that the application for the '123 Patent was filed on February 10, 2017, and claimed the benefit of U.S. Provisional App. No. 62/294,271, filed on February 11, 2016. For the purposes of my opinions, I considered the state of the art and the level of knowledge that a person of ordinary skill in the art would have possessed as of the earliest claimed priority date, February 11, 2016. Unless I state otherwise, whenever I explain a principle or some technical subject matter was known or understood, this refers to the knowledge or understanding of a person of

ordinary skill in the art as of February 11, 2016.

D. Person of Ordinary Skill in the Art (“POSA”)

26. I was asked to evaluate the ’123 Patent from the perspective of a POSA as of the ’123 Patent’s priority date. As I explained above, I evaluated the ’123 Patent and formed my opinions based on the ’123 Patent’s earliest claimed priority date, February 11, 2016.

27. In my opinion, a POSA relevant to the ’123 Patent as of the priority date would have at least a B.S. degree in Mechanical Engineering, Electrical Engineering, Industrial Design, Product Design, or similar field, with at least two years of industry experience in one of these fields; and such POSA would have been familiar with electrically powered vaporizing articles, their components, or the underlying technologies.

28. Based on my education, training, and experience, it is my opinion that I can accurately represent the views of a POSA as of the ’123 Patent’s priority date for at least claims 14–16, 18, 27–29, and 31–32. Thus, I provide the opinions in this declaration using the viewpoint of a POSA as of February 11, 2016.

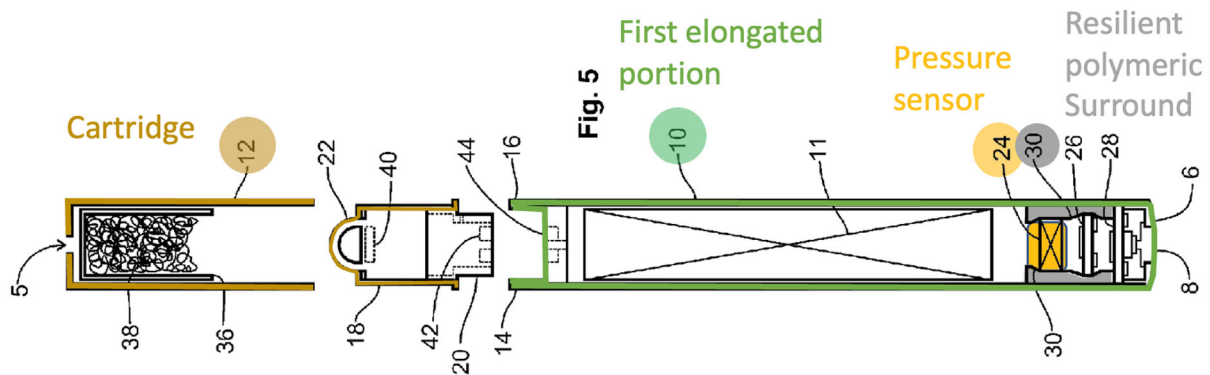
III. THE PRIOR ART

A. Technology Background

29. Differential pressure sensors operate by measuring the difference between two pressures. One of the pressures is a reference pressure. An example of a reference pressure is ambient air. EX1022, [0101] (“Differential pressure sensors

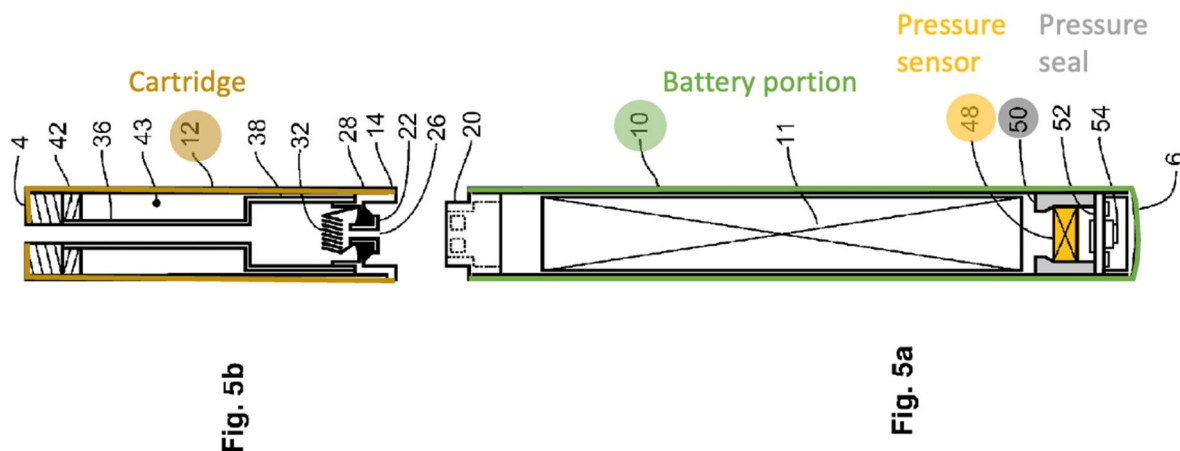
measure two air pressures, one ambient and one that changes.”); EX1023, [0083]. Differential pressure sensors operate by exposing one side of the pressure sensor to one pressure and another side of the pressure sensor to the reference pressure. *See* EX1001, 4:56-60 (“Differential pressure sensors may measure the distance between two pressures, one connected on different sides of the sensor. This includes pressure sensors in which one side is open/connected to ambient atmosphere (pressure).”). Therefore, it is important that the reference pressure is isolated from the variable pressure to detect the difference between the two pressures.

30. Differential pressure sensors have been used in e-cigarettes to detect when a smoker draws on the device. By the time the ’123 Patent was filed, differential pressure sensors were used in the tip end of the device and located within a gasket that sealed the sides of the pressure sensor that measured the different pressures from one another. EX1023, [0083] (“The differential pressure sensor is generally set on an end of the device and put into a gasket that seals one side of the sensor from another side of the sensor.”); EX1022, [0101]. Examples of electronic cigarettes with pressure sensors at the tip of the device within gaskets or other enclosures are shown in EX1006; EX1007; EX1009; EX1006; and EX1010.



EX1009, Fig. 5¹

EX1009 (U.S. Patent No. 8,499,766 (“Newton766”)), 6:6-9 (“The polymeric surround 30 also acts as a pressure seal to insure the draw pressure sensor 24 is properly coupled to detect the negative pressure of the draw.”)



EX1007, Figs. 5a, 5b

Newton569 discloses a pressure sensor 48 “located by a pressure seal 50” at the distal end of the battery portion 10. EX1007, 5:42-43, Fig. 5a.

¹ Colored annotations and highlighting added to figures unless indicated otherwise.

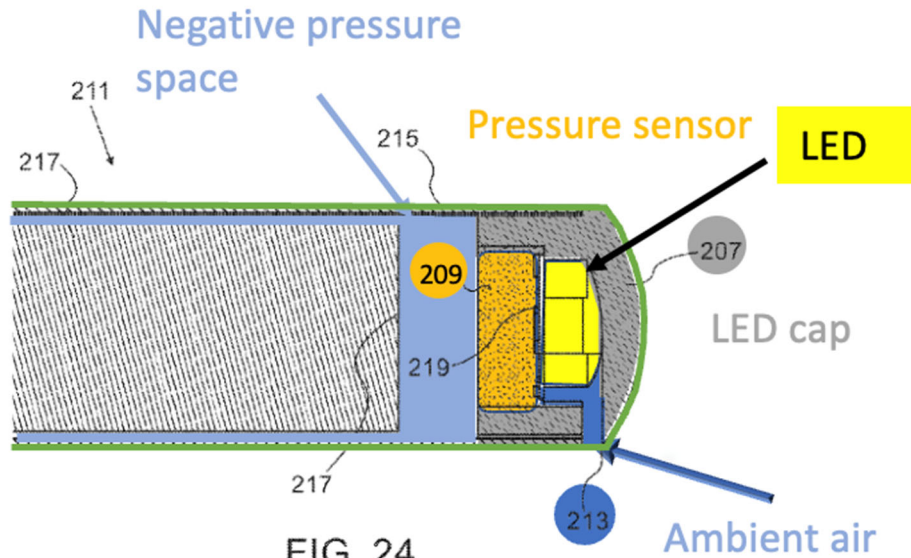


FIG. 24

EX1006, Figs. 23, 24 (Annotated)

EX1006, [0107] (“A sensor unit 209 occupies the interior of the LED cap 207, and is an embodiment of the sensor 24 (FIG. 1), but instead of being inside a plastic housing of its own, the sensor unit 209 is now disposed inside the LED cap 207 in order to save space.”).

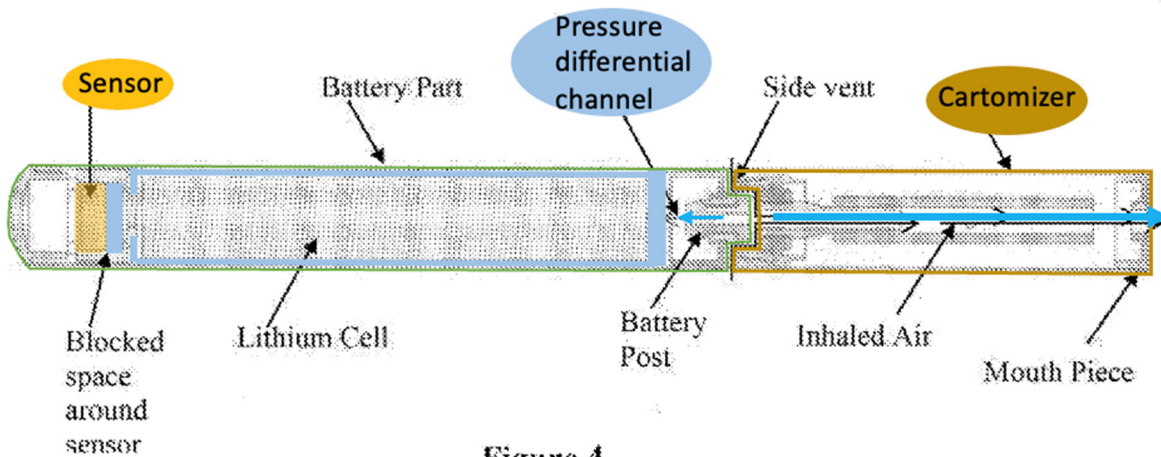


Figure 4

EX1010, Fig. 4

EX1010, [0017] (“As can be seen there, the spaces around the sensor are blocked so no air flow takes place through the cavity of the battery part. During inhalation, air enters from the side of the Battery and enters the post of the Battery via a groove in the battery post”).

31. When a smoker draws on the device, restrictions in the air flow path within the electronic cigarette (sealed air flow path) create a negative pressure. *See* EX1004, [0077] (“The air inlet channel can present a restriction to the flow of air so that the pressure on the interior of the coupler is lower than ambient pressure (and thus lower than the normal pressure space within the control body shell). This reduced pressure is transmitted to the pressure sensor in the control body shell by the pressure channel formed in the coupler. In this manner, a pressure differential can be created across the pressure sensor between the first end of the pressure sensor in the pressure reduction space and the second end of the pressure sensor in the normal pressure space within the shell.”). The differential pressure sensor detects the reduction in pressure in the electronic cigarette caused by a smoker drawing on the device as compared to ambient air. *See* EX1023, [0083] (“When an adult vaper applies a negative pressure, the sealed side of the differential pressure sensor detects a pressure drop (vacuum), while the ambient side detects less of a drop due to the exposure by not being sealed.”); EX1022, [0101].

32. The differential pressure sensor can output a signal based on its sensor readings. EX1005, [0004] (“The MEMS-based sensor is within the housing and configured to detect a pressure on the MEMS-based sensor caused by airflow through at least a portion of the housing. The MEMS-based sensor is configured to convert the pressure to an electrical signal, and output the electrical signal.”); EX1021, 18:27-31 (“In response to a detected airflow, the sensor can be configured to output a variable signal, which can vary, for example, based upon one or more properties of the airflow. Such variable output sensor may be utilized in a variety of embodiments 30 of aerosol delivery devices as described below. Moreover, the sensor 108 in FIG. 1 and/or the sensor 208 in FIG. 2 may be a variable output sensor as described herein.”).

33. When a draw is detected, different functions can be activated, such as the heating element or an inhalation indicator. *See* EX1004, [0077] (“More particularly, the control circuit can be configured to establish electrical current flow from the electrical power source when the pressure sensor detects a reduced pressure in the pressure reduction space relative to the pressure in the normal pressure space. Such electrical current flow can energize a heater in the cartridge to vaporize the aerosol precursor composition.”); EX1021, 23:25-28 (“The variable signal output from the flex/bend sensor can be used by one or more control elements of the aerosol delivery device to control the operation of the device. Such operation can encompass

a variety of functional elements of the device, such as a heating member, a fluid delivery member, a sensory feedback member, and the like.”).

34. The '123 Patent does not allege that the pressure sensor is a novel aspect of the claimed invention. Instead, it discloses that “the pressure sensors described herein may be *any differential pressure sensor....*”² EX1001, 4:49-56; *see also* 41:56-58. There are different types of differential pressure sensors. The '123 Patent also identifies differential sensors that could be used to implement the pressure sensors. EX1001, 4:49-56 (“In general, the pressure sensors described herein may be *any differential pressure sensor, such as MEMS*, capacitive pressures sensors (e.g., including a capacitive membrane), or any force collector type pressure sensors that use a transducer to measure pressure or pressure differences (e.g., diaphragm, piston, etc.), piezoresistive, electromagnetic, piezoelectric, optical, potentiometric, resonant (including MEMS), etc.”); 41:56-58 (“As mentioned above, other types of pressures [sic] sensors may be used (e.g., microelectromechanical systems (MEMS) pressure sensors or any other differential pressure sensor).”).

35. The output of a pressure sensor may include outputting sensor readings. Worm identifies an exemplary pressure sensor (Model 163PC01D36 manufactured by Honeywell) that provides puff-actuation (draw detection). EX1004, [0046]. I was

² Emphasis added unless indicated otherwise.

able to locate a data sheet for this device on the Internet Archives.³ The identified “[d]ifferential pressure sensor[]” provides “output voltage proportional to applied pressure.” See EX1026.001 (160PC Low Pressure Sensors Datasheet for differential pressure sensor model 163PC01D36).

Installation Instructions for 160PC Low Pressure Sensors

PK 87724

GENERAL INFORMATION

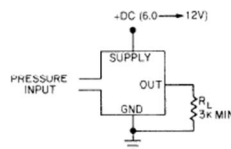
160PC sensors provide an output voltage proportional to applied pressure. They operate from a single, positive supply voltage ranging from 6.0 to 12 VDC. Signal conditioning results in directly usable outputs. Temperature compensation provides predictable performance over specified temperature ranges.

MEASURAND COMPATIBILITY

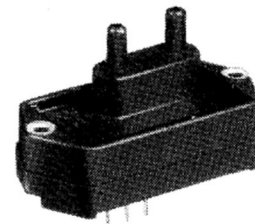
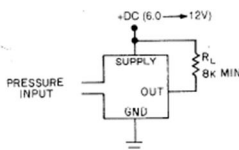
P2 Wetted materials: polyester housing, epoxy adhesive, silicon, borosilicate-glass, silicon-to-glass bond (passive side of IC)*

ELECTRICAL AND PRESSURE CONNECTIONS

Current Source



Current Sink



PRESSURE REFERENCE

Differential pressure sensors apply P1 to the active (connection) side of the chip and P2 to the passive side.

Gage pressure is measured with respect to atmospheric (room) pressure reference.

³ The data sheet for the Model 163PC01D36 manufactured by Honeywell is available on the Honeywell website captured by the Internet Archives at: https://web.archive.org/web/20041127165711/http://honeywell-sensor.com.cn/prodinfo/di_silicon_pressure/installation/p87724_1.pdf. See EX1029 (Screen shots of Internet Archives webpage for Model 163PC01D36 datasheet dated November 27, 2004).

160PC SPECIFICATIONS at 8.0 ± 0.01 VDC, 25°C

Parameter	Min.	Typ.	Max.	Units
F.S.O. (Full Scale Output)*	4.85	5.00	5.15	Volts
Null Offset	0.95	1.00	1.05	Volts
Excitation	6.00	8.00	12.0	VDC
Overpressure	---	---	5	psi
Operating Temperature	-40° to +85°C (-40° to +185°F)			
Storage Temperature	-55° to +125°C (-65° to +257°F)			

*F.S.O. is the algebraic difference between end points (null and full scale pressure outputs). Output voltage at full pressure equals 6.0 ± 0.20 volts at 8.0 VDC.

TYPICAL OUTPUT VOLTAGES for 163PC01D36 and 164PC01D37 Listings @ 8.0 ± 0.1 VDC, 25°C

Listing	Pressure Range	Vo (volts)
163PC01D36	-5" H ₂ O	1.0
	0	3.5
	+5" H ₂ O	6.0
	F.S.O.	5.0
164PC01D37	0	1.0
	10" H ₂ O	6.0
	F.S.O.	5.0

EX1026.001 (160PC Low Pressure Datasheet) (excerpts)

36. One type of differential pressure sensor is a microelectromechanical system (“MEMS”) pressure sensor. MEMS-based pressure sensors were contemplated in an e-cigarette no later than 2008 as disclosed in EP2110034 (“Fernando”). EX1018 (filed April 17, 2008, and published October 21, 2009); [0039] (“Alternatively, the sensor may be any of: a mechanical device, an optical device, an opto-mechanical device and a micro electro-mechanical-systems (MEMS) based sensor.”).

37. When used in an electronic cigarette, a MEMS pressure sensor detects the pressure in a portion of the electronic cigarette and outputs pressure data,

including a pressure sensor reading or pressure value. EX1005, [0004] (“The MEMS-based sensor is within the housing and configured to detect a pressure on the MEMS-based sensor caused by airflow through at least a portion of the housing. The MEMS-based sensor is configured to convert the pressure to an electrical signal, and output the electrical signal.”); *see also* EX1023, [0087]; [0088] (“Thus, the pressure and temperature data PT_{DATA} can include at least one of a pressure measurement and a temperature measurement.”); EX1022, [0105]; [0106].

38. The output from the MEMS pressure sensor can be in pressure units, as illustrated in a datasheet for a commercial product cited by an electronic cigarette patent. Jordan identifies a specific MEMS pressure sensor, Model MS5637-02BA03. EX1023, [0081]; EX1022, [0103] (“The MEMS pressure sensor 525 may be an MS5637-02BA03 Low Voltage Barometric Pressure Sensor, for example.”). I was able to locate a copy of the datasheet for this product on the Internet Archives.⁴ This webpage is contained a downloadable copy of the data sheet from the manufacturer, Measurement Specialties dated May 22, 2013. EX2029 (Screen shots of Internet Archives web pages); EX1020 (datasheet referenced in (showing output

⁴ The data sheet for the Model MS5637-02BA03 manufactured by Measurement Specialties is available on the Measurement Specialties website captured by the Internet Archives at: <https://web.archive.org/web/20130812055654/http://www.meas-spec.com/downloads/MS5637-02BA03.pdf>. *See* EX1029 (Screen shots of Internet Archives webpage for Model 163PC01D36 datasheet dated November 27, 2004); *See* EX1030 (Internet Archives webpages for datasheet dated May 22, 2023).

of pressure values in mbar units).

TECHNICAL DATA

Sensor Performances ($V_{DD} = 3\text{ V}$)				
Pressure	Min	Typ	Max	Unit
Maximum Range	10		2000	mbar
ADC	24			bit
Resolution (1)	0.11 / 0.062 / 0.039 / 0.028 / 0.021 / 0.016			mbar
Error band at 25°C, 300 to 1200 mbar	-2		+2	mbar
Error band, -20°C to + 85°C 300 to 1200 mbar (2)	-4		+4	mbar
Response time (1)	0.5 / 1.1 / 2.1 / 4.1 / 8.22 / 16.44			ms
Long term stability		±1		mbar/yr
Temperature	Min	Typ	Max	Unit
Range	-40		+85	°C
Resolution		<0.01		°C
Accuracy at 25°C	-1		+1	°C
Notes: (1) Oversampling Ratio: 256 / 512 / 1024 / 2048 / 4096 / 8192 (2) With auto-zero at one pressure point				

EX1020.001 (MS5637-02BA03 Datasheet, May 22, 2023) (excerpt)

See also EX1023, [0087] (“As shown, the MEMS pressure sensor 525 includes an I/O pin 550a for transmitting pressure and temperature data PT_{DATA} , and receiving read and write requests (R/W Command) and an input pin 550b for receiving a clock CLK from the microprocessor 502.”); EX1022, [0105]); EX1005, [0006] (“In some examples, the MEMS-based sensor may be configured to convert the pressure to the

electrical signal that varies with a corresponding variation in the pressure relative to an ambient pressure on the MEMS-based sensor. In these examples, the corresponding variation may be caused by variation in the airflow such as a variation in the rate of airflow.”); [0007] (“The change in capacitance causes a change in an output Voltage across the variable capacitor. And the MEMS microphone is configured to output the output Voltage or a digital representation thereof as the electrical signal.”); [0008] (“The change in resistance causes a change in an output voltage across the piezoresistor(s). And the MEMS pressure sensor is configured to output the output Voltage.”).

B. Worm (EX1004)

39. U.S. Patent Publication No. 2015/0245658 (“Worm”) was filed February 28, 2014, and published on September 3, 2015.

40. Worm discloses⁵ a device it calls an electronic smoking article 200. The device includes a control body 202 and a cartridge 204. The control body includes a coupler 224 that has a cavity 225 for receiving the cartridge and mechanically coupling the control body to the cartridge. EX1004, [0056]. Worm’s electronic smoking article 200 includes a pressure sensor 208 within the control body 202. EX1004, [0053]. Figure 2 illustrates the device:

⁵ Note that the same components in the figures in Worm are represented by the same last two digits in the different figures in Worm. For example, the control body in Figure 2 is 202, in Figure 7 it is 702 and in Figure 8 it is 802.

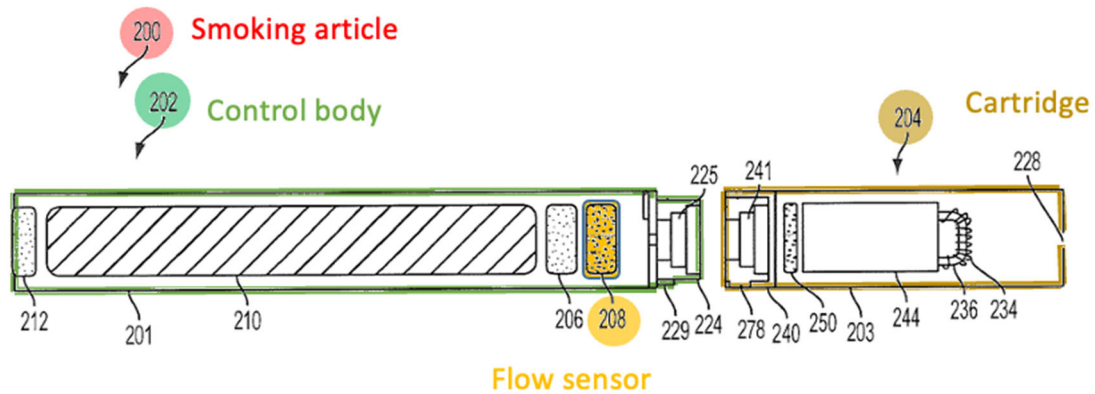


FIG. 2

EX1004, Fig. 2

41. Figure 5 of Worm includes a more detailed illustration of the pressure sensor 308 in Worm's control body 302. In this figure, in addition to pressure sensor 308, Worm discloses a normal pressure space that is open to ambient air (dark blue), a pressure reduction space 383 (light blue), a sealing member 380 (grey), an air inlet 388 and air inlet aperture 389. EX1004, [0064].

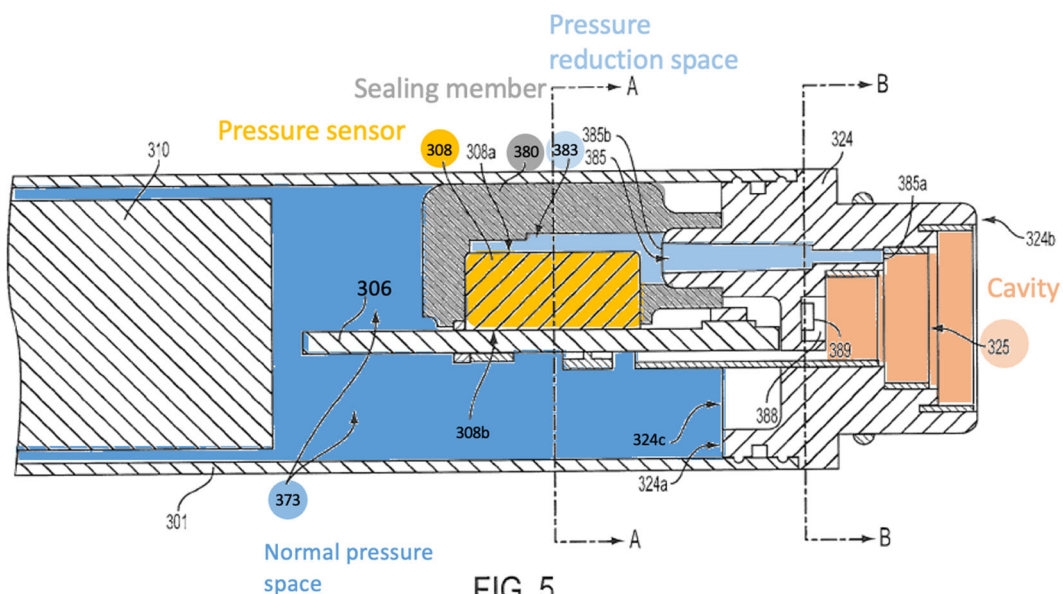


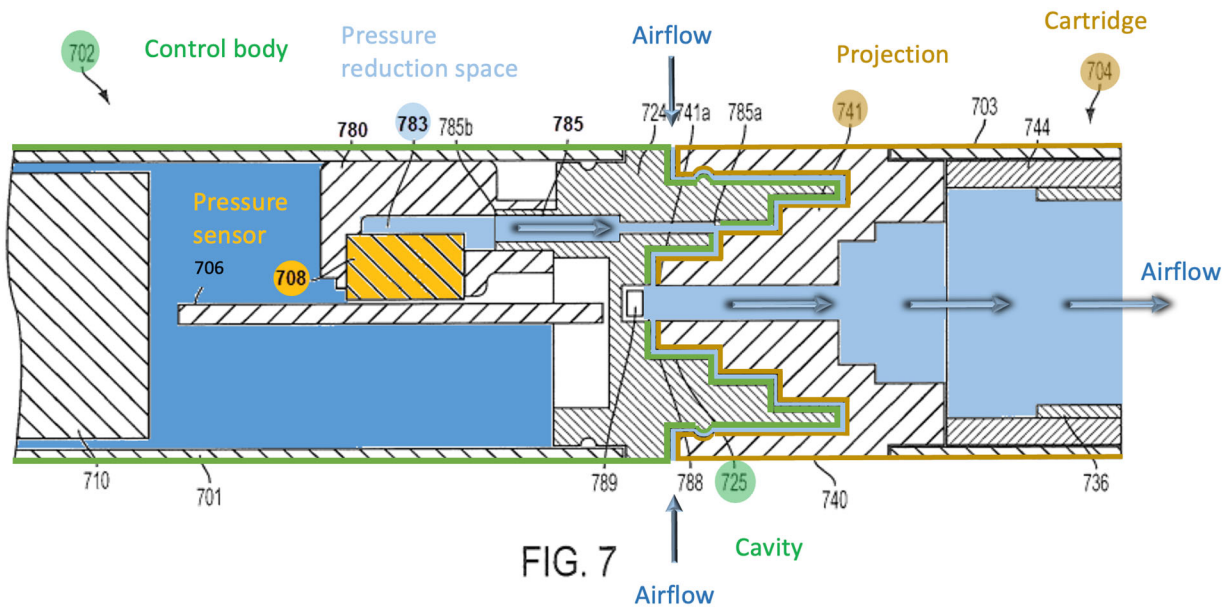
FIG. 5

EX1004, Fig. 5

42. As in the '123 Patent (EX1001, 42:25-46), Worm discloses that different portions of Worm's pressure sensor 308 are exposed to different air flow paths and those paths are sealed from each other by a gasket. EX1004, [0063] ("The normal pressure space can be maintained at ambient pressure and experience no significant change in pressure related to use of the control body in an electronic smoking article."). One portion of pressure sensor 308 is exposed to an air flow path in the normal pressure space 373 that is open to ambient air. EX1004, [0063]-[0064]. When the device is in use, another portion of pressure sensor 308 is exposed to negative pressure in the pressure reduction space 383. EX1004, [0063] ("The pressure reduction space can be isolated from the normal pressure space, and the pressure within the pressure reduction space can be reduced below the pressure in the normal pressure space during use of the article (i.e., during draw on the article)."); [0064]. Worm's sealing member 380 in Figure 5 is a gasket that surrounds pressure sensor 308 and isolates the pressure reduction space from the normal pressure space. EX1004, [0064] ("The sealing member 380 can substantially surround the perimeter of the pressure sensor 308 and be in a sealing contact therewith.").

43. Figure 7 further illustrates the coupler and pressure sensor in Worm's device. When a smoker draws on the device, there are different air inlets through

which air enters the device. One location is the interface at the connection between the cartridge 704 (i.e., projection 741 of the cartridge) and the control body (i.e., cavity 725). This interface can be seen where the green outline of the control body 702 meets the brown outline of the cartridge 704 near the “Airflow” arrows added to Figure 7 below.



EX1004, Fig. 7

This interface runs through the connection between the control body 702 and cartridge. The interface defines a channel between the interior of the cavity 725 and the exterior of the projection 741 of the cartridge because the connection is purposefully designed not to be airtight. EX1004, [0076] (“The matched configuration of the cavity 725 and the projection 741 preferably does not substantially form an air tight connection therebetween.”). This is designed such

that, when a smoker draws on the device, the pressure drop in the in the non-airtight connection (channel) is communicated to the pressure reduction space 783 through the pressure channel 785. EX1004, [0076] (“Thus, the pressure drop in the cavity 725 is likewise communicated to the pressure channel 785 from the first end 785*a* to the second end 785*b* and thus the pressure reduction space 783.”).

44. The spacing of this non-airtight connection is shown in the excerpt below from Figure 7. In figure 7, Worm discloses a uniform gap between the projection of cartridge 704 and the cavity 725 in coupler 724 of control body 702, consistent with the description in Worm. Therefore, since the cavity 725 is in communication with the pressure reduction space 783 through pressure channel 785, the cavity 725 is also in communication with ambient air entering from the interface between the control body and cartridge at the periphery of the device.

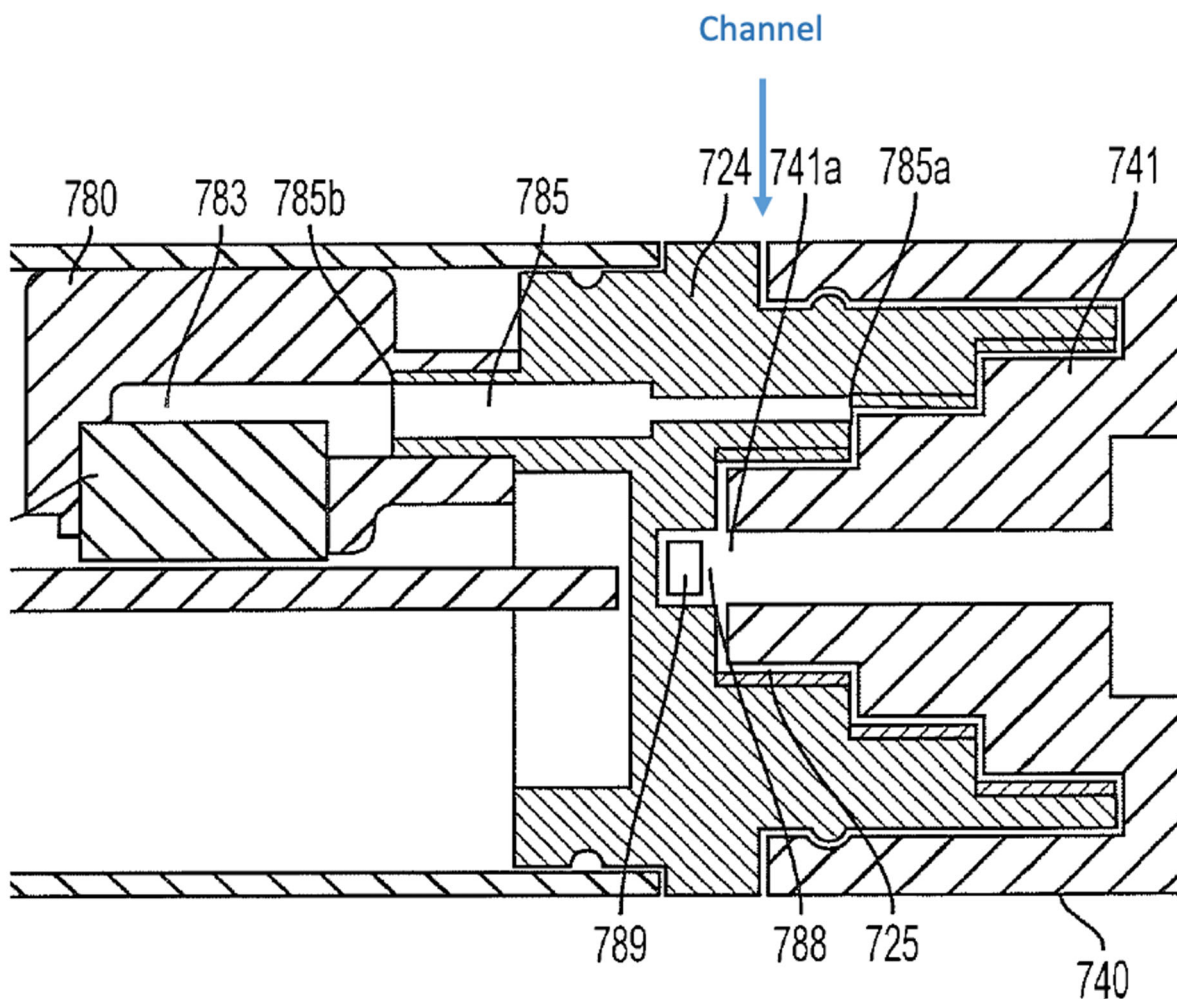
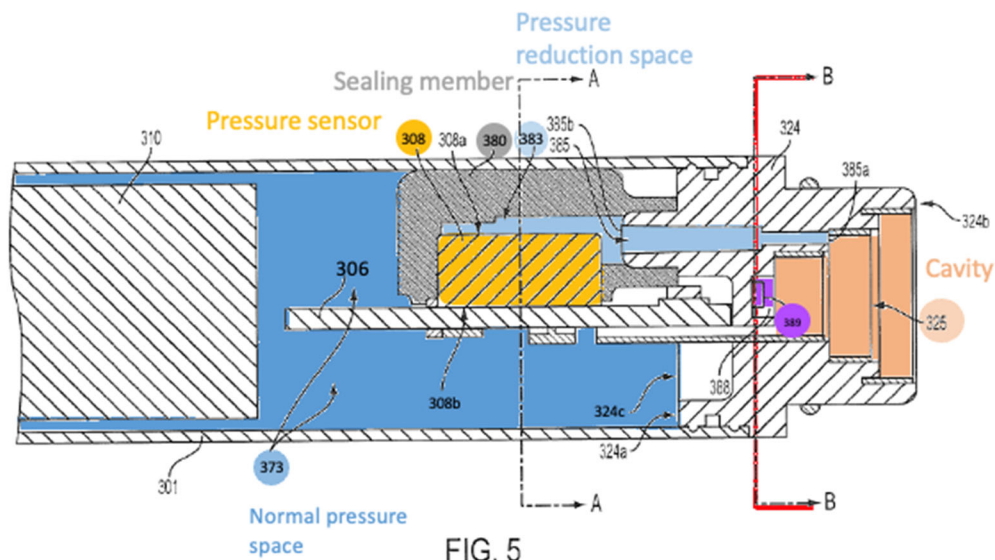


FIG. 7

EX1004, Fig. 7 (excerpted)

45. As shown below in purple in Figures 5, 6B, and 7, in some embodiments, air enters through one or more air inlet apertures 389 and then through air inlet channel 388 before it enters the cavity 325. EX1004, [0069] (“In some embodiments, the coupler 324 can include an air inlet channel 388...ambient air can

enter the air inlet channel 388 through an air inlet aperture 389 that opens through the outer surface of the coupler.”); [0075] (“[A]ir draw on the mouthend of the cartridge (see element 130 in FIG. 1) causes air to enter the air inlet channel 788 of the coupler 724 through one or more air inlet apertures 789...Air flow through the device thus can proceed from the air inlet channel 788 downstream toward the mouthend of the cartridge 704.”).



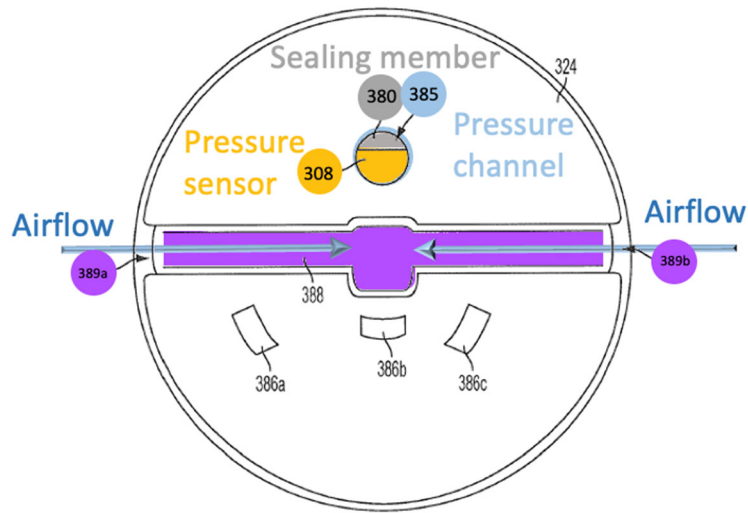


FIG. 6B

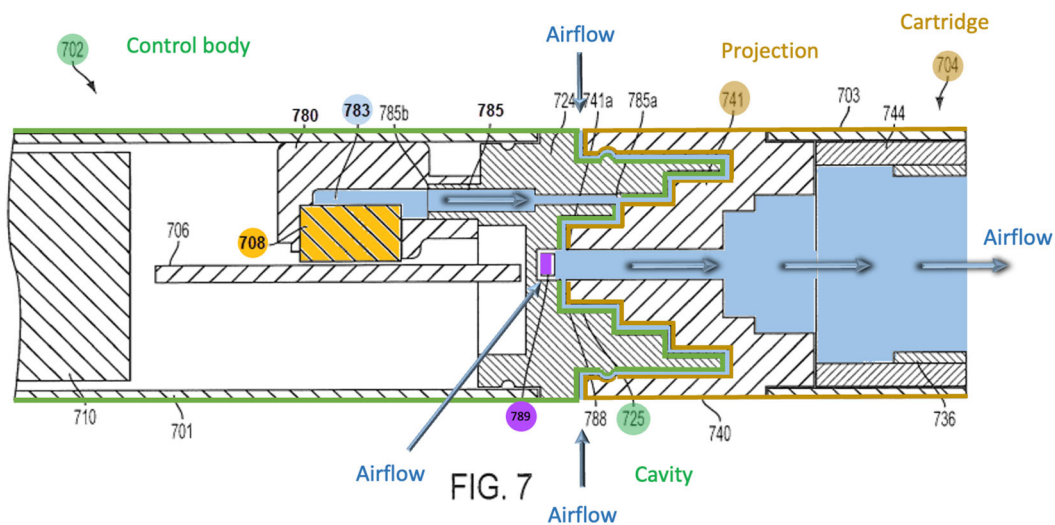


FIG. 7

EX1004, Figs. 5, 6B, 7

46. Even embodiments that include air inlet apertures 389/789 and air inlet channels 388/788, also include the non-airtight channel that communicates a pressure drop to the pressure reduction space 783 through pressure channel 785. EX1004, [0076] (“When draw on the device causing air to enter the air inlet channel 788 through the air inlet aperture 789 causes a pressure drop, such pressure drop is

communicated to the cavity 725. The matched configuration of the cavity 725 and the projection 741 preferably does not substantially form an air tight connection therebetween. Thus, the pressure drop in the cavity 725 is likewise communicated to the pressure channel 785 from the first end 785a to the second end 785b and thus the pressure reduction space 783.”).

47. During use, the pressure sensor detects a pressure differential between the pressure reduction space and the normal pressure space. The control circuit then establishes electrical current flow from the power source to activate the device. EX1004, [0008] (“The control circuit of the control body can be configured to establish electrical current flow from the electrical power source when the pressure sensor detects a reduced pressure in the pressure reduction space relative to the pressure in the normal pressure space.”); [0077]. Worm identifies an exemplary component that provides puff-actuation (a pressure sensor that detects a draw on the device). EX1004, [0046]. The component is Model 163PC01D36 manufactured by Honeywell. The Honeywell pressure sensor is a differential pressure sensor that outputs “voltage proportional to applied pressure.” *See* EX1026.001 (160PC Low Pressure Sensors Datasheet⁶ for differential pressure sensor model 163PC01D36).

⁶ *See* EX1029 (Internet Archives webpages for this datasheet, dated November 27, 2004).

Installation Instructions for 160PC Low Pressure Sensors

PK 87724

GENERAL INFORMATION

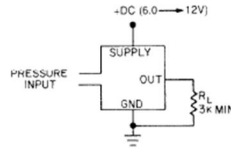
160PC sensors provide an output voltage proportional to applied pressure. They operate from a single, positive supply voltage ranging from 6.0 to 12 VDC. Signal conditioning results in directly usable outputs. Temperature compensation provides predictable performance over specified temperature ranges.

MEASURAND COMPATIBILITY

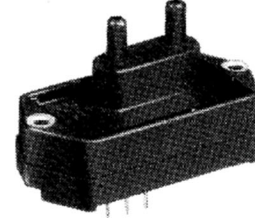
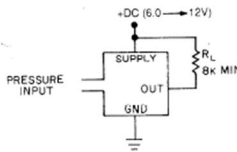
P2 Wetted materials: polyester housing, epoxy adhesive, silicon, borosilicate-glass, silicon-to-glass bond (passive side of IC)*

ELECTRICAL AND PRESSURE CONNECTIONS

Current Source



Current Sink



PRESSURE REFERENCE

Differential pressure sensors apply P1 to the active (connection) side of the chip and P2 to the passive side.

Gage pressure is measured with respect to atmospheric (room) pressure reference.

160PC SPECIFICATIONS at 8.0 ± 0.01 VDC, 25°C

Parameter	Min.	Typ.	Max.	Units
F.S.O. (Full Scale Output)*	4.85	5.00	5.15	Volts
Null Offset	0.95	1.00	1.05	Volts
Excitation	6.00	8.00	12.0	VDC
Overpressure	---	---	5	psi
Operating Temperature	-40° to +85°C (-40° to +185°F)			
Storage Temperature	-55° to +125°C (-65° to +257°F)			

*F.S.O. is the algebraic difference between end points (null and full scale pressure outputs). Output voltage at full pressure equals 6.0 ± 0.20 volts at 8.0 VDC.

TYPICAL OUTPUT VOLTAGES for 163PC01D36 and 164PC01D37 Listings @ 8.0 ± 0.1 VDC, 25°C

Listing	Pressure Range	Vo (volts)
163PC01D36	-5" H ₂ O	1.0
	0	3.5
	+5" H ₂ O	6.0
	F.S.O.	5.0
164PC01D37	0	1.0
	10" H ₂ O	6.0
	F.S.O.	5.0

EX1026.001 (160PC Low Pressure Sensors) (excerpts)

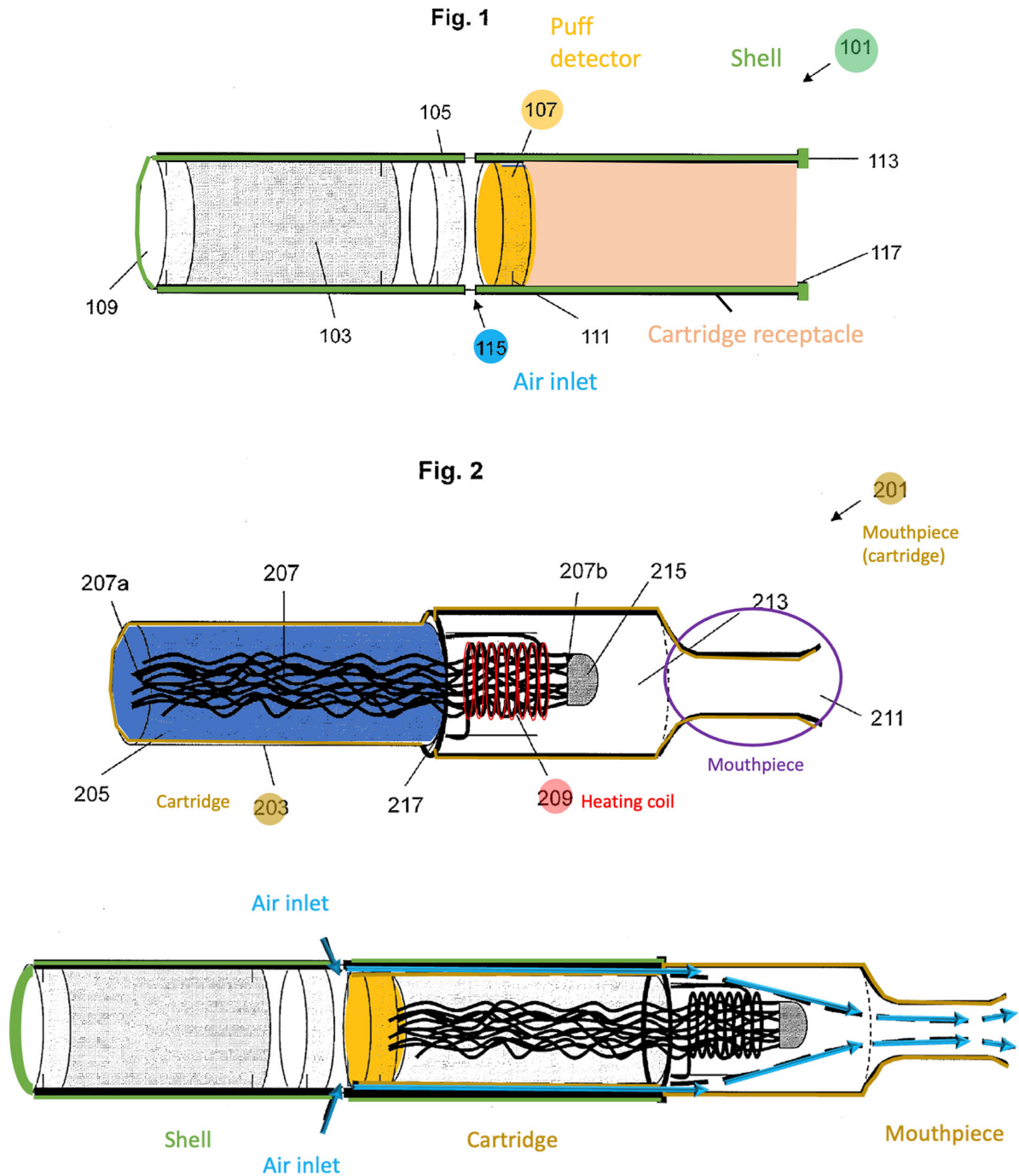
48. I understand Worm was one of several references listed on an

Information Disclosure Statement submitted to the Patent Office during prosecution of the '123 Patent on August 14, 2018. EX1002, 345. Neither the Examiner nor the Applicant discussed Worm alone or in combination with another reference during prosecution of the '123 Patent.

C. Thorens (EX1016)

49. U.S. Patent Publication No. 2014/0318559 (“Thorens”) was published on July 7, 2014, as a divisional of U.S. App. No. 12/432,215, filed April 29, 2009. Thorens claims priority to EP 08251579, filed April 30, 2008, and published on October 30, 2014.

50. Thorens discloses an electrically heated smoking system. The electrically heated smoking system 301 includes a shell 101 that includes a battery 103 and a mouthpiece 201. EX1016, [0044]. The shell includes a portion for receiving a portion of the mouthpiece 201, the battery 103, and a puff detector 107 (pressure sensor). EX1016, [0042]. The mouthpiece includes a portion referred to as a cartridge 203. The mouthpiece includes vaporizable liquid 205 and a heating coil 209. EX1016, [0043]. Figure 1 illustrates the shell 101, Figure 2 illustrates the mouthpiece 201, and Figure 3 illustrates the device when the shell and the mouthpiece are engaged:



EX1016, Figs. 1-3

51. During use, a smoker draws on the device, which causes air to be drawn in through air inlets 115 in the shell 101. Air then travels to the heating coil 209 and

out the air outlet 211 into the mouth of a user. EX1016, [0045] (“When the user draws on the device at the air outlet 211, ambient air is drawn through air inlets 115. In this embodiment, the puff detection system 107 senses the puff and activates the heating coil 209 and switches on the puff indicator 109.”); [0007] (“In the aerosol forming chamber, the vapor condenses to form an aerosol, which is carried towards the air outlet into the mouth of a user.”).

52. The puff detector 107 (pressure sensor) in shell 101 detects when a smoker draws on the device. The circuitry 105 preferable includes circuitry 105 and puff detector 107 which manages the device. EX1016, [0046] (“The circuitry 105 and puff detection system 107 can be used to manage the device operation.”); [0017] (“In a preferred embodiment, the electric circuitry comprises a sensor to detect air flow indicative of a user taking a puff, and the at least one inlet is in the shell, upstream of the sensor.”); [0045] (“In this embodiment, the puff detection system 107 senses the puff and activates the heating coil 209 and switches on the puff indicator 109.”); [0034].

53. Thorens is not the same reference as Thorens II and Thorens was not cited during the prosecution of the application that issued as the ’123 Patent, as discussed below in Section IV.C.

D. Levitz (EX1010)

54. WO 2012/142293 (“Levitz”) was filed April 12, 2012, claiming priority

to U.S. Provisional App. No. 61/474,569, and published on October 18, 2012.

55. Levitz discloses an electronic cigarette with a battery section and a removable atomizer section it refers to as a cartomizer. EX1010, [0006] (“One example of an electronic cigarette...is a ‘two-piece’ device having a first battery section and a second atomizer section, wherein the atomizer section is detachable from the battery section.”).

56. Levitz is a secondary reference that discloses an air flow path that begins at an air inlet on the side of the device located at the interface where the battery section connects to the cartomizer (a cartridge and atomizer). Air travels from the inlet through a channel defined between the battery section and the cartomizer, then enters the cartomizer (cartridge) and exits through an opening in the opposite end of the cartomizer into a smoker’s mouth. EX1010, [0017] (“During inhalation, air enters from the side of the Battery and enters the post of the Battery via a groove in the battery post. It then enters into the Cartomizer through the axial opening in the Cartomizer post and exits the Cartomizer into the smoker’s mouth.”). This air flow path is illustrated by the blue arrows in the path labeled “Inhaled Air Flow Path” in Figure 16:

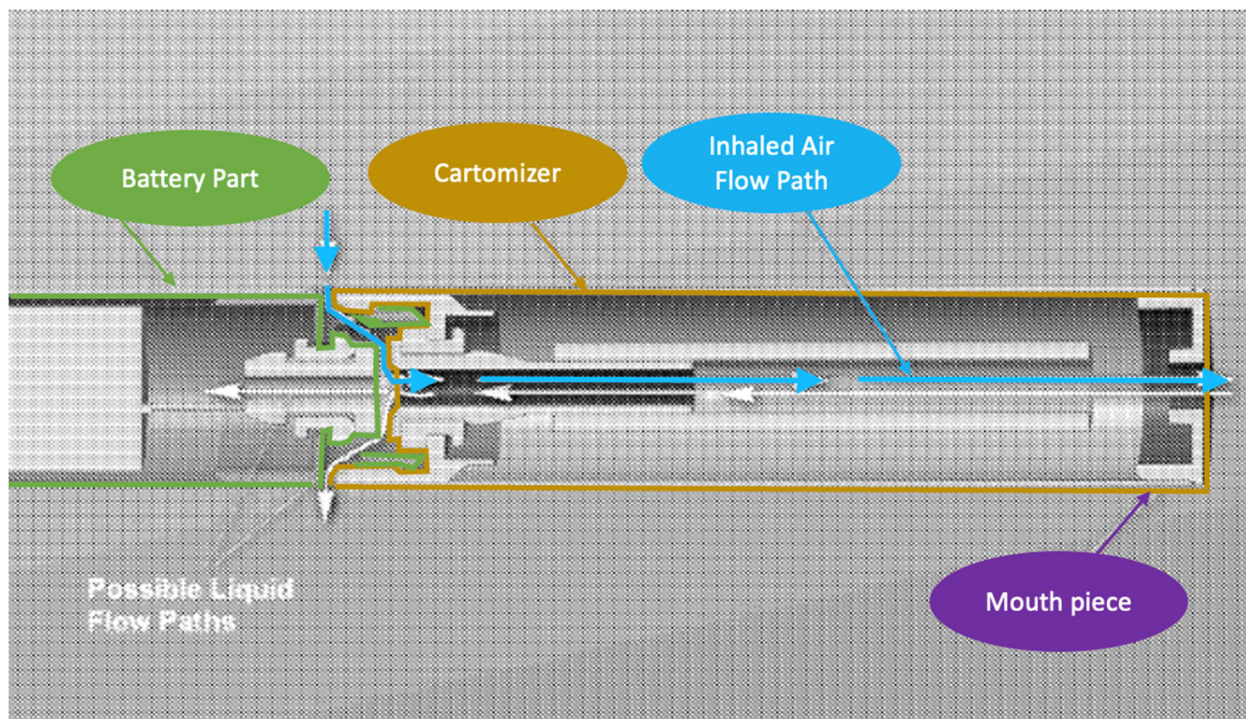


Figure 16

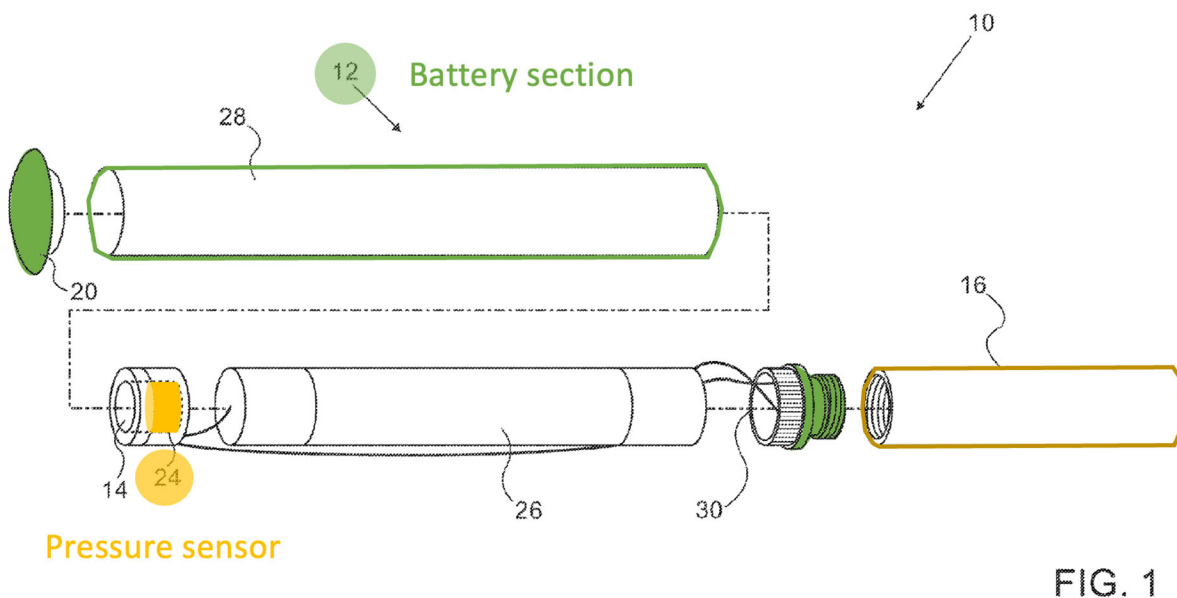
EX1010, Fig. 16

E. Weigensberg (EX1006)

57. U.S. Patent Publication No. 2015/0020831 (“Weigensberg”) was filed as a PCT on December 9, 2012, claiming priority to U.S. Provisional App. No. 61/577,024 filed on December 18, 2011. Weigensberg was published on January 22, 2015.

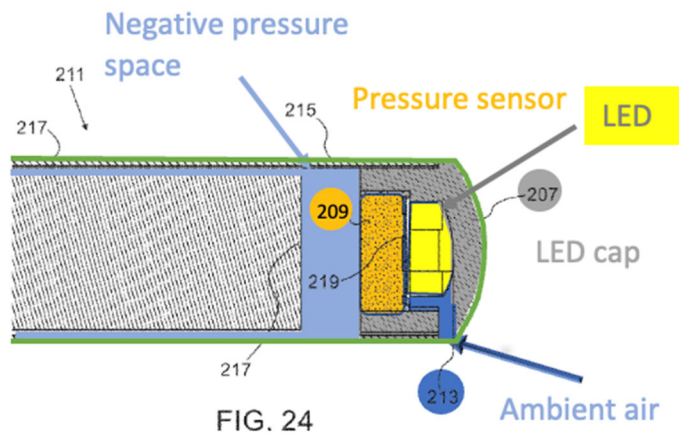
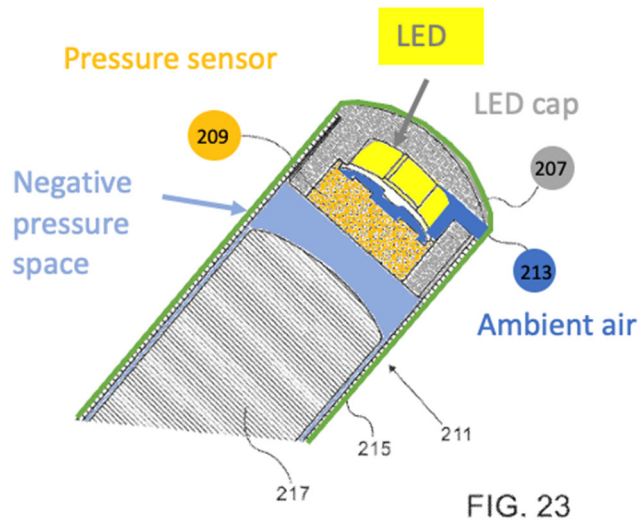
58. Weigensberg is a secondary reference that discloses a differential pressure sensor 24 located in the distal end (tip) of the battery portion of an electronic cigarette. Weigensberg’s tip section with pressure sensor is a replacement tip for a standard electronic cigarette. EX1006, [0058] (“The battery section 12 may include power control circuitry 14, which is typically encased as a unit with a vacuum sensor

24, and which may be enclosed in a plastic holder.”); [0061] (“This assembly is compact, comprising a tip section 36 that replaces the tip 20 of the standard device 10 shown in FIG. 1. In addition, the adaptor 34 houses the sensor 24 (FIG. 1).”). Figure 1 illustrates the standard electronic cigarette device and the tip 20 that Weigensberg’s tip section 36 replaces. During use, a pressure differential created by a smoker drawing on the device is sensed by the pressure sensor.



EX1006, Fig. 1

59. Weigensberg discloses multiple tip embodiments. Figures 22 and 23 illustrate an embodiment with a tip that includes a different pressure sensor 209 enclosed within LED cap 207.



EX1006, Figs. 23, 24

60. Weigensberg teaches that the pressure sensor can output sensor readings. EX1006, [0087] (“Alternatively, the sensor S 167 may be realized as an analog circuit, with appropriate modification of the microcontroller 159 to accommodate an analog device, for example, by including an analog-to-digital converter as is known in the art.”).

F. Lamb (EX1005)

61. U.S. Patent Publication No. 2016/0128389 (“Lamb”) was filed on

November 12, 2014, and was published on May 12, 2016.

62. Lamb is a secondary reference that discloses the use of a MEMS-based differential pressure sensor in an electronic cigarette as well as a differential pressure sensor that outputs pressure values.

63. Lamb's Figure 1 discloses the same device as shown in Worm's Figure 2. Compare EX1004, Fig. 2 with EX1005, Fig. 1. These figures are shown below:

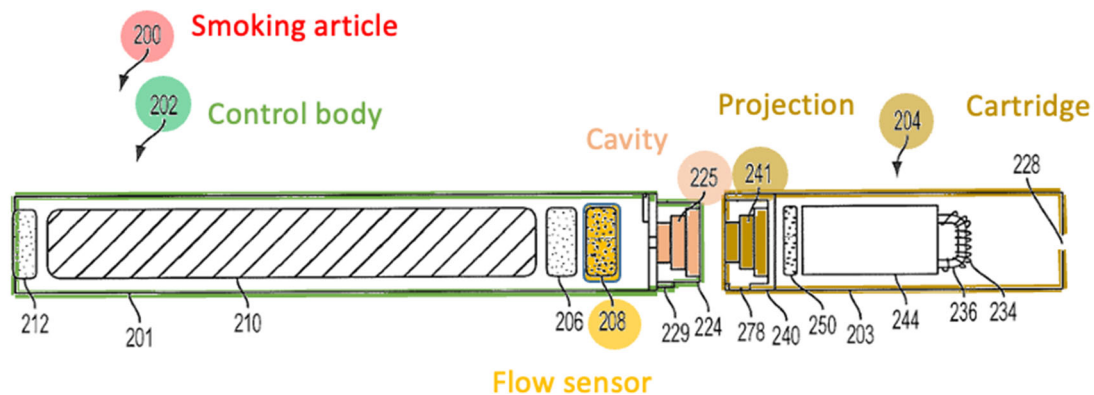


FIG. 2

EX1004 (Worm), Fig. 2

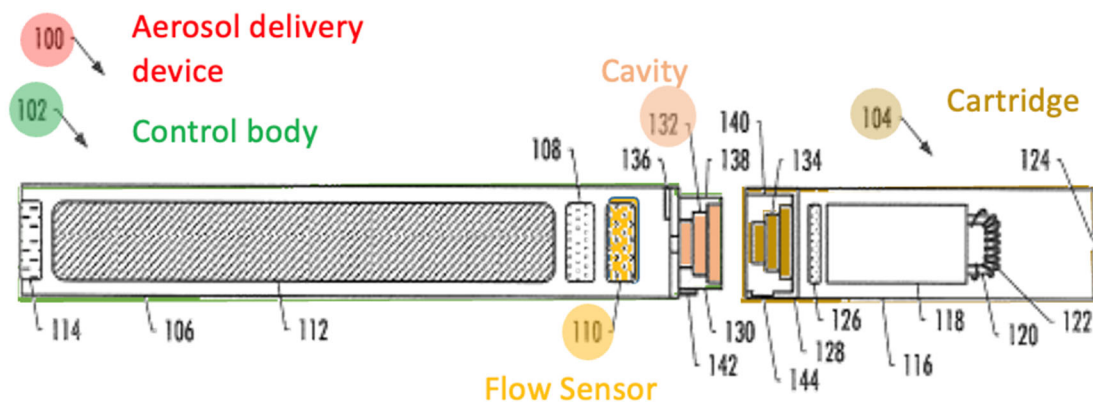


FIG. 1

EX1005 (Lamb), Fig. 1

64. The description of Worm’s Figure 2 is also substantially similar to the description of Lamb’s Figure 1. *Compare* EX1004, [0053]-[0057] with EX1005, [0026]-[0032].

65. As illustrated in Figure 1 above, Lamb discloses a device that it calls an aerosol delivery device 100 with a control body 102 and cartridge 104. The control body 102 includes a coupler 130 with a cavity 132 that receives a projection 134 of cartridge 104. The control body 102 also includes a flow sensor 110. EX1004, [0026], [0030]-[0032].

66. The flow sensor 110 in Lamb is disclosed as a microelectromechanical systems-based (“MEMS-based”) sensor and is configured to “detect a pressure on the MEMS-based sensor caused by airflow through at least a portion of the housing.” EX1005, [0004]. The operation of Lamb’s flow sensor is consistent with Worm’s

disclosure of a differential pressure sensor that detects relative pressure differentials between a portion of the device relative to ambient pressure in another portion of the device. *Compare* EX1004, [0077] (“In this manner, a pressure differential can be created across the pressure sensor between the first end of the pressure sensor in the pressure reduction space and the second end of the pressure sensor in the normal pressure space within the shell. More particularly, the control circuit can be configured to establish electrical current flow from the electrical power source when the pressure sensor detects a reduced pressure in the pressure reduction space relative to the pressure in the normal pressure space.”) *with* EX1005, [0045] (“...the MEMS-based sensor may be configured to convert the pressure to the electrical signal that varies with a corresponding variation in the pressure relative to an ambient pressure on the MEMS-based sensor.”).

IV. THE '123 PATENT

A. Overview

67. The '123 Patent discloses a vaporizer device that has a device body 20 and a pod or cartridge 30a. The device body includes a cartridge receptacle 21 that is configured to receive the cartridge. Figure 12 illustrates an embodiment, which is shown below.

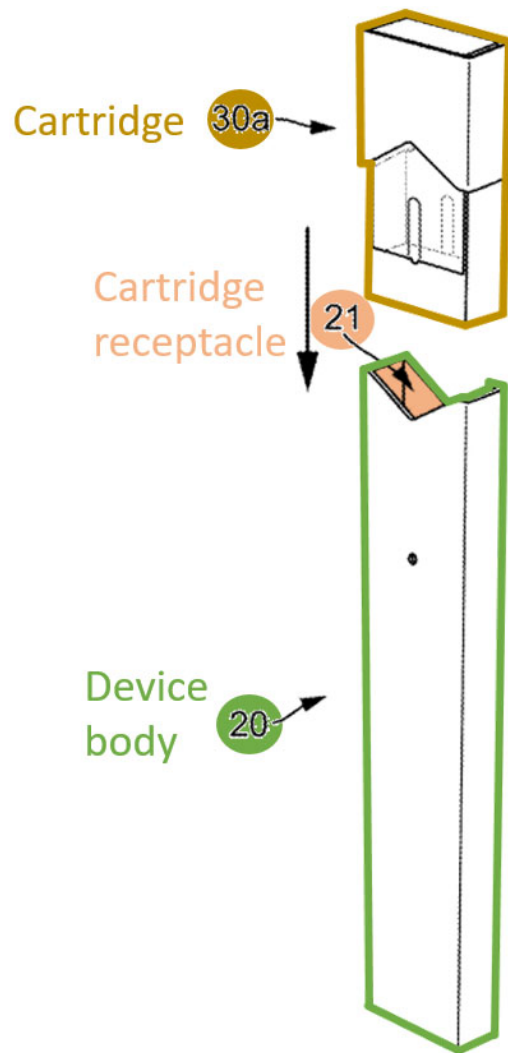


FIG. 12

EX1001, Fig. 12

68. The device body also includes a pressure sensor 2509. One side of the pressure sensor is exposed to ambient pressure and another side is exposed to a negative pressure when a smoker draws on the device. EX1001, 42:32-39. Figure 25 illustrates the pressure sensor 2509, the pressures and air paths.

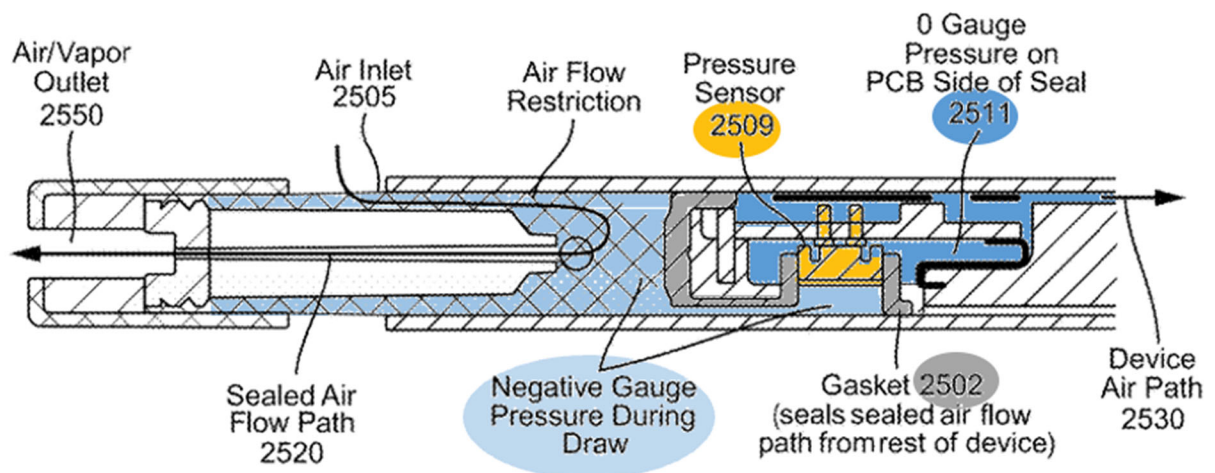


FIG. 25

EX1001, Figure 25

69. The side of the pressure sensor 2509 exposed to ambient pressure is referred to as device air path 2530 (dark blue) and is open to the environment. EX1001, 42:35-39. Another side of the pressure sensor 2509 exposed to negative pressure in a portion of the device by a path is referred to as the sealed air flow path 2520 (light blue). This path creates a negative pressure when the smoker inhales on the device at the outlet 2550. EX1001, 42:32-46. The '123 Patent refers to an airflow path created by inhalation as "sealed" because that path is isolated from device air path 2530 by sealing gasket 2502 (grey). EX1001, 42:14-46. The sealed air flow path 2520 is shown as initiating at an air inlet 2505 on the side of the device and following a channel formed between the cartridge receptacle and the cartridge. The sealed air flow path then travels through the cartridge and out the air/vapor outlet

2550. EX1001, Fig. 25. The cartridge includes a heating element and reservoir with vaporizable material. EX1001, 16:51-62.

B. Summary of the Challenged Claims

70. The challenged claims are claims 14-16, 18, 27-29, and 31-32. Claims 14 and 27 are independent claims. Each independent claim requires a pressure sensor that is exposed to the device air path and sealed air flow path, which are separated by a gasket.

71. Independent claim 14 of the '123 Patent is reproduced below. The claim is directed to a vaporizer device body comprising:

a cartridge receptacle configured to insertably receive a cartridge containing a vaporizable material;

a pressure sensor configured to output sensor readings, wherein a first side of the pressure sensor is exposed to a sealed air flow path and a second side of the pressure sensor is exposed to a device air path open to ambient pressure, the sealed air flow path comprising a channel formed between an interior surface of the cartridge receptacle and an exterior surface of the cartridge, the sealed air flow path passing from an air inlet, through the channel and to a heater and an outlet of a mouthpiece within the cartridge; and

a gasket around the pressure sensor, the gasket configured to seal the device air path from the sealed air flow path.

72. Dependent claim 15 requires the pressure sensor to comprise a capacitive membrane.

73. Dependent claim 16 requires the pressure sensor to comprise a MEMS pressure sensor.

74. Dependent claim 18 requires that the sensor readings output by the pressure sensor comprise pressure values.

75. Independent claim 27 of the '123 Patent is reproduced below. The claim is directed to a cartridge comprising:

a reservoir configured to hold a vaporizable material, a heater configured to heat the vaporizable material, and a mouthpiece in fluid communication with the heater; and a device body comprising:

a cartridge receptacle configured to insertably receive the cartridge;

a pressure sensor configured to output sensor readings, wherein a first side of the pressure sensor is exposed to a sealed air flow path and a second side of the pressure sensor is exposed to a device air path open to ambient pressure, the sealed air flow path comprising a channel formed between an interior surface of the cartridge receptacle and an exterior surface of the cartridge, the sealed air flow path passing from an air inlet, through the channel and to the heater and an outlet in the mouthpiece of the cartridge; and

a gasket around the pressure sensor, the gasket configured to seal the device air path from the sealed air flow path.

76. Dependent claim 28 requires the pressure sensor to comprise a capacitive membrane.

77. Dependent claim 29 requires the pressure sensor to comprise a MEMS pressure sensor.

78. Dependent claim 31 requires the sensor readings output by the pressure sensor comprise pressure values.

79. Dependent claim 32 requires the cartridge to comprise the vaporizable

material that comprises a nicotine formulation.

C. Prosecution History

80. The '123 Patent issued from U.S. App. No. 15/430,317, filed on February 10, 2017, and claimed the benefit of U.S. Provisional App. No. 62/294,271, filed on February 11, 2016.

81. Claims 1, 3-6, 13-19, 21, 24, and 25 were rejected as obvious based on U.S. Patent Pub. No. 2017/0318861 to Thorens ("Thorens II") on November 27, 2017, but the Examiner indicated that claims 2, 8, 11, 12, 22, and 23 would be allowable if written in independent form or amended into all of the limitations of the base and intermediate independent claims. EX1002, 126-131. Claim 2 claimed:

The device of claim 1, wherein a first side of the pressure sensor is exposed to a first air path through the mouthpiece and a second side of the pressure sensor is exposed to a second air path open to ambient pressure, and wherein the second air path is sealed from the first air path by a gasket around the pressure sensor.

EX1002, 34. Claim 8 requires that the pressure sensor in claim 1 was a MEMS pressure sensor. EX1002, 35.

82. Thorens II discloses a single-housing inhaling device that allows a user to inhale an aerosol and includes a gas flow sensor. Thorens II "relates to devices and methods that can recognize or authenticate a user based on the puffing behaviour of the user." EX1014, [0001]. Puff signatures can be stored based on flow rate measurements and used for authentication before using the device. EX1014, [0082].

83. The Examiner objected to the drawings because neither the cartridge receptacle nor the cartridge was clearly depicted in Figures 5-6D, 7C, 8A, 8B, and 10A, citing paragraph [0193] of the 123 Patent:

[0193]. . .The channel may form a first side of the air inlet passage, and an internal surface of the cartridge receptacle may form a second side of the air inlet passage, as illustrated in various non-limiting aspects of FIGS. 5-6D, 7C, 8A, 8B, and 10A.

EX1002, 76.

84. The Examiner also raised an objection to the drawings because the figures in the '123 Patent did not “clearly illustrate the structural relationships described in paragraphs [0228]-[0231]:

[0228] Provided herein is a device for generating an inhalable aerosol comprising: a device body 20 comprising a cartridge receptacle 21 for receiving a cartridge 30; wherein an interior surface of the cartridge receptacle forms a first side of an air inlet passage 51 when a cartridge comprising a channel integral 40 to an exterior surface is inserted into the cartridge receptacle 21, and wherein the channel forms a second side of the air inlet passage 51.

EX1002, 84.

85. The Examiner did not identify any references as disclosing a differential sensor with one side exposed to a sealed air path and another side exposed to ambient air.

86. On May 30, 2018, the Applicant addressed the objections to the drawings. Applicant indicated the receptacle in paragraph [0193] of the original

application was now labeled 21⁷ in Figures 10A and 10B and argued that the channel in paragraph [0228] of the original application was item 40 in Figure 8B and the passage was item 51 in Figure 10A. EX1002, 170, 172.

87. Applicant added new claims, including independent claims 29 and 31. Claim 29 became issued claim 14 and claim 31 became issued claim 27. Applicant indicated that “[n]ew independent Claims 29 and 31 incorporate features of allowable claim 2 while omitting some of the features of original Claim 1.” EX1002, 176-177. Applicant omitted limitations in claim 1 directed to the operation of a microcontroller with respect to instantaneous sensor readings. Applicant added limitations from claim 2 and other limitations such as a cartridge receptacle and various characteristics of a sealed air path. *Compare* EX1002, 34 to EX1002, 166-167.

88. A comparison of original claims 1 and 2 with claims 29 and 31 is below:

Claim 1 and 2	Claim 29	Claim 31
1. A vaporizer device comprising:	29. (New) A vaporizer device body comprising:	31. (New) A vaporizer device comprising:
a reservoir configured to hold a vaporizable material; a heater configured to heat the vaporizable material; a mouthpiece in communication with the reservoir;		a cartridge comprising a reservoir configured to hold a vaporizable material, a heater configured to heat the vaporizable material, and a mouthpiece in fluid communication with the

⁷ These figures do not include a label “21” but do include a label “31.”

Claim 1 and 2	Claim 29	Claim 31
		heater; and
	a cartridge receptacle configured to insertably receive a cartridge containing a vaporizable material;	a device body comprising: a cartridge receptacle configured to insertably receive the cartridge;
a pressure sensor configured to output instantaneous sensor readings; and	a pressure sensor configured to output sensor readings,	a pressure sensor configured to output sensor readings,
wherein a first side of the pressure sensor is exposed to a first air path through the mouthpiece and a second side of the pressure sensor is exposed to a second air path open to ambient pressure, and (claim 2)	wherein a first side of the pressure sensor is exposed to a sealed air path and a second side of the pressure sensor is exposed to a device air path open to ambient pressure,	wherein a first side of the pressure sensor is exposed to a sealed air path and a second side of the pressure sensor is exposed to a device air path open to ambient pressure,
	the sealed air path comprising a channel formed between an interior surface of the receptacle and an exterior surface of the cartridge,	the sealed air path comprising a channel formed between an interior surface of the receptacle and an exterior surface of the cartridge,
	the sealed air flow path passing from an air inlet, through the channel and to a heater and an outlet of mouthpiece within the cartridge; and	the sealed air flow path passing from an air inlet, through the channel and to the heater and an outlet in the mouthpiece of the cartridge; and
wherein the second air path is sealed from the first air path by a gasket around the pressure sensor. (claim 2)	a gasket around the pressure sensor, the gasket configured to seal the device air path from the sealed air flow path.	a gasket around the pressure sensor, the gasket configured to seal the device air path from the sealed air flow path.
a microcontroller,		

Claim 1 and 2	Claim 29	Claim 31
wherein the microcontroller is configured to:		
determine a baseline based on filtering the instantaneous sensor readings;		
hold the baseline at a prior value of the baseline while the instantaneous sensor readings are above the baseline by a first offset value or below the baseline by a second offset value;		
compare the instantaneous sensor readings to the baseline and activate the heater to generate vapor from the vaporizable material when the instantaneous sensor readings are offset from the baseline by more than a third offset value indicating suction is being applied to the mouthpiece.		

89. An information disclosure statement dated August 14, 2018, was filed by the Applicant identifying US-20150245658-A1 (“Worm”), among other references. EX1002, 345.

90. A notice of allowance issued on September 19, 2018, which included

an Examiner's amendment. EX1002, 507-511. In the notice of allowance, the Examiner stated in the Reasons for Allowance that claims 29 and 31 were allowed:

... at least in part, with the prior art not showing or fairly teaching a vaporizer device comprising a pressure sensor which on one side is exposed to a sealed airflow path and on a second side is exposed to a device air path open to ambient pressure, where a gasket around the pressure sensor seals the device air path from the sealed air flow path in conjunction with ALL the remaining limitations within respective claims 1, 15, 29 and 31; where it is understood the method of controlling the claimed components within an operative device is inseparable from the device.

EX1002, 522.

91. The Applicant filed an amendment after allowance on the same day as the Notice of Allowance, September 19, 2019. In this amendment, Applicant cancelled claims 1-28 and added claim 55 (issued claim 32). EX1002, 601; EX1002, 605. The Examiner entered the claim amendments, without citing any additional references, but rejected the amended abstract. EX1002, 620.

92. The '123 Patent issued November 20, 2018.

93. On October 15, 2019, the USPTO issued a certificate of correction cancelling claims 1-13, 41-53 of the '123 Patent and replacing the original abstract with an amended one. EX1002, 631.

D. Meaning of Certain Claim Terms

94. I understand that the '123 Patent is involved in Section 337 Investigation before the International Trade Commission, *Certain Vaporizer*

Devices, Cartridges Used Therewith, and Components Thereof, 337-TA-1368 (“ITC Investigation”). I further understand that the Petitioner and Patent Owner construed the term “pressure values” in claims 18 and 31 of the challenged claims, but as of the date of my declaration, the terms have not yet been construed by the ALJ or the Commission.

95. I understand Petitioner construed “pressure values” in claims 18 and 31 as “a numerical amount of pressure (in mmHg, atm, or other units).” EX1019, 1. Petitioner cited as support the following portion of the ’125 Patent: (“In such cases the output of the sensor (which may be converted by the sensor and/or associated circuitry into a pressure value (e.g., in mmHg, atm, etc.)”). EX1001, 41:58-65.

96. I also understand that Patent Owner construed “pressure values” as having its plain and ordinary meaning, “e.g., a numerical value indicative of pressure.” EX1019, 2.

97. In my analysis below, I identify which construction or constructions I have adopted for each ground.

V. THE CHALLENGED CLAIMS ARE UNPATENTABLE

98. Below I describe how the prior art discloses the limitations of the challenged claims. In summary, my opinion is that claims 14-16, 18, 27-29, and 31-32 are invalid over the combination discussed below.

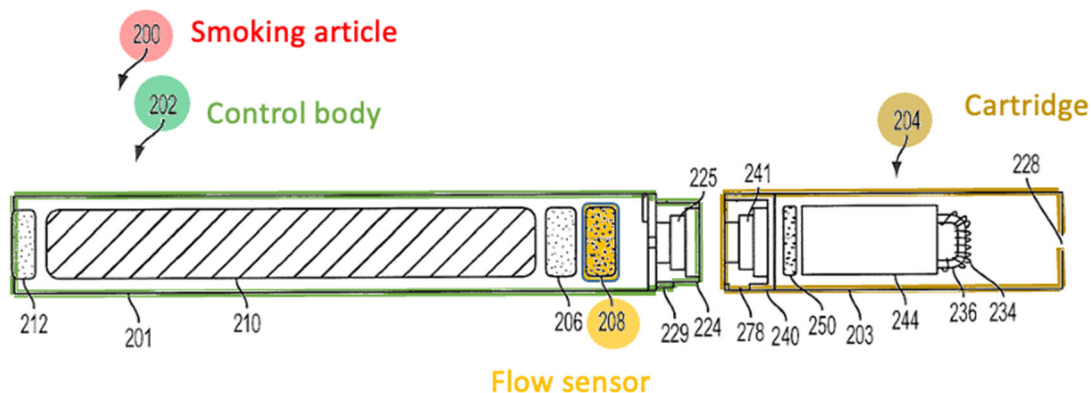
A. Ground 1: Worm Anticipates Claims 14, 27 and 32 of the '123 Patent

1. Claim 14

a. [14.A] A vaporizer device body comprising:

99. Worm discloses a vaporizer device body.

100. Worm discloses smoking article 200 comprising control body 202 and cartridge 204. Figure 2 illustrates these elements:



EX1004, Fig. 2

101. Control body 202 “includes a shell and a coupler that is adapted to connect the control body to a cartridge of an electronic smoking article.” EX1004, Abstract; *see also* EX1004, [0056] (“The control body 202 and the cartridge 204 may include components adapted to facilitate a fluid engagement therebetween.”). Worm also discloses that the aerosol delivery device produces vapor, so it is a vaporizer device. EX1004, [0026] (“Aerosol delivery devices of the present disclosure also can be characterized as being vapor-producing articles, smoking

articles, or medicament delivery articles.”).

102. Worm’s coupler is part of the control body 202, rather than a separate or distinct component. *See, e.g.*, EX1004, Claim 1 (“the control body comprising:... a coupler”); [0005] (“This [the control body] can incorporate a coupler element”); [0010] (“The control body further can comprise a coupler formed of an elongated body having a first end that forms a wall and that engages the proximal end of the shell and a second end that comprises a cavity configured to releasably engage a cartridge”).

b. **[14.B] a cartridge receptacle configured to insertably receive a cartridge containing a vaporizable material;**

103. Worm discloses this limitation.

104. As discussed in [14.A], Worm discloses control body 202 and cartridge 204. Worm’s cartridge 204 includes projection 241. Control body 202 includes a coupler 224 with a cavity 225 (cartridge receptacle) that receives the projection 241 of the cartridge 204. EX1004, [0056] (“As illustrated in FIG. 2, the control body 202 can include a coupler 224 having a cavity 225 therein. The cartridge 204 can include a base 240 adapted to engage the coupler 224 and can include a *projection 241 adapted to fit within the cavity 225*. Such engagement can facilitate a stable connection...”). Figure 2 illustrates the control body 202 with cavity 225 and cartridge 204 with projection 241 uncoupled:

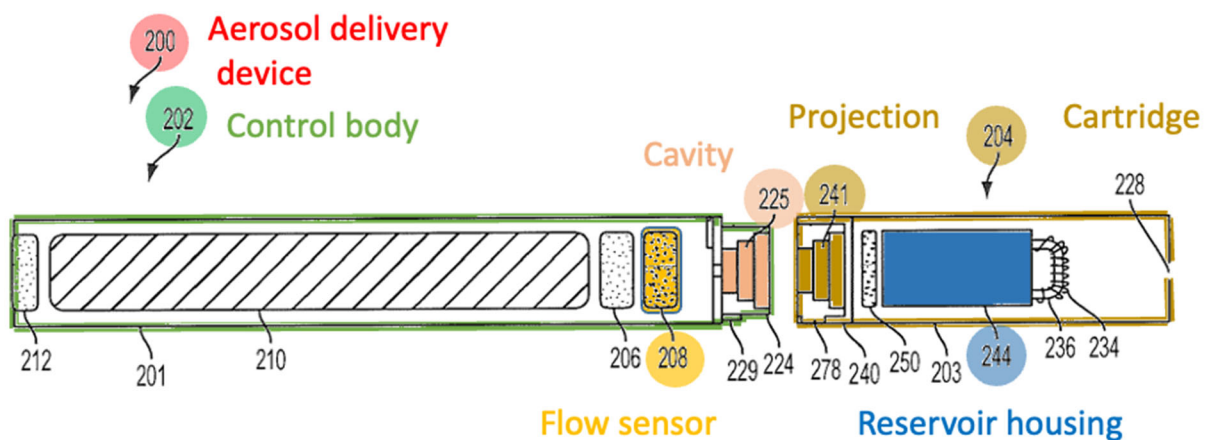


FIG. 2

EX1004, Fig. 2

105. To connect these sections of the smoking article 200, cartridge 204 is inserted into cavity 225 (cartridge receptacle) within the coupler of control body 202 to form the mechanical connection. EX1004, [0057] (“For example, a coupler as seen in FIG. 2 may define an outer periphery 226 configured to mate with an inner periphery 242 of the base 240. In one embodiment the inner periphery of the base may define a radius that is substantially equal to, or slightly greater than, a radius of the outer periphery of the coupler. Further, the coupler 224 may define one or more protrusions 229 at the outer periphery 226 configured to engage one or more recesses 278 defined at the inner periphery of the base.”).

106. Cartridge 204 includes a reservoir housing 244 that holds a vaporizable liquid. EX1004, [0053] (“A cartridge 204 can be formed of a cartridge shell 203 enclosing the reservoir housing 244 that is in fluid communication with a liquid

transport element 236 adapted to wick or otherwise transport an *aerosol precursor composition* stored in the reservoir housing to a heater 234.”). Worm discloses that this liquid is heated to vaporize the liquid into an aerosol. EX1004, [0029] (“Aerosol delivery devices of the present disclosure most preferably comprise...a heater or heat generation component (e.g., an electrical resistance heating element or component commonly referred to as an ‘atomizer’), an aerosol precursor composition (e.g., commonly a liquid capable of yielding an aerosol upon application of sufficient heat, such as ingredients commonly referred to as ‘smoke juice,’ ‘e-liquid’ and ‘e-juice’)...”); [0053] (disclosing wicking or otherwise transporting the aerosol precursor composition to heater 234); [0077] (“Such electrical current flow can energize a heater in the cartridge to vaporize the aerosol precursor composition.”).

c. **[14.C] a pressure sensor configured to output sensor readings,**

107. Worm discloses this limitation.

108. Worm discloses a pressure sensor 308 / flow sensor 208. EX1004, [0053]; [0054] (“Although the control component 206 and the flow sensor 208 are illustrated separately, it is understood that the control component and the flow sensor may be combined as an electronic circuit board with the air flow sensor attached directly thereto.”); EX1004, [0060] (“The electronic circuit board 306 can include a pressure sensor 308 attached directly thereto.”). Clearly, Worm discloses a pressure

sensor.

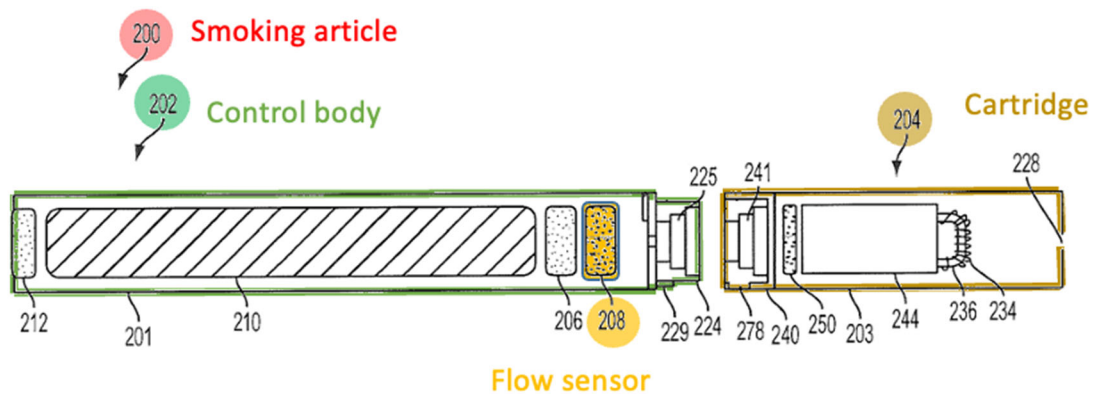


FIG. 2

EX1004, Fig. 2

109. Worm includes a more detailed illustration of the pressure sensor 308 (orange) in Figure 5:

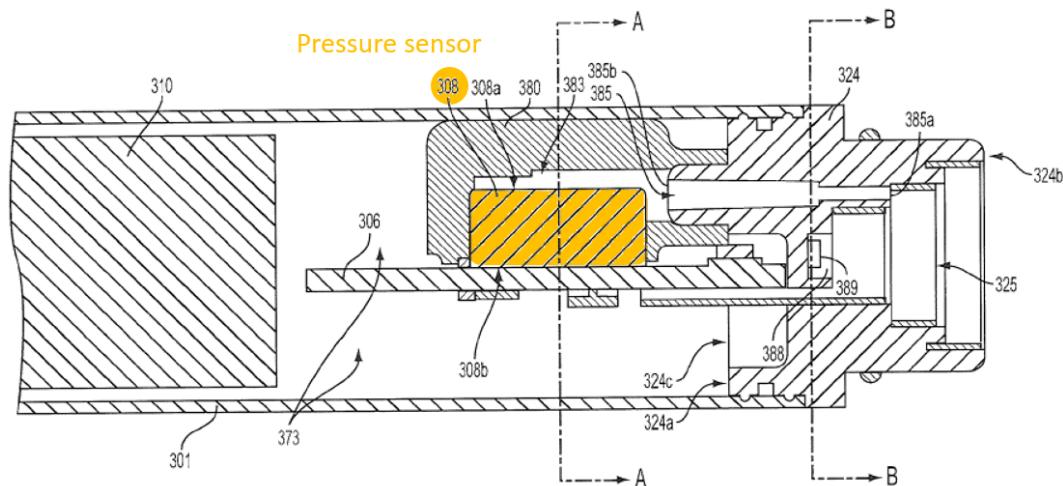


FIG. 5

EX1004, Fig. 5

110. Worm discloses that the pressure sensor 308 is connected to the control board or electronic circuit board 306. EX1004, [0060]. The connection between the

pressure sensor in Worm is via pins on the pressure sensor and avoids other connections such as wired connection. EX1004, [0060] (“A direct attachment in this sense is intended to mean a connection whereby the pressure sensor can be electrically connected to the electronic circuit board via integrated components (e.g., pins) as opposed to a wired connection....The direct attachment can mean that the electrical contacts or pins of the pressure sensor are in direct contact with the electronic circuit board although the body of the pressure sensor may be spaced apart from the electronic circuit board.”).

111. Worm discloses that the control board or electronic circuit board 306 responds to the pressure sensor 308 when the pressure sensor detects a reduced pressure in the pressure reduction space 383 as compared to the pressure in the normal pressure space 373 to control the operation of the smoking article 200. EX1004, [0008] (“The control circuit of the control body can be configured to establish electrical current flow from the electrical power source when the pressure sensor detects a reduced pressure in the pressure reduction space relative to the pressure in the normal pressure space.”); [0034] (“In the exemplified embodiment, the control body 102 includes a control component 106 (e.g., a microcontroller), a flow sensor 108, and a battery 110, which can be variably aligned, and can include a plurality of indicators 112 at a distal end 114 of an outer body 116.”); *see also* EX1004, [0077] (“[T]he control circuit can be configured to establish electrical

current flow from the electrical power source when the pressure sensor detects a reduced pressure in the pressure reduction space relative to the pressure in the normal pressure space.”). Thus, the pressure sensor is configured to output sensor readings to the control circuit so that the control circuit can establish current flow based on reduced pressure detection.

112. Additionally, a POSA would have understood that pressure sensor 308 outputs a signal to the control board or electronic circuit board 306 to control the operation of the smoking article 200. For example, a POSA would have understood that Worm’s pressure sensor provides sensor readings via pins of the pressure sensor in response to detection of a reduced pressure reading that are used by the controller to operate the device (*e.g.*, to determine the current flow to the heating element). EX1004, [0060] (“The direct attachment can mean that the electrical contacts or pins of the pressure sensor are in direct contact with the electronic circuit board although the body of the pressure sensor may be spaced apart from the electronic circuit board.”).

113. Worm additionally discloses an exemplary device with puff-actuation capability. EX1004, [0046] (“An exemplary mechanism that can provide puff-actuation capability includes a Model 163PC01D36 silicon sensor, manufactured by the MicroSwitch division of Honeywell, Inc., Freeport, Ill.”). Such an explicitly described actuation based on the occurrence of one or more puffs, would be clearly

understood by a POSA to refer to puff (draw) detection associated with a drop in pressure within a portion of the device.

114. That the output from the pressure sensor is a pressure sensor reading is further confirmed by the datasheet of an exemplary device identified by Worm. Worm identifies an exemplary device that provides draw detection. EX1004, [0046]. This is exemplary of a pressure sensor that could have been used. A copy of the exemplary datasheet on Honeywell's website in November 27, 2004 (among other dates) for this pressure sensor is available on the internet archives at http://www.honeywell-sensor.com.cn/prodinfo/di_silicon_pressure/installation/p87724_1.pdf.

115. This “[d]ifferential pressure sensor[.]” provides an “output voltage proportional to applied pressure.” EX1026 (160PC Low Pressure Sensors Datasheet for differential pressure sensor model 163PC01D36).

Installation Instructions for 160PC Low Pressure Sensors

PK 87724

GENERAL INFORMATION

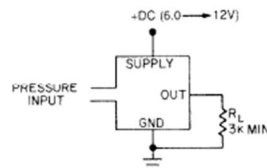
160PC sensors provide an output voltage proportional to applied pressure. They operate from a single, positive supply voltage ranging from 6.0 to 12 VDC. Signal conditioning results in directly usable outputs. Temperature compensation provides predictable performance over specified temperature ranges.

MEASURAND COMPATIBILITY

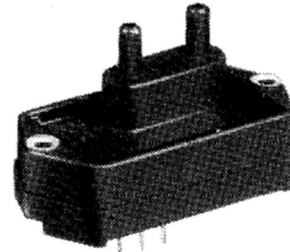
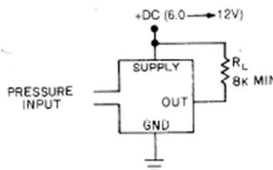
P2 Wetted materials: polyester housing, epoxy adhesive, silicon, borosilicate-glass, silicon-to-glass bond (passive side of IC)*

ELECTRICAL AND PRESSURE CONNECTIONS

Current Source



Current Sink



PRESSURE REFERENCE

Differential pressure sensors apply P1 to the active (connection) side of the chip and P2 to the passive side.

Gage pressure is measured with respect to atmospheric (room) pressure reference.

160PC SPECIFICATIONS at 8.0 ± 0.01 VDC, 25°C

Parameter	Min.	Typ.	Max.	Units
F.S.O. (Full Scale Output)*	4.85	5.00	5.15	Volts
Null Offset	0.95	1.00	1.05	Volts
Excitation	6.00	8.00	12.0	VDC
Overpressure	---	---	5	psi
Operating Temperature	-40° to +85°C (-40° to +185°F)			
Storage Temperature	-55° to +125°C (-65° to +257°F)			

*F.S.O. is the algebraic difference between end points (null and full scale pressure outputs). Output voltage at full pressure equals 6.0 ± 0.20 volts at 8.0 VDC.

TYPICAL OUTPUT VOLTAGES for 163PC01D36 and 164PC01D37 Listings @ 8.0 ± 0.1 VDC, 25°C

Listing	Pressure Range	Vo (volts)
163PC01D36	-5" H ₂ O	1.0
	0	3.5
	+5" H ₂ O	6.0
	F.S.O.	5.0
164PC01D37	0	1.0
	10" H ₂ O	6.0
	F.S.O.	5.0

EX1026 (Model 163PC01D36 Installation Instructions) (excerpts)

116. Thus, in addition to explicitly identifying a pressure sensor, a POSA would have understood that Worm discloses a pressure sensor configured to output sensor readings for the reasons stated above.

- d. **[14.D] wherein a first side of the pressure sensor is exposed to a sealed air flow path and a second side of the pressure sensor is exposed to a device air path open to ambient pressure,**

117. Worm discloses this limitation.

118. As discussed above for limitation [14.C], Worm discloses a pressure sensor (*e.g.*, 308 in Figure 5). Worm additionally discloses that one side (308a) of pressure sensor 308 is exposed to the pressure in pressure reduction space 383. Worm further discloses that another side (308b) of pressure sensor 308, where it attaches to the electronic circuit board 306, is exposed to the pressure in normal pressure space 373. EX1004, [0064] (“In the embodiment illustrated in FIG. 5, a first end 308a of the pressure sensor 308 can be positioned to be in fluid communication with the pressure reduction space 383, and a second end 308b of the pressure sensor can be positioned to be in fluid communication with the normal pressure space 373.”); [0077] (“In this manner, a pressure differential can be created across the pressure sensor between the first end of the pressure sensor in the pressure reduction space and the second end of the pressure sensor in the normal pressure space within the shell.”). Pressure reduction space 383 (light blue) and normal pressure space 373

(dark blue) in relation to the different sides of the pressure sensor 308 are shown below:

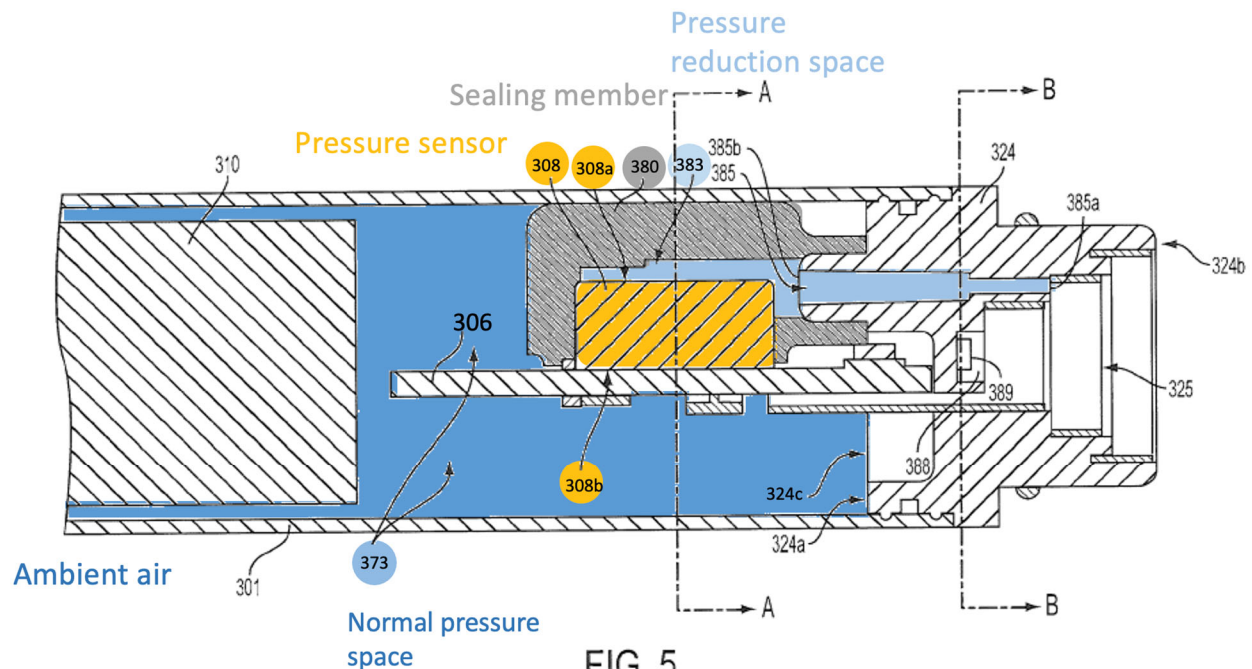


FIG. 5

EX1004, Fig. 5

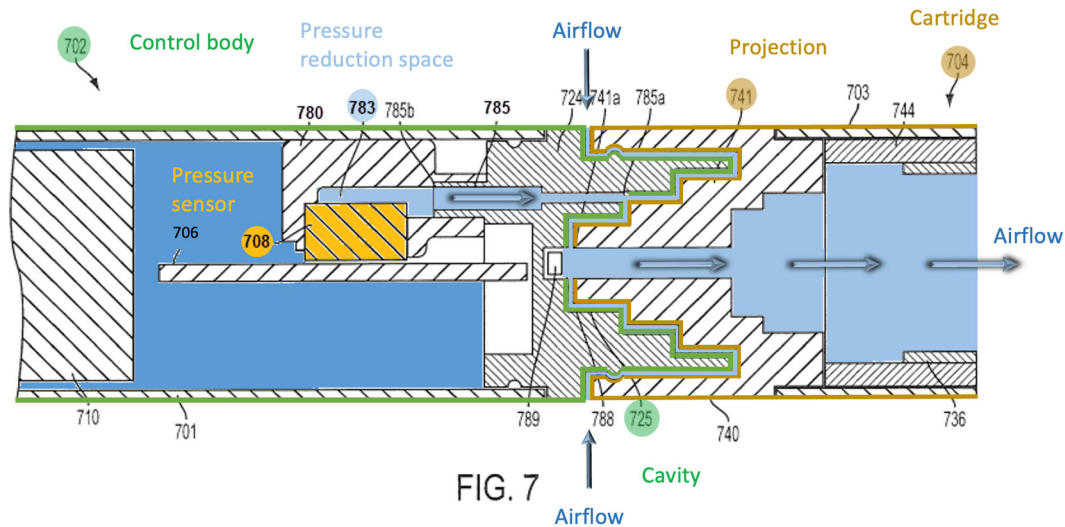
119. Figure 5 above also discloses that a sealing member 380 (grey) seals the pressures exposed to the different sides of the pressure sensor 308 from each other. EX1004, [0007] (“The control body can comprise a sealing member configured to form an air tight seal around the pressure sensor and the second end of the pressure channel and thus define the pressure reduction space encompassing the opening at the second end of the pressure channel and the first end of the pressure sensor.”); [0064] (“In some embodiments, the pressure reduction space can be defined by a sealing member 380....As such, the second end 308b of the pressure sensor 308 and the electronic circuit board 306 are positioned within the normal

pressure space 373.”).

120. The normal pressure space 373 in Worm is open to ambient air, so side 308b of the pressure sensor is exposed to ambient pressure. The '123 Patent refers to this as the “device air path.” EX1004, [0063] (“The normal pressure space can be maintained at ambient pressure and experience no significant change in pressure related to use of the control body in an electronic smoking article. Normal pressure can be maintained with an opening in the shell 301 to the surrounding atmosphere.”).

121. The reduced pressure space 383 in Worm is used to detect a draw on the device. The reduced pressure space 383 is isolated from normal pressure space 373, allowing it to have a pressure that is reduced below the pressure in the normal pressure space while the device is in use. EX1004, [0063] (“The pressure reduction space can be isolated from the normal pressure space, and the pressure within the pressure reduction space can be reduced below the pressure in the normal pressure space during use of the article (i.e., during draw on the article).”). This space includes the “sealed air flow path.” The sealed airflow path starts at the periphery of the interface where the control body 704 and cartridge connect. The sealed air flow path extends through the channel formed by this connection. EX1004, [0076] (“The matched configuration of the cavity 725 and the projection 741 preferably does not substantially form an air tight connection therebetween.”); *see also* EX1004, [0063]. This interface can be seen at the edge of the device where the green outline of the

control body 702 meets the brown outline of the cartridge 704 near the “Airflow” arrows added to Figure 7 below.



EX1004, Fig. 7

122. During use, air travels from the periphery to the center of the cavity where it enters the cartridge and then exits out an opening in the mouthpiece into the smoker’s mouth. The pressure reduction space is exposed to this path as shown in Figure 7 above.

123. One can see the spacing of this non-airtight connection in the excerpt from Figure 7 in Worm below. Worm discloses a uniform gap between the projection of cartridge 704 and the cavity 725 in coupler 724 of control body 702, consistent with the description in Worm. Therefore, since the cavity 725 is in communication with the pressure reduction space 783 through pressure channel 785, the cavity 725 is also in communication with ambient air entering from the interface between the

control body and cartridge at the periphery of the device.

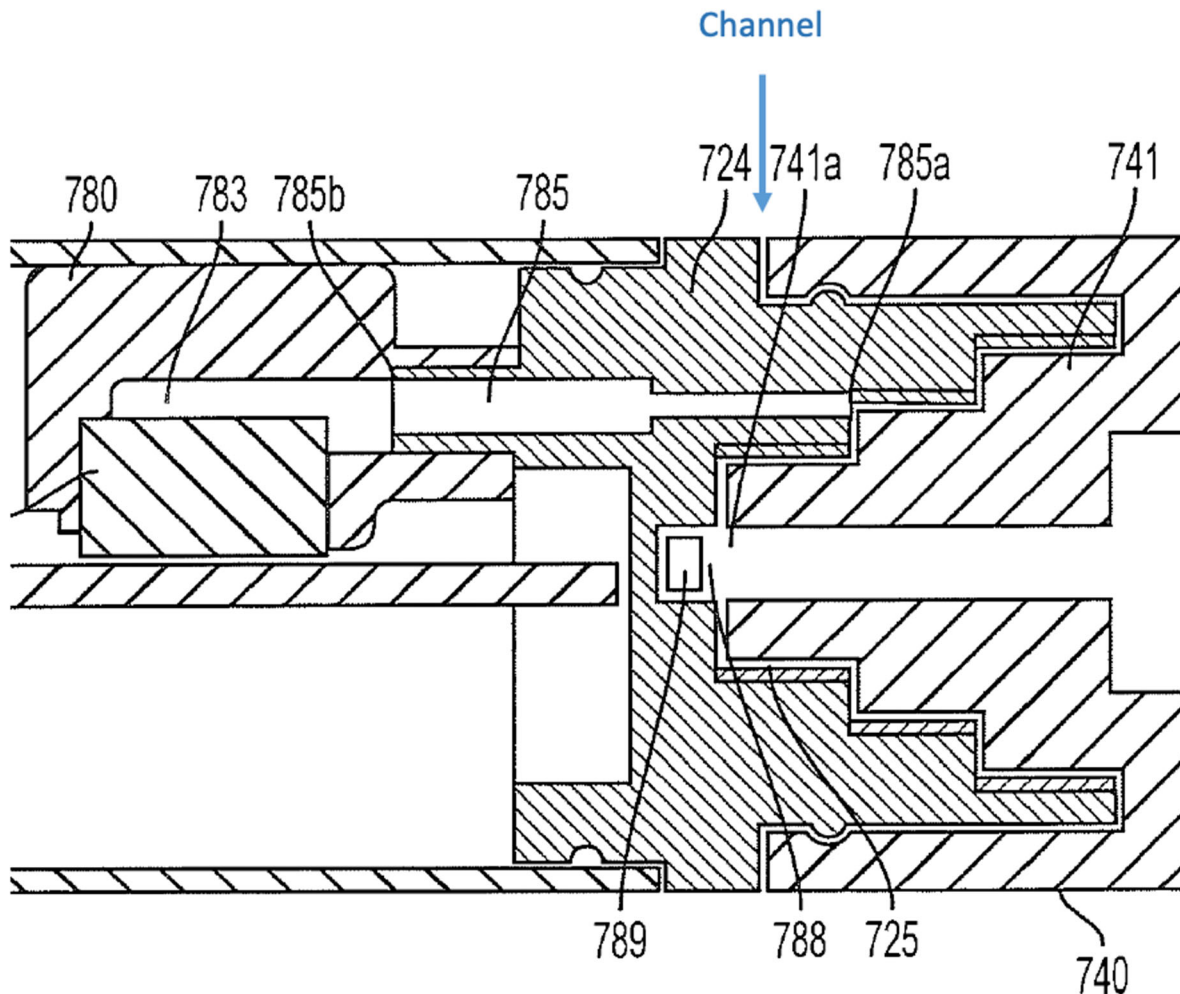


FIG. 7

EX1004, Fig. 7 (excerpted)

124. The sealed air flow path and device air path in the '123 Patent are described the same way. *See* EX1001, 4:38-42 (“The first side of the pressure sensor may be exposed to a first air path through the mouthpiece and a second side of the pressure sensor is exposed to a second air path open to ambient pressure, and wherein

the second air path is sealed from the first air path by a gasket around the pressure sensor.”).

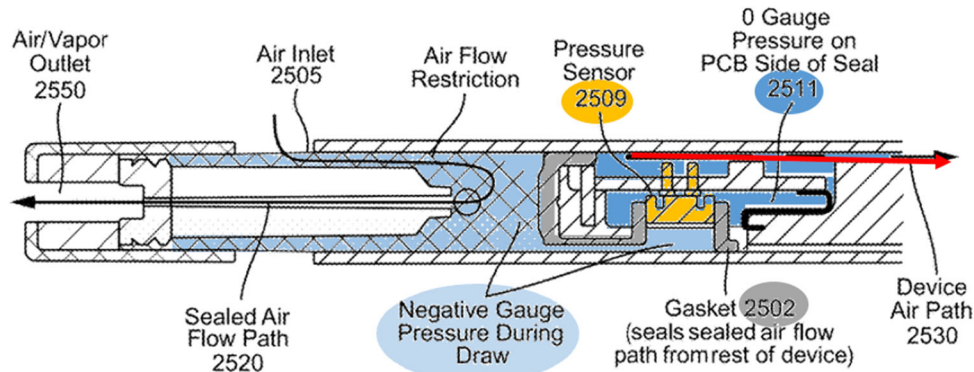


FIG. 25

EX1001, Fig. 25

125. When a smoker draws on Worm’s device, there are different air inlets where air enters the device. One location is the connection at the interface of the cartridge 704 (i.e., projection 741 of the cartridge) and the control body (i.e., cavity 725), described above.

126. In some embodiments, as shown below in Figures 5, 6B, and 7, air enters through one or more air inlet apertures 389/789 and then through air inlet channel 388/788 (purple) before it enters the cavity 325. EX1004, [0069] (“In some embodiments, the coupler 324 can include an air inlet channel 388 that can be adapted to distribute drawn, ambient air through an electronic smoking article including the coupler....ambient air can enter the air inlet channel 388 through an air inlet aperture 389 that opens through the outer surface of the coupler.”); [0075]

(“[A]ir draw on the mouthend of the cartridge (see element 130 in FIG. 1) causes air to enter the air inlet channel 788 of the coupler 724 through one or more air inlet apertures 789...Air flow through the device thus can proceed from the air inlet channel 788 downstream toward the mouthend of the cartridge 704.”).

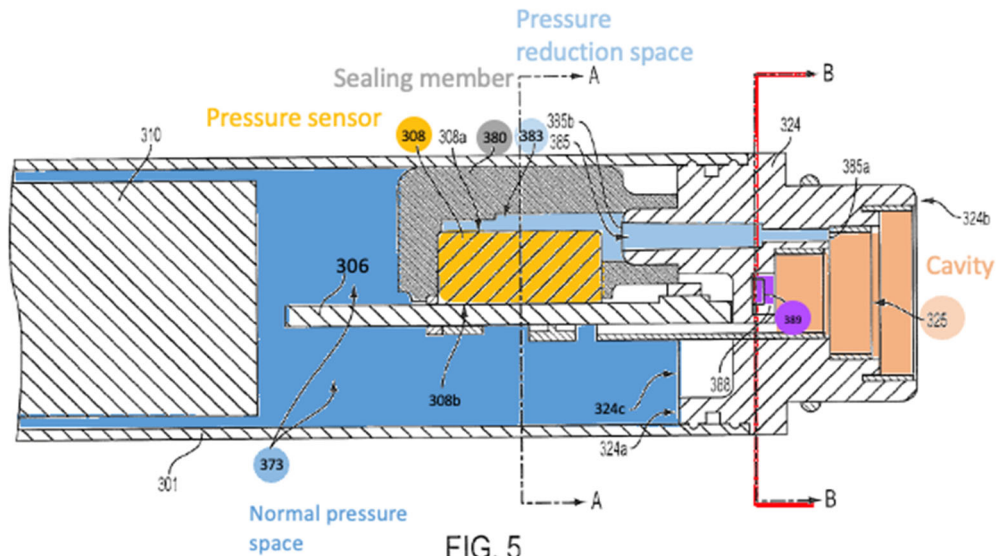


FIG. 5

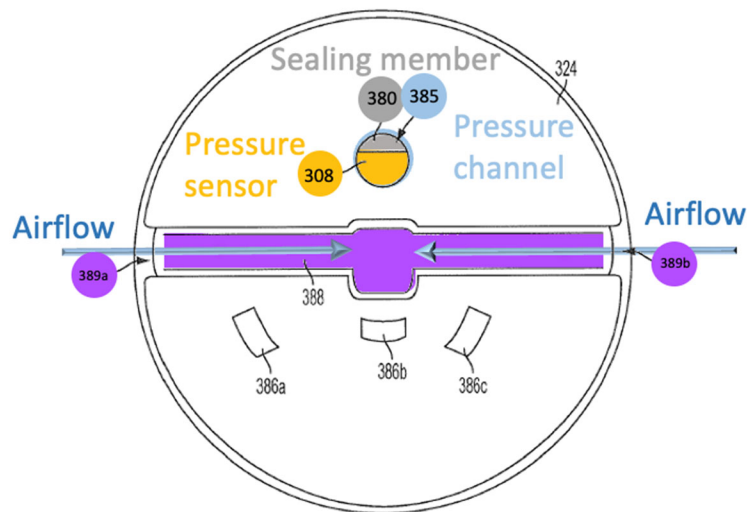
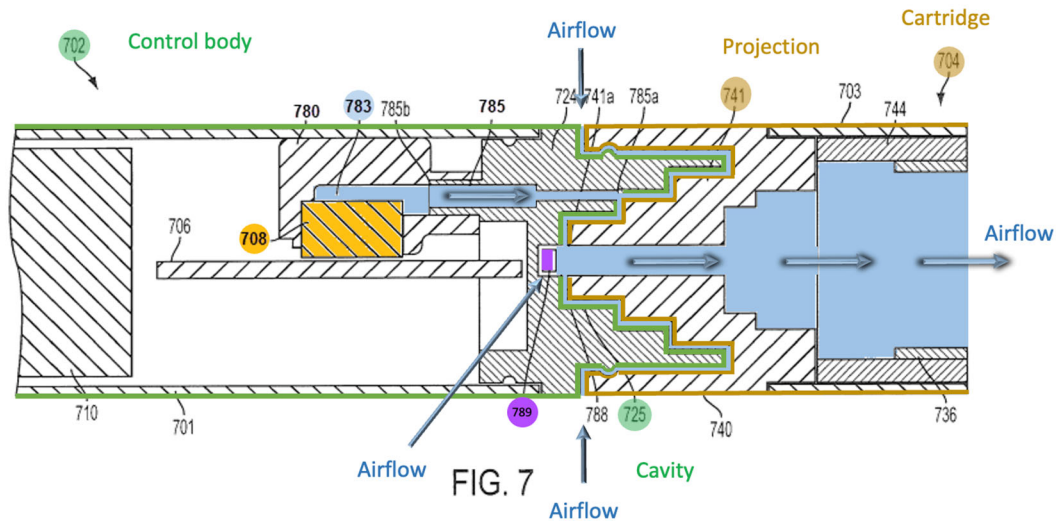


FIG. 6B



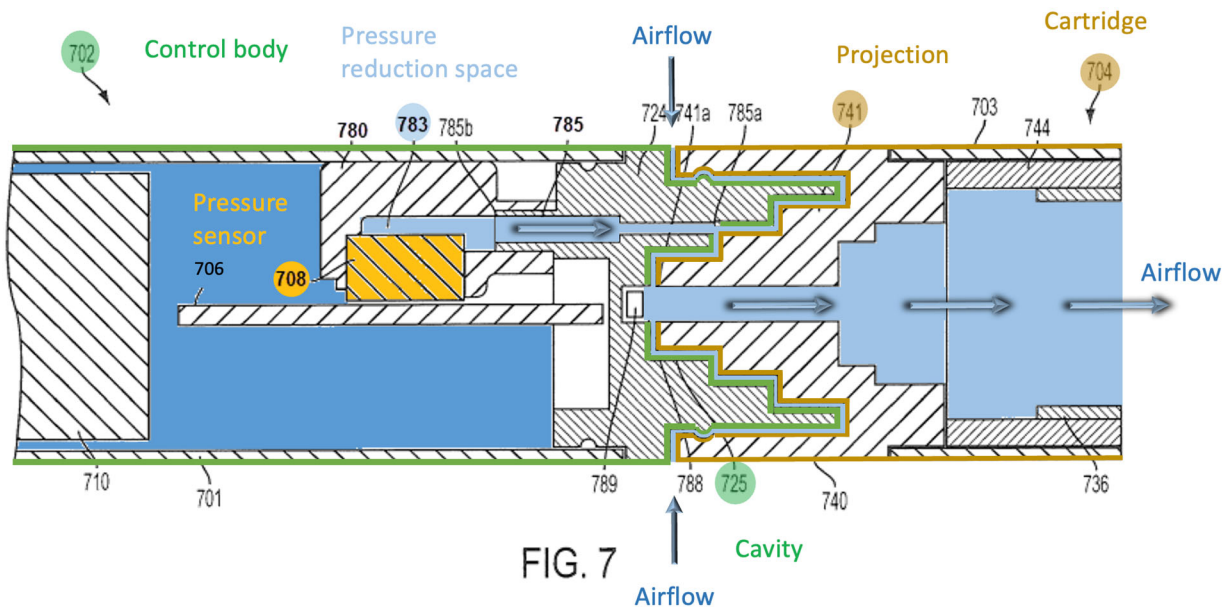
EX1004, Figs. 5, 6B, 7

127. Even embodiments that include air inlet apertures 389/789 and air inlet channels 388/788 also include the non-airtight channel that communicates a pressure drop to the pressure reduction space 783 through pressure channel 785. EX1004, [0076] (“When draw on the device causing air to enter the air inlet channel 788 through the air inlet aperture 789 causes a pressure drop, such pressure drop is communicated to the cavity 725. The matched configuration of the cavity 725 and the projection 741 preferably does not substantially form an airtight connection therebetween. Thus, the pressure drop in the cavity 725 is likewise communicated to the pressure channel 785 from the first end 785a to the second end 785b and thus the pressure reduction space 783.”).

- e. [14.E] the sealed air flow path comprising a channel formed between an interior surface of the cartridge receptacle and an exterior surface of the cartridge,

128. Worm discloses this limitation.

129. As discussed above for limitation [14.D], Worm discloses a sealed air flow path. Worm discloses that the sealed air flow path includes a channel that is formed by the uniform gap between the interior of cavity 725 (cartridge receptacle) and the projection 741 of cartridge 704, which extends to the periphery of the device as show in Figure 7. In Figure 7 below, the sealed air flow path is identified in light blue.

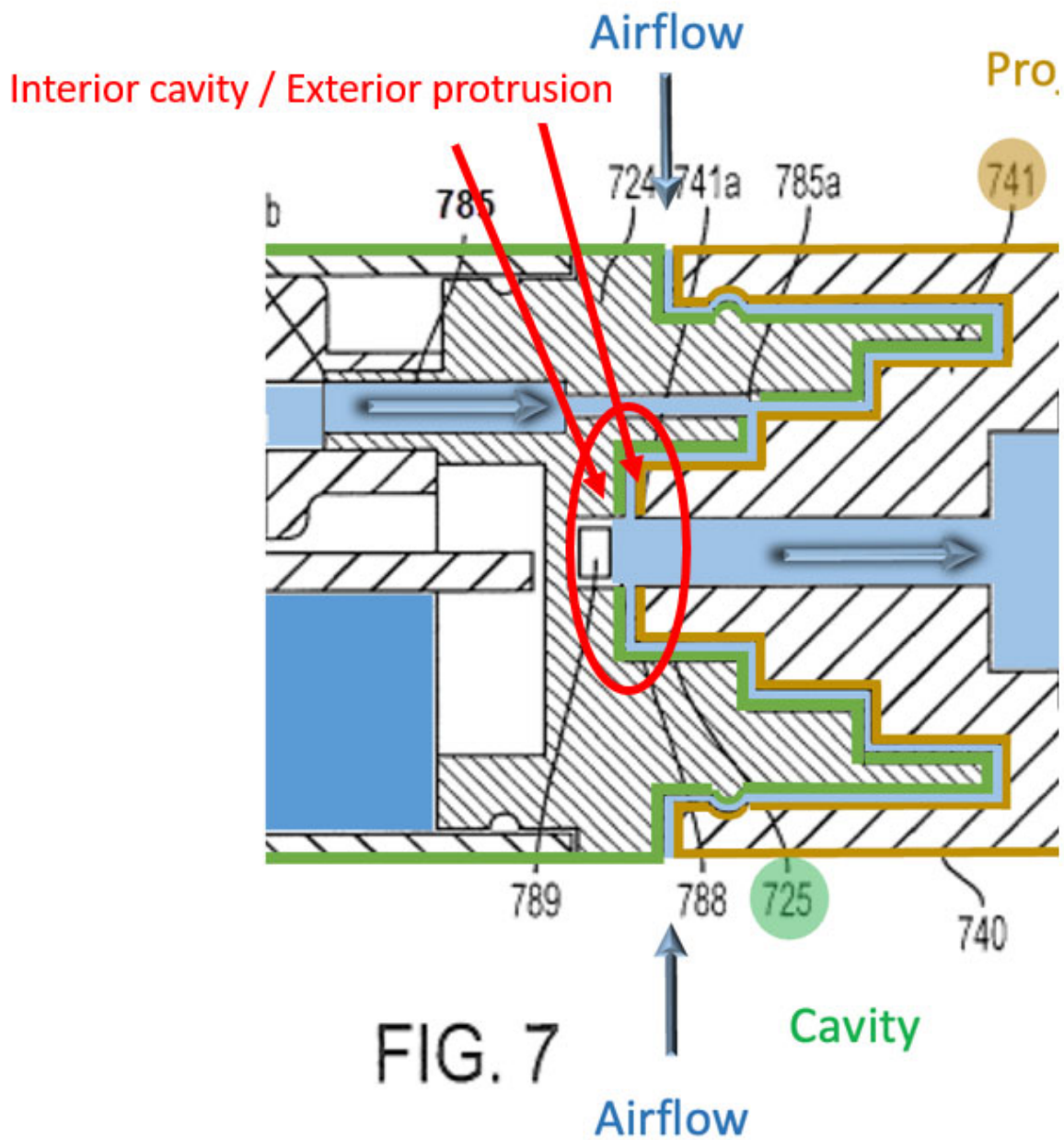


EX1004, Fig. 7

130. This channel between the control body 702 and cartridge 704 communicates the reduced pressure to pressure channel 785 when a smoker draws on the device and allows air to enter from the periphery. EX1004, [0076] (“The matched configuration of the cavity 725 and the projection 741 preferably does not

substantially form an air tight connection therebetween. Thus, the pressure drop in the cavity 725 is likewise communicated to the pressure channel 785 from the first end 785a to the second end 785b and thus the pressure reduction space 783.”).

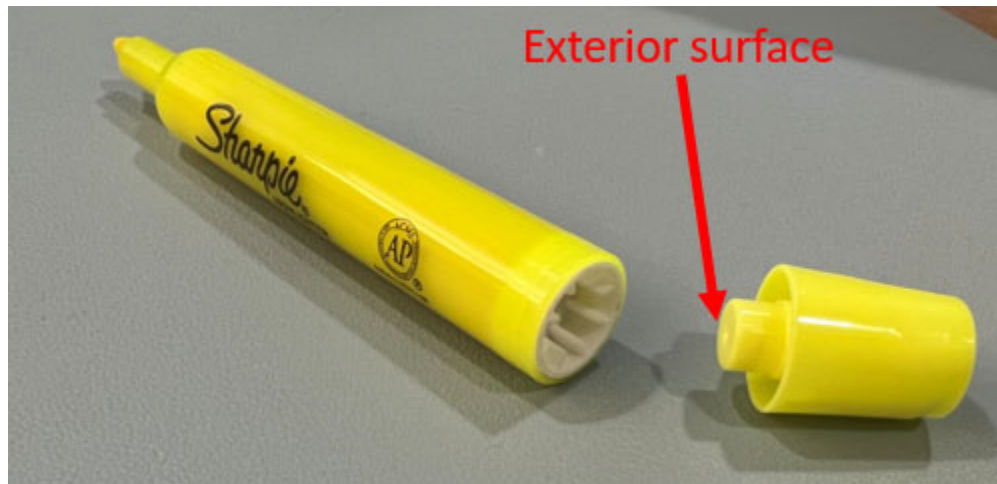
131. As shown in a close-up excerpt of Figure 7, the channel is formed by the surface of the cavity 725 (green) and the surface of the projection 741 of the cartridge (brown). At least a portion of the surface of the cavity 725 (green) is an interior surface of the cavity and at least a portion of the surface of the projection 741 (brown) is an exterior surface of the projection. I have circled where these portions form a channel.



EX1004, Fig. 7 (excerpted)

By way of example, a POSA would have understood that this connection between the cavity in the coupler and the projection of the cartridge is similar to that of a Sharpie highlighter and its cap. The end of the Sharpie insertably receives the exterior projection of a highlighter cap into the interior surface of the cavity in the

distal end of the highlighter. The center portion of the cap clearly protrudes (just like Worm's protrusion) and a POSA would have recognized this as an exterior wall of the cap. This exterior wall mates with the interior wall of the cavity.



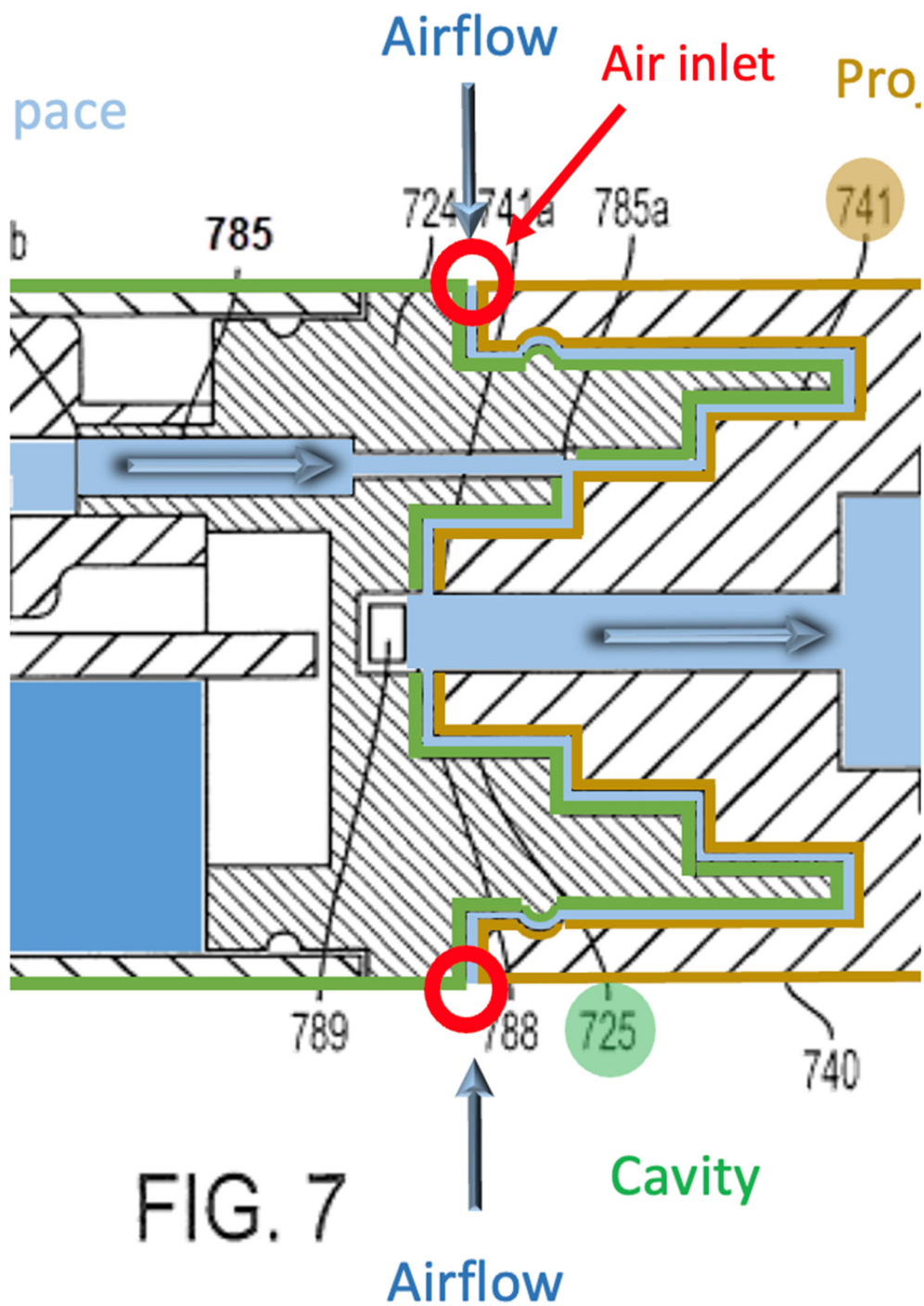
132. Thus, as illustrated in the figures above, Worm discloses a sealed airflow path that includes a channel formed by an interior surface of the cavity in the battery portion (cartridge receptacle) and an exterior surface in the cartridge projection (cartridge).

- f. **[14.F] the sealed air flow path passing from an air inlet, through the channel and to a heater and an outlet of a mouthpiece within the cartridge; and**

133. Worm discloses this limitation.

134. As discussed above for limitations [14.D] and [14.E], Worm discloses a sealed air flow path that includes a channel formed between the control body's cavity 725 (cartridge receptacle) and the projection 741 of the cartridge 704. As illustrated in the excerpt of Figure 7 below, the openings at the periphery of the

channel formed by the interior surface of the cavity 725 (green) and the exterior surface of the projection 741 of the cartridge (brown) is an air inlet because the connection between the control body's cavity 725 (cartridge receptacle) and the projection 741 of the cartridge 704 is not airtight.



EX1004, Fig. 7 (excerpted)

135. As illustrated in Figure 2, air enters these air inlets, travels through the channel at the gap between the control body's cavity and the cartridge before it enters

the cartridge through air flow entry 741. Once the air enters the cartridge, it travels to Worm's heater than exits through an opening in the mouth end of the cartridge. *See*, EX1004, Figs. 1, 2; [0053] ("A cartridge 204 can be formed of a cartridge shell 203 enclosing the reservoir housing 244 that is in fluid communication with a liquid transport element 236 adapted to wick or otherwise transport an aerosol precursor composition stored in the reservoir housing to a heater 234. An opening 228 may be present in the cartridge shell 203 to allow for egress of formed aerosol from the cartridge 204."); [0044].

FIG. 2

136. I understand the end portion of the device with opening 228 is a mouthpiece as the Patent Owner has applied that term in the ITC Investigation. Specifically, with respect to other asserted patents in the ITC Investigation, I understand the Patent Owner has taken the position that the term mouthpiece means a portion used by a mouth. *See* EX1019. I have applied this meaning in my analysis.

- g. **[14.G] a gasket around the pressure sensor, the gasket configured to seal the device air path from the sealed air flow path.**

137. Worm discloses this limitation.

138. As discussed above for limitation [14.D], Worm discloses a device air path and a sealed air flow path. Worm additionally discloses a sealing member 380 (gasket). In some embodiments, the sealing member defines the pressure reduction space. EX1004, [0064] (“For example, the sealing member can comprise a silicone rubber or like material. In some embodiments, the sealing member may be a cup seal. The sealing member 380 can substantially surround the perimeter of the pressure sensor 308 and be in a sealing contact therewith.”). The sealing member 380 (grey) in relation to the pressure sensor 308 (orange), the pressure reduction space 383 (light blue) and the normal pressure space 373 (dark blue) are shown in Figure 5:

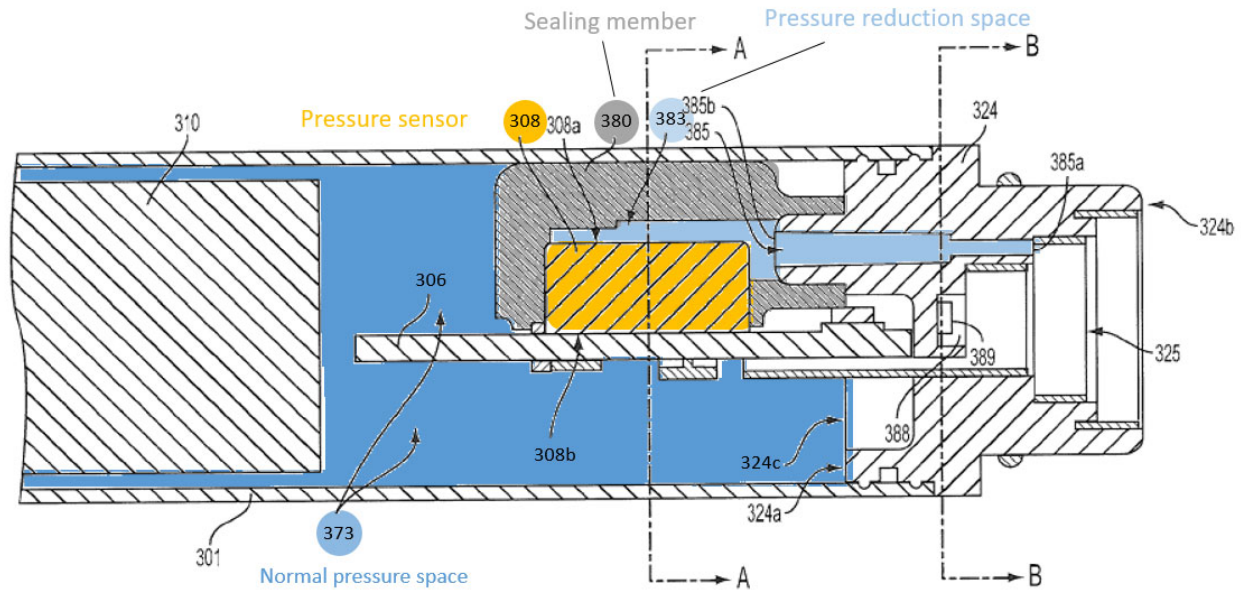


FIG. 5

EX1004, Fig. 5

139. The sealing member 380 forms an airtight seal by surrounding the pressure sensor and the pressure reduction space 373, isolating the sealed air flow path in the pressure reduction space 373 from the device air path. EX1004, [0007] (“The control body can comprise a sealing member configured to form an air tight seal around the pressure sensor and the second end of the pressure channel and thus define the pressure reduction space encompassing the opening at the second end of the pressure channel and the first end of the pressure sensor.”); EX1004, [0063] (“The pressure reduction space can be isolated from the normal pressure space, and the pressure within the pressure reduction space can be reduced below the pressure in the normal pressure space during use of the article (i.e., during draw on the article).”). Worm’s sealing member is a gasket.

2. Claim 27

a. [27.A] A vaporizer device comprising:

140. As discussed above with respect to the preamble [14.A], Worm discloses a vaporizer device.

b. [27.B] a cartridge comprising a reservoir configured to hold a vaporizable material, a heater configured to heat the vaporizable material, and a mouthpiece in fluid communication with the heater; and

141. Worm discloses this limitation.

142. Worm's cartridge 204 includes a reservoir housing 244 (reservoir) that holds an aerosol precursor composition (vaporizable material). EX1004, [0053] ("A cartridge 204 can be formed of a cartridge shell 203 enclosing the reservoir housing 244...."). Worm's cartridge 204 also includes a heater 234 to heat the aerosol precursor composition held in the reservoir housing 24, which is transported out of an opening in the mouthend of the cartridge 204. EX1004, [0053] ("A cartridge 204 can be formed of a cartridge shell 203 enclosing the reservoir housing 244 that is in fluid communication with a liquid transport element 236 adapted to wick or otherwise transport an aerosol precursor composition stored in the reservoir housing to a heater 234. An opening 228 may be present in the cartridge shell 203 to allow for egress of formed aerosol from the cartridge 204."); *see also id.*, [0077] ("In use, an individual may draw on the mouthend of a cartridge (which may include a mouthpiece)").

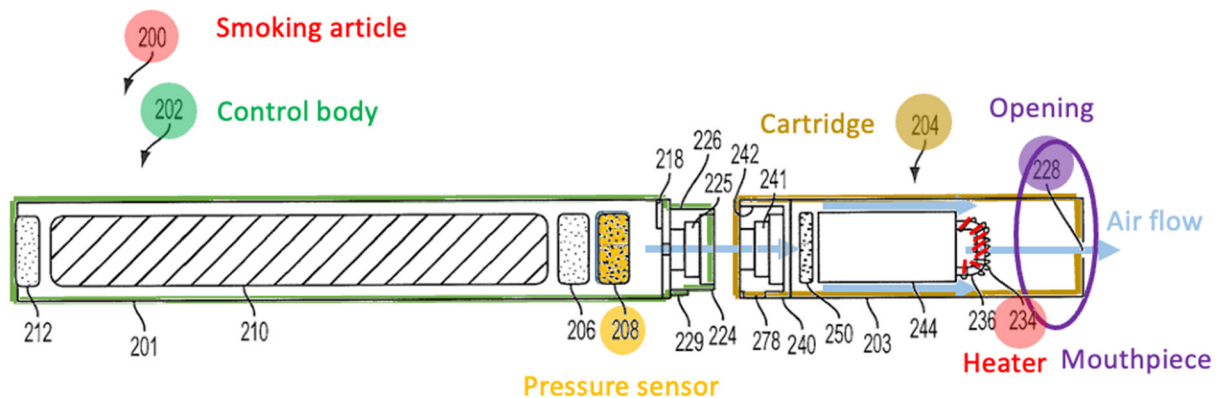


FIG. 2

EX1004, Fig. 2

c. **[27.C] a device body comprising:**

143. As discussed above with respect to limitation [14.A], Worm discloses this limitation.

d. **[27.D] a cartridge receptacle configured to insertably receive the cartridge;**

144. As discussed above with respect to limitation [14.B], Worm discloses this limitation.

e. **[27.E] a pressure sensor configured to output sensor readings,**

145. As discussed above with respect to limitation [14.C], Worm discloses this limitation.

f. **[27.F] wherein a first side of the pressure sensor is exposed to a sealed air flow path and a second side of the pressure sensor is exposed to a device air path open to ambient pressure,**

146. As discussed above with respect to limitation [14.D], Worm discloses

this limitation.

- g. [27.G] the sealed air flow path comprising a channel formed between an interior surface of the cartridge receptacle and an exterior surface of the cartridge,

147. As discussed above with respect to limitation [14.E], Worm discloses this limitation.

- h. [27.H] the sealed air flow path passing from an air inlet, through the channel and to the heater and an outlet in the mouthpiece of the cartridge; and

148. As discussed above with respect to limitation [14.F], Worm discloses this limitation.

- i. [27.I] a gasket around the pressure sensor, the gasket configured to seal the device air path from the sealed air flow path.

149. As discussed above with respect to limitation [14.G], Worm discloses this limitation.

- 3. Claim 32: The vaporizer device of claim 27, wherein the cartridge comprises the vaporizable material, and wherein the vaporizable material comprises a nicotine formulation.

150. Worm discloses this limitation.

151. As discussed above with respect to claim 27 and limitation [14.B], Worm discloses a smoking article with a cartridge 204 containing an aerosol precursor (vaporizable material). EX1004, [0053] (“An exemplary embodiment of a smoking article 200 according to the present disclosure is shown in FIG. 2....A cartridge 204 can be formed of a cartridge shell 203 enclosing the reservoir housing

244 that is in fluid communication with a liquid transport element 236 adapted to wick or otherwise transport an aerosol precursor composition stored in the reservoir housing to a heater 234.”). Worm describes that the aerosol precursor (vaporizable material) composition ingredients are “commonly referred to as ‘smoke juice,’ ‘e-liquid’ and ‘e-juice’”. EX1004, [0029].

152. Exemplary ingredients incorporated by reference into Worm’s specification explicitly disclose the use of a nicotine formulation in the precursor liquid. Worm identifies two references as disclosing exemplary formulations for aerosol precursor materials and incorporates their disclosures by reference in their entirety. EX1004, [0029] (“Exemplary formulations for aerosol precursor materials that may be used according to the present disclosure are described in U.S. Pat. Pub. No. 2013/0008457 to Zheng et al. and U.S. patent application Ser. No. 13/536,438 to Sebastian et al., filed Jun. 28, 2012, the disclosures of which are incorporated herein by reference in their entirety.”).

153. One of the references incorporated into Worm’s specification is Sebastian.⁸ Sebastian teaches tobacco extracts with liquid nicotine for introducing a desirable characteristic to an aerosol precursor. EX1008, [0056] (“As such,

⁸ Worm cites U.S. Patent Application Ser. No. 13/536,438, titled “Reservoir and Heater System for Controllable Delivery of Multiple Aerosolizable Materials In An Electronic Smoking Article,” which published as U.S. Pat. Pub. No. 2014/0000638 (EX1008).

exemplary preferred tobacco extracts possess less than 45 percent nicotine.... In addition, highly preferred tobacco extracts are highly aromatic and flavorful, and hence introduce desirable sensory characteristics to the aerosol produced by the smoking articles incorporating those extracts.”).

154. Thus, Worm discloses a vaporizable material that includes a nicotine formulation. Further, a POSA would have understood that nicotine is a popular ingredient in such precursor liquids for smoking articles, such as Worm.

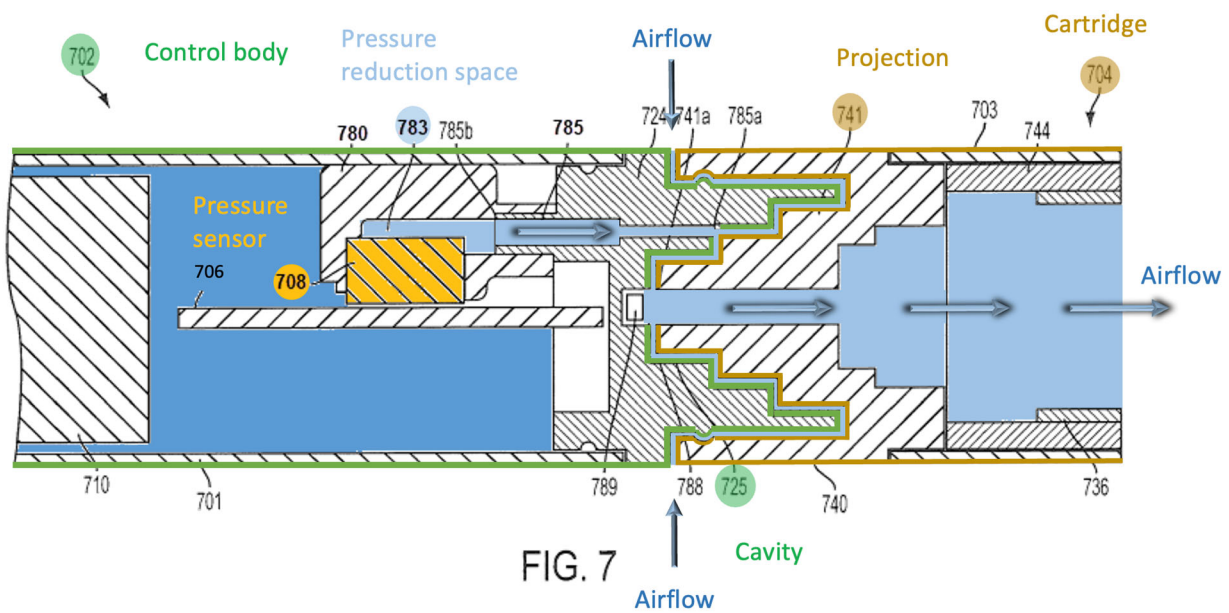
155. Therefore, in summary, Worm anticipates claims 14, 27, and 32 of the ’123 Patent.

B. Ground 2: Worm in view of the Knowledge of a POSA Renders Obvious Claims 14, 27 and 32 of the ’123 Patent

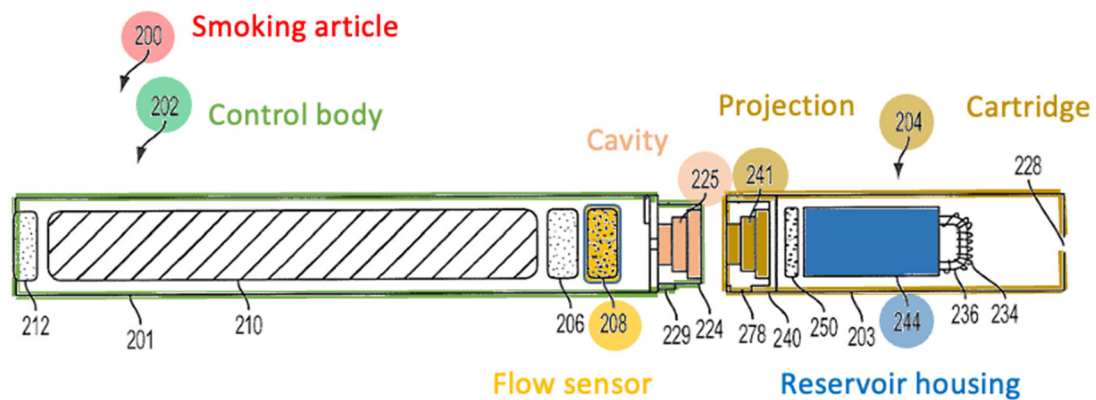
156. As described above in detail in Ground 1, Worm discloses all limitations of each of claims 14, 27, and 32 and thus anticipates each of those claims. To the extent it is argued that the air flow path located at the interface between Worm’s cartridge receptacle in the control body and the cartridge in Worm fails to disclose the “sealed air flow path” required by claim limitations [14.E], [14.F], [27.G] and [27.H] in claims 14 and 27, it would have been obvious to a POSA that Worm’s cartridge receptacle and cartridge form a channel that allows air to enter the cavity and satisfies the “sealed air flow path” limitation in claims 14 and 27 (and claim 32 by dependency). These limitations require “the sealed air flow path comprising a channel formed between an interior of the cartridge receptacle and an

exterior surface of the cartridge, the sealed air flow path passing from an air inlet, through the channel and to a heater and an outlet of a mouthpiece within the cartridge.”

157. The non-airtight channel formed between Worm’s cartridge receptacle and cartridge communicates air pressure along this channel. EX1004, [0076] (“The matched configuration of the cavity 725 and the projection 741 preferably does not substantially form an air tight connection therebetween.”). The channel is illustrated as a uniform gap from the periphery to the center of the device, a POSA would have understood that, when a smoker draws on the device, air enters at the periphery and into the gap due to the negative pressure that is generated. Air from the periphery joins the air evacuated from the pressure reduction space and enters into the cartridge, passes by the heater, and exits into the smoker’s mouth. EX1004, [0053] (“An opening 228 may be present in the cartridge shell 203 to allow for egress of formed aerosol from the cartridge 204.”).



EX1004, Fig. 7



EX1004, Fig. 2

158. Worm discloses that in some embodiments, air enters the cavity through air inlet apertures 789 and air inlet channel 788. EX1004, [0069]; [0075]. However, in those embodiments, air still enters the device and into the cavity at the periphery

of the interface connection (i.e., between the cavity 725 (cartridge receptacle) and the projection 741) as the negative pressure increases. However, for embodiments in which the air inlet apertures 789 and air inlet channel 788 are not used, ambient air enters through the periphery at the interface connection because it is the only source of ambient air in Worm, as shown in Figure 7 above. Otherwise, a vacuum would be created in the device rendering the device nonfunctional if there are no external air sources when a smoker draws on the device.

159. Therefore, the “sealed air flow path limitations” [14.E], [14.F], [27.G] and [27.H] and claims 14 and 27 (and claim 32 by dependency) of the ’123 Patent are rendered obvious over Worm in view of the knowledge of a POSA. Thus, Worm in view of the knowledge of a POSA renders obvious claims 14, 27, and 32 of the ’123 Patent.

C. Ground 3: Worm in view of Levitz Renders Obvious Claims 14, 27, and 32 of the ’123 Patent

160. Worm in view of Levitz renders obvious claims 14, 27, and 32 of the ’123 Patent.

1. Sealed air flow path (limitations [14.E], [14.F], [27.G], and [27.H])

161. As described above in detail in Ground 1, Worm discloses all limitations of each of claims 14, 27, and 32 and thus anticipates each of those claims. Limitations [14.E], [14.F], [27.G] and [27.H] require “the sealed air flow path

comprising a channel formed between an interior of the cartridge receptacle and an exterior surface of the cartridge, the sealed air flow path passing from an air inlet, through the channel and to a heater and an outlet of a mouthpiece within the cartridge.” To the extent it is argued that the air flow path located at the interface between Worm’s cartridge receptacle in the control body and the cartridge does not disclose or render obvious (as set forth in Grounds 1 and 2 above) the “sealed air flow path” required by limitations [14.E], [14.F], [27.G] and [27.H] in claims 14 and 27, including such path would have been obvious to a POSA based on Worm in view of Levitz. Levitz teaches an air flow path located at the interface connection between the control body and the cartridge of an electronic cigarette.

162. Levitz discloses an electronic cigarette with a battery portion and an atomizer or cartomizer (cartridge). EX1010, [0006] (“One example of an electronic cigarette... is a ‘two-piece’ device having a first battery section and a second atomizer section, wherein the atomizer section is detachable from the battery section.”). Levitz’s air flow path is defined by an opening in the side of the device (air inlet) and includes a path at the connection between the battery section and the cartomizer. Air then is directed up the cartomizer before it exits through an opening into the smoker’s mouth. EX1010, [0017] (“During inhalation, air enters from the side of the Battery and enters the post of the Battery via a groove in the battery post. It then enters into the Cartomizer through the axial opening in the Cartomizer post

and exits the Cartomizer into the smoker's mouth.”). This air flow is in communication with one side of a pressure sensor through a pressure differential channel. EX1010, [0017] (“...the sensor can detect a pressure differential via said pressure differential channel.”)

163. In Figure 16 below, the battery connector is shown with a male connector and the cartomizer is shown with a female connector (receptacle). However, Levitz also teaches the reverse male and female connections too. EX1010, [0048] (“It should be appreciated that although the above-described embodiments demonstrate that some embodiments of the present invention are designed such that the Battery comprises the ‘male’ connection and the Cartomizer comprises the ‘female’ connection, the reverse configuration may be equally suitable, depending on design requirements. Accordingly, the Cartomizer may comprise the ‘male’ connection and the Battery may comprise the ‘female’ connection.”). When reversed, the battery portion would include the female connector for receiving the cartomizer (cartridge receptacle) and the cartomizer (cartridge) would include a male connector.

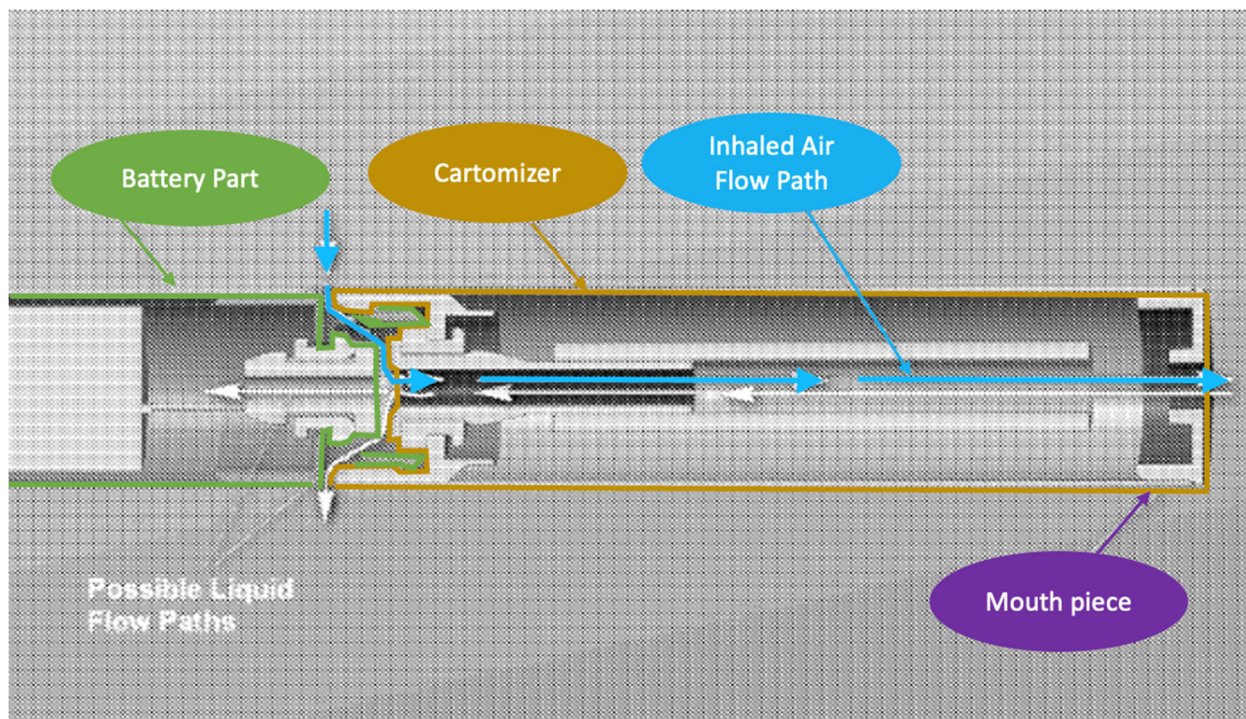


Figure 16

EX1010, Fig. 16

164. In one embodiment, illustrated in Figure 15, Levitz discloses a connector for a battery section. EX1010, [0042].

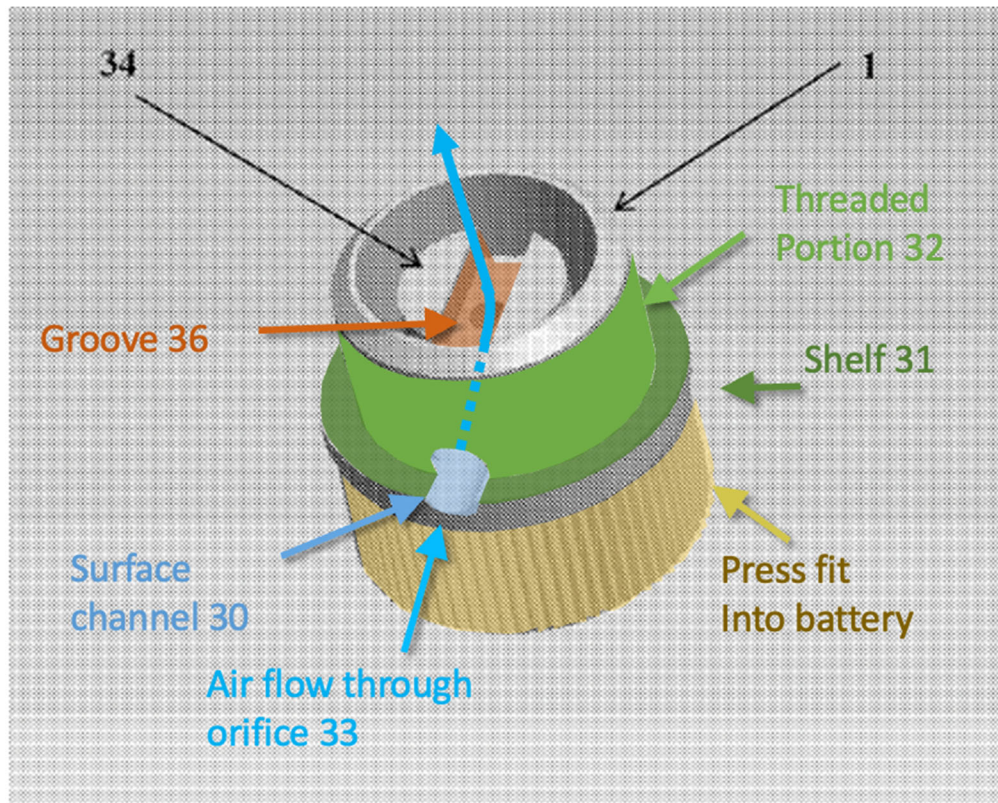


Figure 15

EX1010, Fig. 15⁹

165. The bottom of the connector in Figure 15 is press fit into the battery portion of Levitz’s electronic cigarette. The upper portion of the connector 32 is threaded (not shown) and connects with the threaded section of the cartomizer up to shelf 31. At the sides of the connector are surface channels 30 that are drilled through shaft 32 at orifices 33 that provide air into the connector. EX1010, [0042] (“...instead of a notch in the outer perimeter of the flange 7, toward distal end 5,

⁹ As discussed above with respect to Figure 16, Figure 15 depicts a connector for a male battery portion and a female cartomizer, but also discloses the reverse male/female connections configuration. EX1010, [0048].

perpendicular surface channels 30 are drilled on shelf 31 of flange 7. The channels continue and penetrate through the shaft 32 of connector 1...at orifices 33 and continue through inner shelf 45.”). Air then travels along the channel between the battery portion and the cartomizer as guided by groove 36. EX1010, [0042] (“...groove 36 which assists in guiding air inhaled or exhaled through perpendicular surface channel 30 and orifice 33.”).

166. “The airflow through the connector and battery post combination shown in Figures 13-15 is illustrated in Figure 16.” EX1010, [0044].

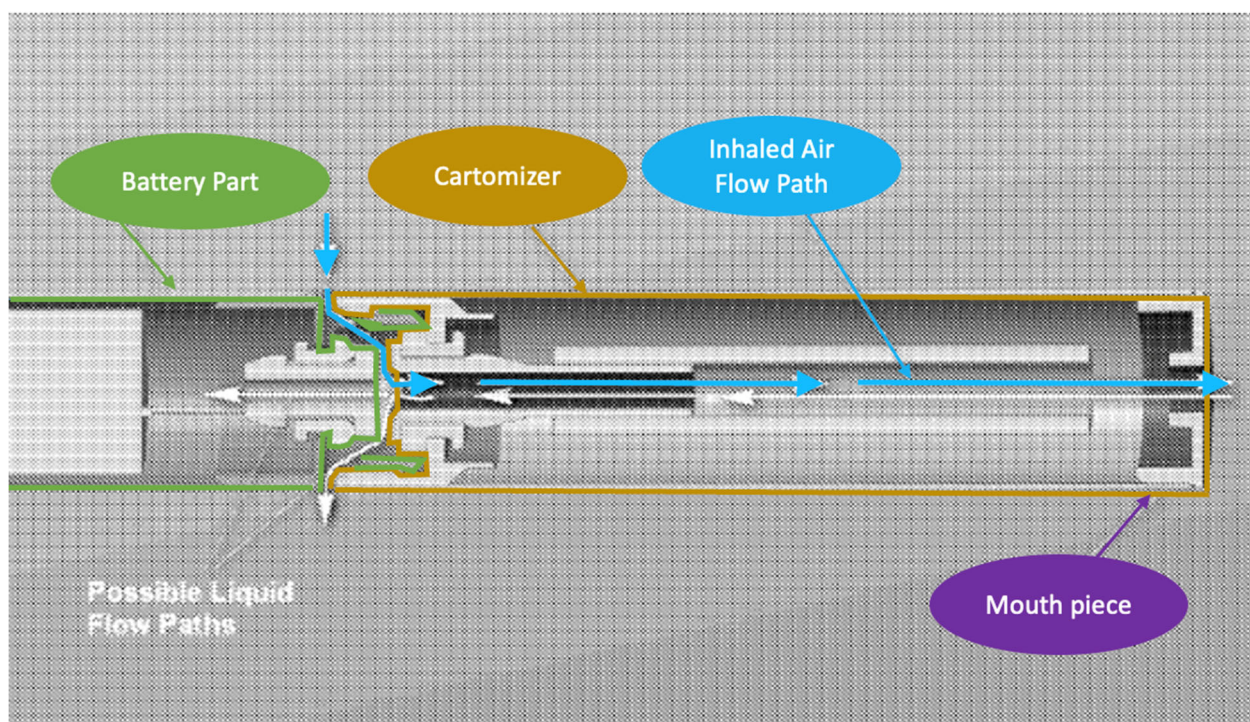


Figure 16

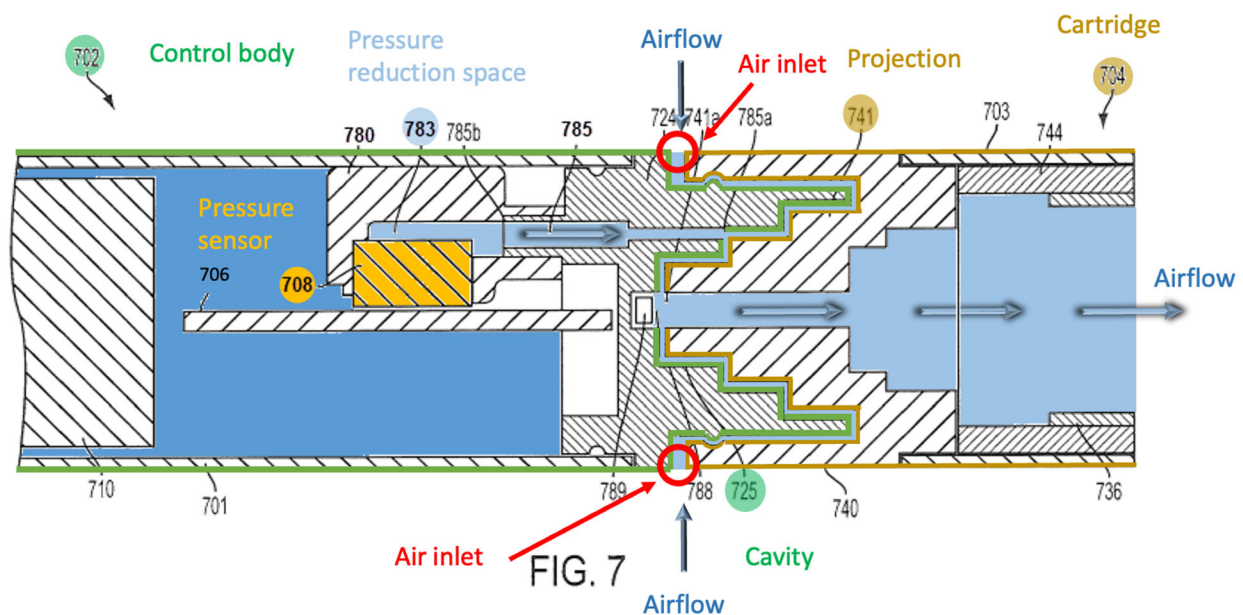
EX1010, Fig. 16

167. As illustrated in Figure 16, Levitz teaches an air flow path that enters

an air inlet aligned with surface channels 30 in the side of the device and orifices 33, and then travels through the interface between the battery portion and the cartomizer before entering the cartomizer. EX1010, [0042]-[0044].

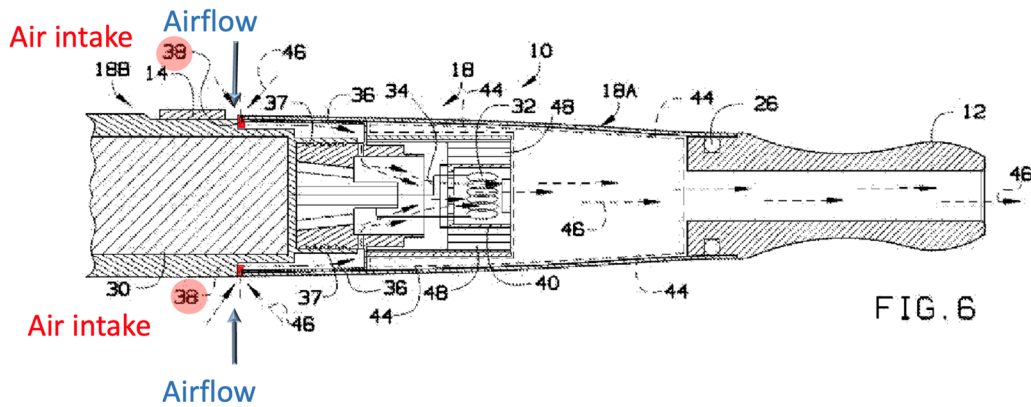
168. If there is any argument that Worm does not disclose an air inlet that allows air to enter the interface at the connection between Worm's control body 702 and its cartridge 704, it would have been obvious to a POSA to modify Worm in view of Levitz's teachings. Based on these teachings, a POSA would have been motivated to modify Worm so that outside air enters the interface at the connection between the control body 702's cavity 725 and the projection 741 of its cartridge 704.

169. A POSA would have understood that the location of the air inlet could be anywhere along the interface to the connection between the control body 702's cavity 725 and the projection 741 of its cartridge 704. EX1007, 4:41-43 ("The air inlet openings 16 can be located elsewhere on the electronic cigarette 2, and is a matter of design choice.").

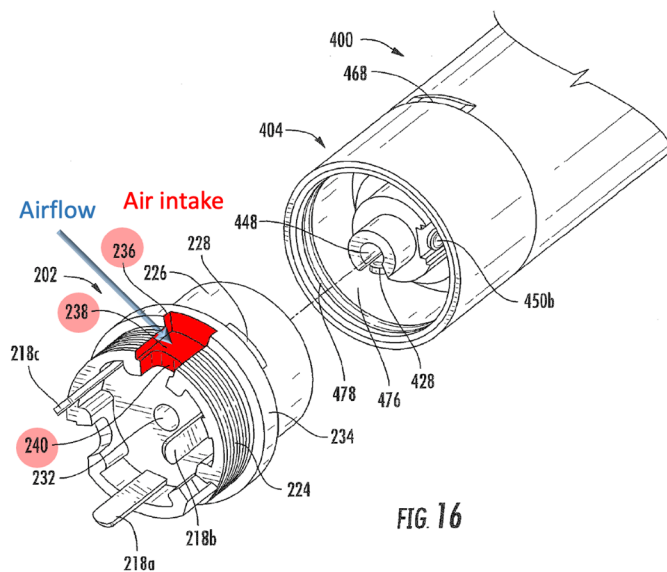


Modified Worm

170. A POSA would have recognized that locating air inlets at the interface between the connection of the battery portion and the cartridge portion of an electronic cigarette is one such location. As shown in the table below, air entering this location was well known and could be implemented in a variety of configurations, as shown below.



EX1012, Fig. 6; [0028] (“...housings 18A and 18B connect by the adapters 36 which have air intakes 38 to promote sufficient airflow 46 through the burn housing section 18A when a user inhales through the mouthpiece 12.”)



EX1013, Fig.16; [0097] (“...the coupler 202 may define a fluid pathway configured to receive air from an ambient environment and direct the air to the cartridge 400 when a user draws thereon.”)

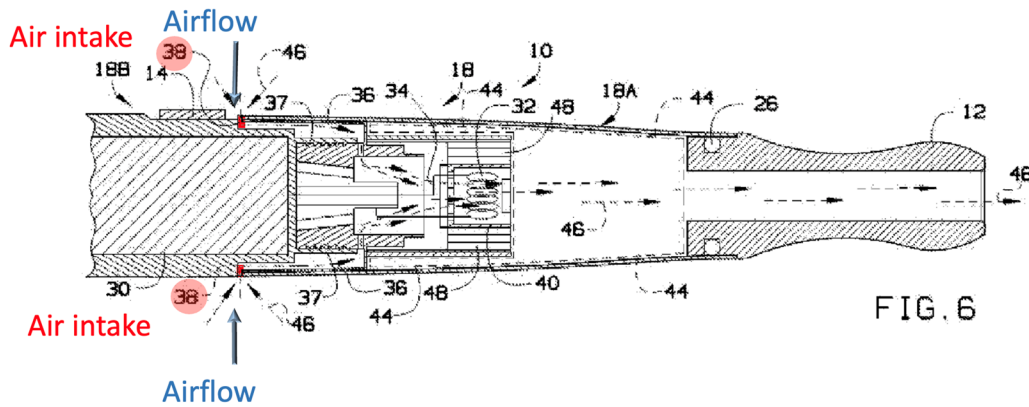


FIG. 6

EX1012, Fig. 6; [0028] (“...housings 18A and 18B connect by the adapters 36 which have air intakes 38 to promote sufficient airflow 46 through the burn housing section 18A when a user inhales through the mouthpiece 12.”)

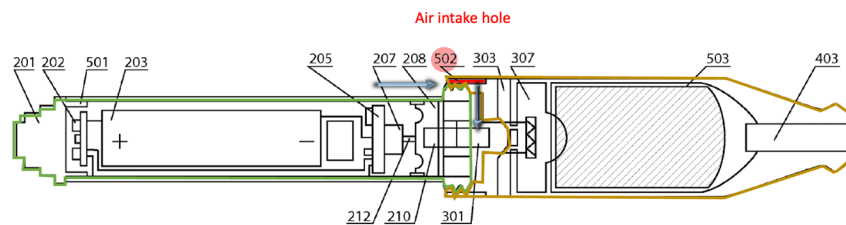


Figure 5A

EX1011, Fig. 5A; 4:9-12 (“The air enters through the air intake hole (502), passes through the run-through hole on the air-liquid separator (303)...”)

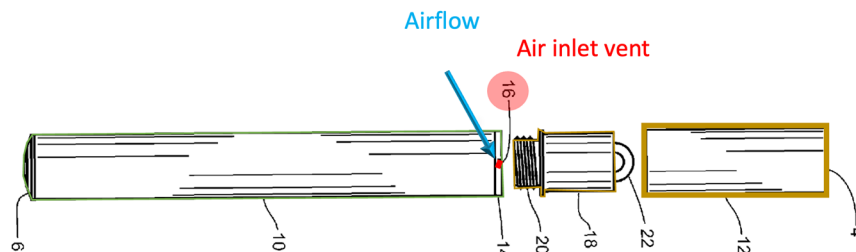


Fig. 3

EX1009, Fig. 3; 4:45-48 (“One or more air inlet vents 16 are provided about the coupler 14 for allowing airflow into the cartridge 12 when the user draws air through the electronic cigarette 2.”).

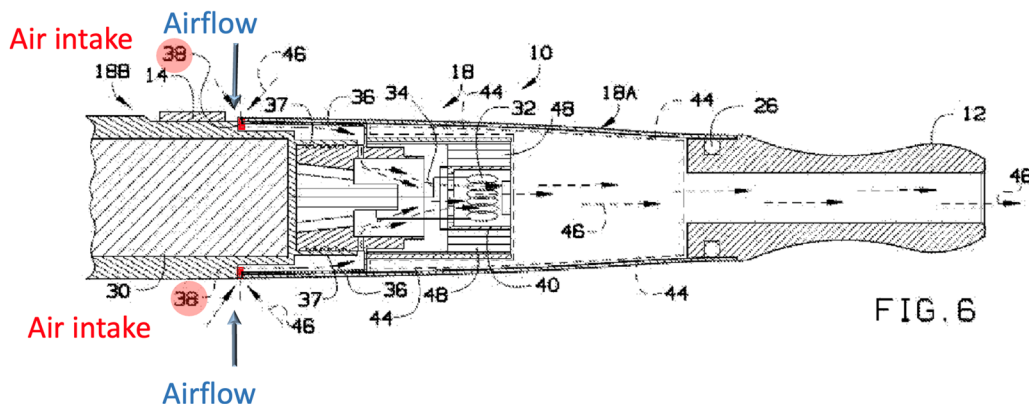


FIG. 6

EX1012, Fig. 6; [0028] (“...housings 18A and 18B connect by the adapters 36 which have air intakes 38 to promote sufficient airflow 46 through the burn housing section 18A when a user inhales through the mouthpiece 12.”)

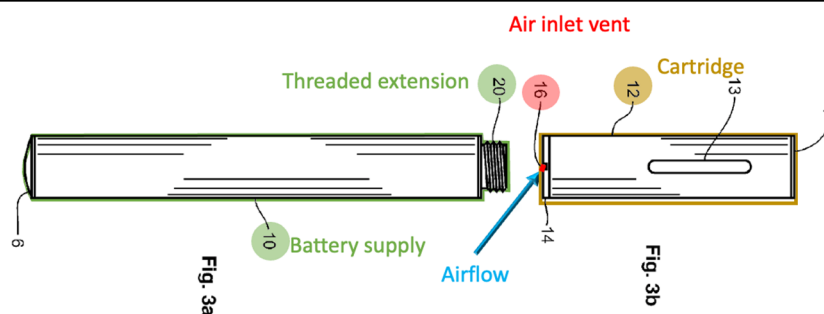


Fig. 3a

Fig. 3b

EX1007, Figs. 3a, 3b; 1:64-2:1 (“...an inlet vent formed on the exterior of the elongated housing that is coupled to deliver air to the atomizing chamber air inlet. In a refinement to this embodiment, the inlet vent is coupled to the atomizing chamber air inlet by a conduit.”); 4:15-18.

171. The above references disclose an electronic cigarette design having air entering at the battery-cartridge connection interface.

172. Additionally, a POSA would have been motivated to locate the air inlet at the interface to the connection between the battery portion and cartridge because Worm teaches the disadvantages of the sealed air flow path entering the battery

compartment. EX1004, [0005] (“Such coupler can particularly be useful to reduce or prevent passage of liquid from an attached cartridge through the coupler and into the control body and thus reduce or prevent contamination of the sensor or other electronic elements present in the control body.”). When modified in light of Levitz’s teachings, modified Worm includes additional pathways for backflow of vapor or liquid to exit the interface at the periphery rather than collect in the negative pressure space.

173. A POSA would also have been motivated to modify Worm to include the air inlet at the interface connection between the coupler of the control body and the cartridge. Worm recognizes that vapor can backflow through the air inlet channel 788, which leads to the buildup of residue in the channel, potentially limiting airflow through the channel. A POSA would have been motivated to form the air channel at the interface connection (*e.g.*, on the surface of the coupler) to allow a smoker to periodically clean the air inlet channel (*e.g.*, vapor or liquid residue buildup) by detaching the cartridge to access the exposed air inlet channel. If the air flow channel were not coextensive with the interface connection between the cavity and the projection, (*i.e.*, it was completely embedded within the coupler), a smoker would not have access to the channel to clean it.

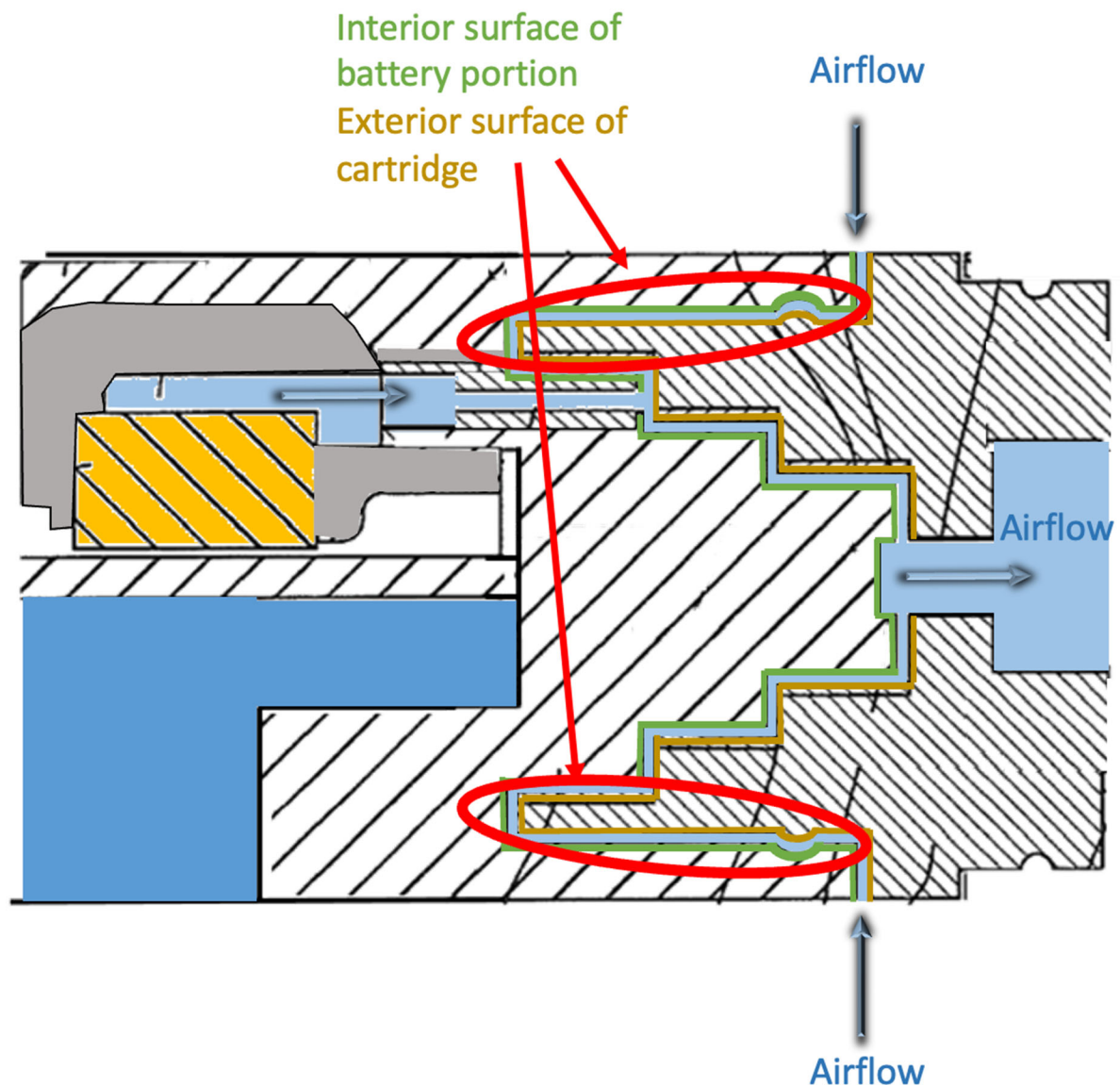
174. A POSA would have had a reasonable expectation of success in combining Worm and Levitz. The designs of the electronic cigarettes are similar. As

discussed above, Levitz and Worm disclose an electronic cigarette with a battery portion and an atomizer or cartomizer (cartridge). EX1010, [0006] (“One example of an electronic cigarette... is a ‘two-piece’ device having a first battery section and a second atomizer section, wherein the atomizer section is detachable from the battery section.”). They both have a mechanical coupler with air inlets in the coupler and a pressure sensor that activates the device when a negative pressure is detected. Moreover, it was well-known to a POSA that the air inlet location is a design choice and locating an air inlet at the interface between the battery and cartridge was a common choice. An air inlet at that location would not interfere with how Worm operates; and implementing the air inlet at that location would be within the skills of a POSA.

175. Moreover, if there is any argument that Worm’s cartridge projection does not include any exterior surfaces to form a channel, Levitz provides a clear teaching that the male-female connections can instead be female-male (i.e., it could be the reverse). EX1010, [0048] (“It should be appreciated that although the above-described embodiments demonstrate that some embodiments of the present invention are designed such that the Battery comprises the ‘male’ connection and the Cartomizer comprises the ‘female’ connection, the reverse configuration may be equally suitable, depending on design requirements. Accordingly, the Cartomizer may comprise the ‘male’ connection and the Battery may comprise the ‘female’

connection.”).

176. In the combination of Worm in view of Levitz, there is a male connector on the battery portion coupled with a female connector on the cartridge as is seen in the following exemplary modified Worm. The sealed air flow path in the figure below illustrates a channel formed between the interior surface of the cartridge receptacle in the battery portion and the exterior surface of the cartridge as shown below:



Modified Worm in view of Levitz

The figure above is annotated to show the air inlet that passes air to the channel that is formed between the interior of the modified cartridge receptacle and exterior of the modified cartridge connection.

177. A POSA would have been motivated to make this modification because Levitz teaches that the coupling arrangement is no more than a design choice.

EX1010, [0048] (“...reverse configuration may be equally suitable, depending on design requirements.”).

178. A POSA would have had a reasonable expectation of success in modifying Worm by reversing the coupling. It would not have impacted the rest of the device in any meaningful way. The modified couplers also maintain the structural stability of the device when connected.

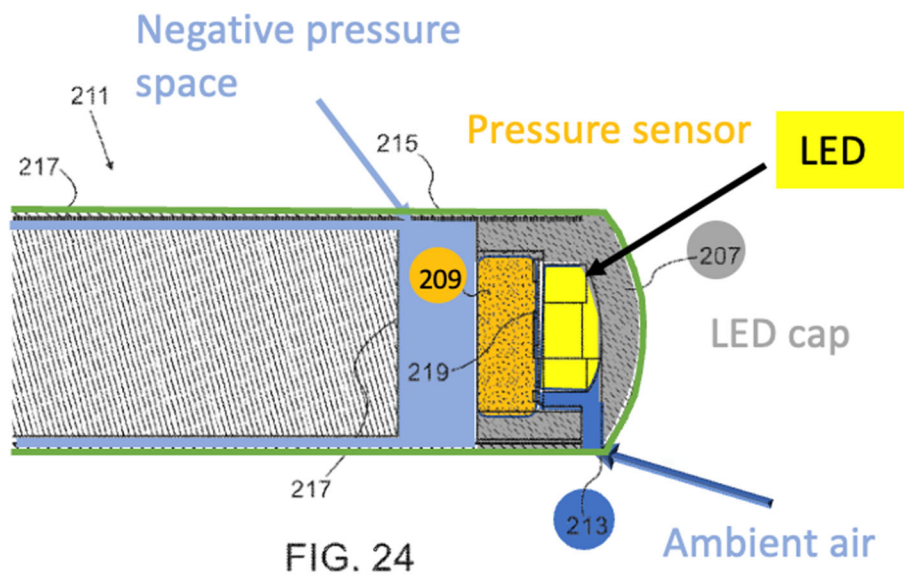
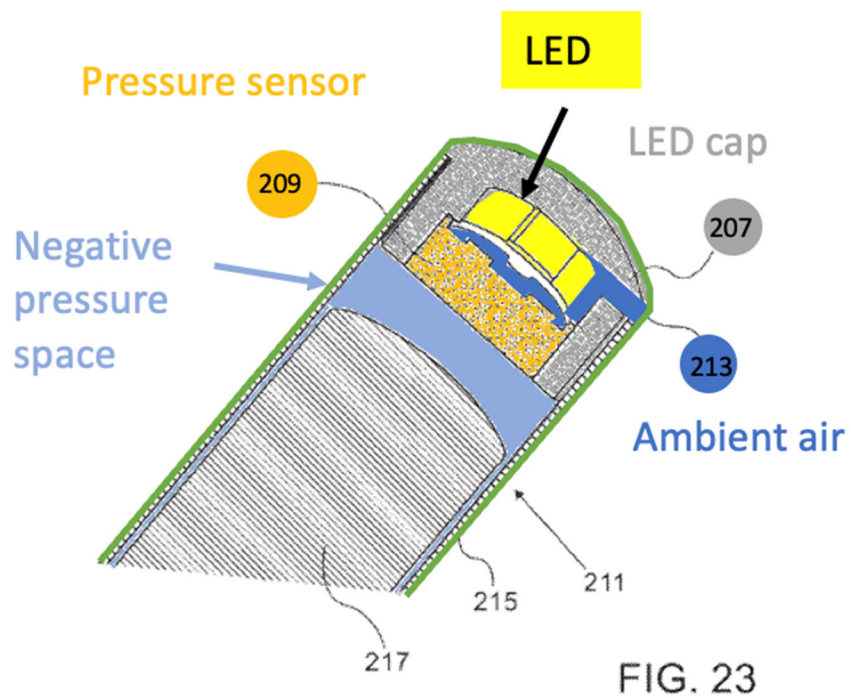
D. Ground 4: Thorens and Weigensberg in view of the Knowledge of a POSA Renders Obvious Claims 14, 27, and 32 of the '123 Patent

179. Thorens and Weigensberg in view of the knowledge of a POSA renders obvious claims 14, 27, and 32 of the '123 Patent. As discussed below, Thorens discloses all limitations in claims 14, 27, and 32 except that Thorens does not disclose a differential pressure sensor exposed to ambient air, a gasket around the pressure sensor, or a pressure sensor outputting pressure sensor values.

180. The use of pressure sensors, including differential pressure sensors, in devices such as electronics cigarettes was common as of the filing date of the '123 Patent. The '123 Patent discloses that many electronic cigarettes use a pressure sensor to control aspects of the electronic cigarette. EX1001, 2:32-40 (“Many electronic cigarettes use a pressure sensor to determine when the device should be heating or not. This may allow for an intuitive user interface where the user simply draws from (sucks on) the device to power it. It is advantageous over powering the device with a button in that the device's heating element is only powered when there

is airflow over it assuming the device's pressure sensor and microcontroller can accurately detect the start and end of a draw”); EX1023, [0083] (“Conventionally, e-vaping devices use a differential pressure sensor. Differential pressure sensors measure two air pressures, one ambient and one that changes. The differential pressure sensor is generally set on an end of the device and put into a gasket that seals one side of the sensor from another side of the sensor.”); *see also* EX1022, [0101]. Multiple types of differential pressure sensors were also well-known and the ’123 Patent discloses that the pressure sensors described could be any differential pressure sensor. EX1001, 4:49-60 (“In general, the pressure sensors described herein may be *any differential pressure sensor.*”).

181. As described in U.S. Patent Pub. No. 2016/0374397 (“Jordan”; EX1022; *see also* U.S. Patent Provisional No. 62/184569; EX1023), a differential pressure sensor could be located in the tip of an electronic cigarette. EX1023, [0083]; EX1022, [0101]. An example of a differential pressure sensor for use in electronic cigarettes is Weigensberg.

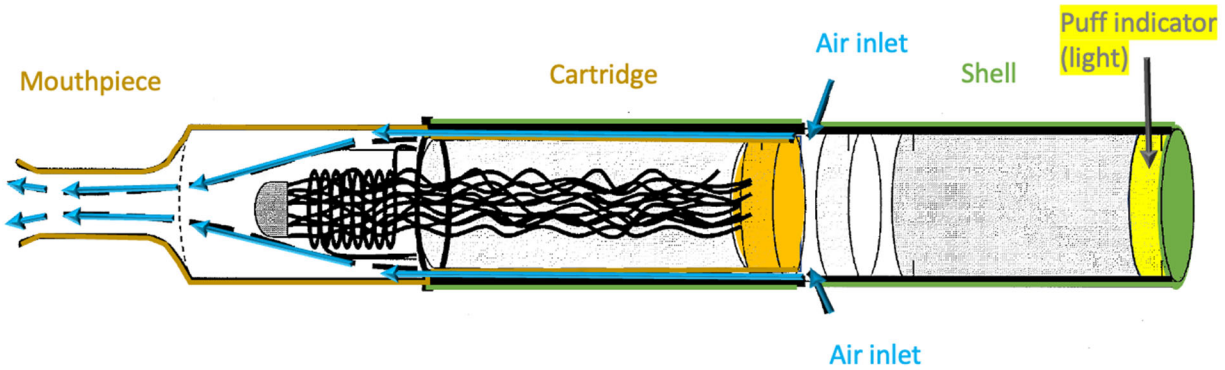


EX1006, Figs. 23, 24

182. Weigensberg describes a replacement tip with a differential pressure sensor. Weigensberg's pressure sensor 24/209 is exposed to an internal device air

path that experiences a negative air pressure when a user draws on the device. EX1006, [0059] (“In one mode of operation the device 10 is capped by a tip 20. When smoke enters the device 10, an internal aperture (not shown) typically constricts the flow, thereby creating a pressure differential, which is sensed by a vacuum sensor 24 of known type.”). Another side of the pressure sensor 209 is open to ambient air through holes in its enclosure. EX1006, [0107] (“The LED cap 207 has a perforation 213 for communication between the sensor unit 209 and the ambient atmosphere.”).

183. Thorens describes a two-piece electronic cigarette with a puff detector, control circuitry and a puff indicator. Preferably, the electric circuitry includes the puff detector. EX1016, [0034] (“Preferably, the electric circuitry comprises a sensor to detect air flow indicative of a user taking a puff.”). A POSA would have been motivated to adapt Thorens to include a differential sensor as was well-known in the art. The differential pressure sensor disclosed in Weigensberg’s replaceable tip would be one example. Thorens already has a puff indicator (light) at its tip. EX1016, [0042] (“The shell 101 comprises an electric power supply in the form of battery 103, electric circuitry in the form of circuitry 105 and puff detection system 107, a puff indicator 109, electrical connections 111, electrical contacts 113, air inlets 115 and a lock mechanism 117.”).



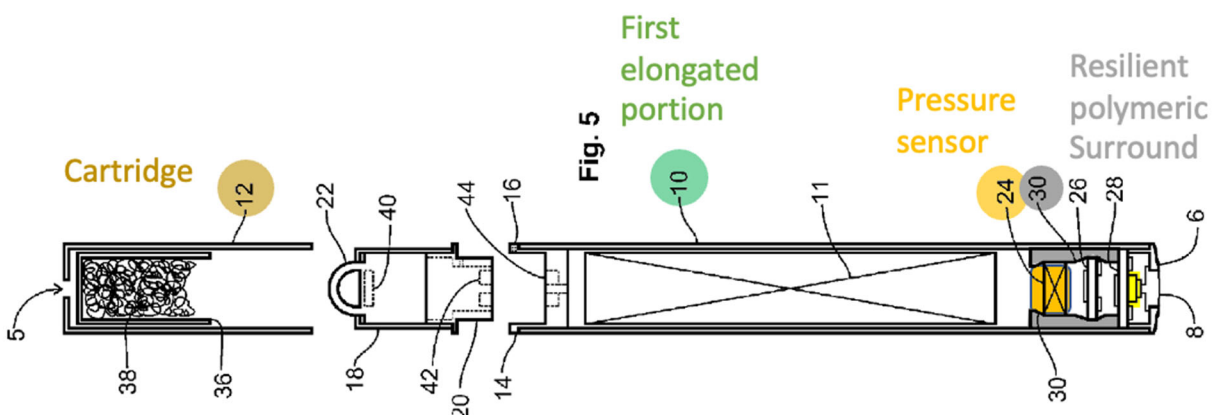
EX1016, Fig. 3

184. Weigensberg's tip has control circuitry and an LED, in addition to the pressure sensor with a space-saving design. EX1006, [0107] ("A sensor unit 209 occupies the interior of the LED cap 207, and is an embodiment of the sensor 24 (FIG. 1), but instead of being inside a plastic housing of its own, the sensor unit 209 is now disposed inside the LED cap 207 in order to save space.").

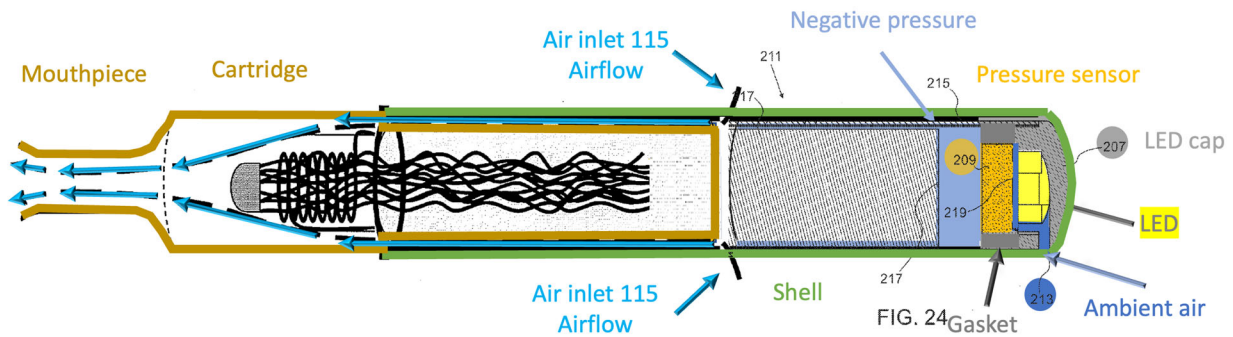
185. Weigensberg's plastic LED cap acts as a gasket that isolates the ambient air pressure path from the device path to allow the pressure sensor to detect differences from ambient air. *See* EX1006, [0107] ("The LED cap 207 is mostly inset into the end of the barrel 215....The LED cap 207 may be constructed of a plastic material as described for the member 193 (FIG. 20)."); [0104]-[0105] ("The member 193 has a first function: it acts as an electrical insulator between the two contacts, band 189 and plug 191. It is formed of an electrically non-conductive material. The member 193 has a second function: placing the interior of the body 195 into fluid communication with ambient air as seen in FIG. 21, so as to facilitate

operation of a pressure sensor, e.g., sensor 24 (FIG. 1). The member 193 achieves this using a groove or channel 197 formed therein, which emerges onto the exterior of the tip at a point 199 and debouches into the interior of the body 195 at point 201.”).

186. If it is argued that Weigensberg does not disclose a gasket, a POSA would have understood that Weigensberg’s pressure sensor would have a surrounding gasket, as was conventional, to isolate the pressure on the ambient side of the pressure sensor from the other side that senses the negative pressure within a portion of the device. EX1023, [0083] (“Conventionally,...[t]he differential pressure sensor is generally set on an end of the device and put into a gasket that seals one side of the sensor from another side of the sensor.”); *see also* EX1022, [0101]. Other designs with pressure sensors in the tip follow this conventional design. *See* EX1009, 6:6-9 (“The polymeric surround 30 also acts as a pressure seal to insure the draw pressure sensor 24 is properly coupled to detect the negative pressure of the draw.”).

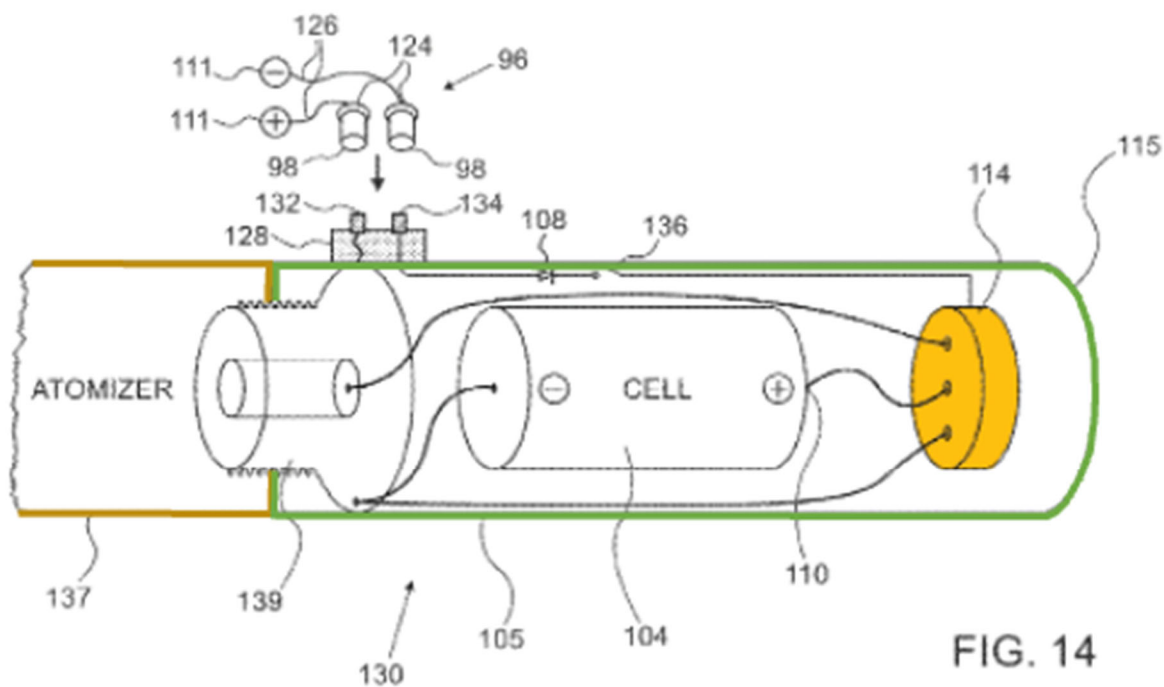


EX1009, Fig. 5 (illustrating a gasket around a differential pressure sensor)



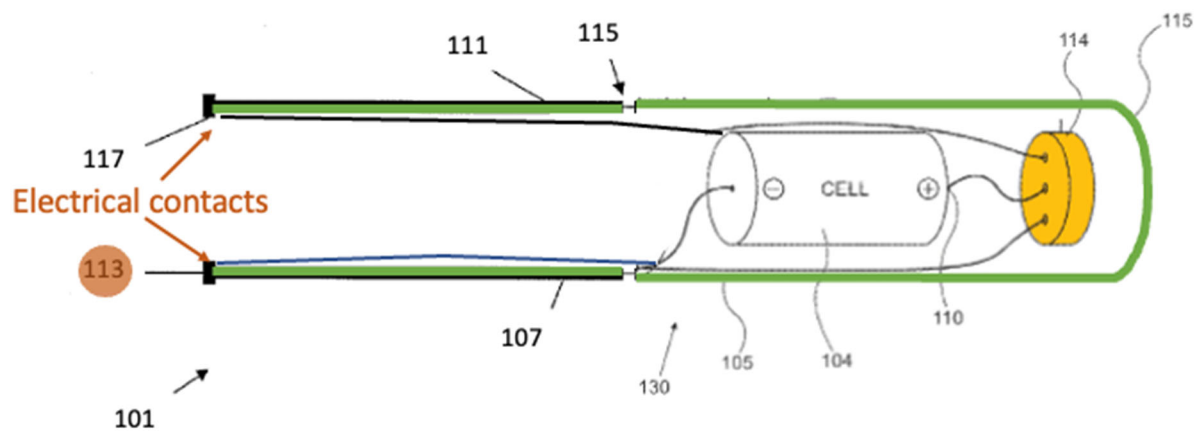
Modified Thorens

187. As shown in the above illustration of the modified Thorens, Thorens' pressure sensor, circuitry, and LED are replaced by Weigensberg's control circuitry, pressure sensor, and LED using Weigensberg's replacement tip. The design also ensures that LED cap or other gasket surrounds the pressure sensor to isolate the sealed, negative pressure internal area from the side of the pressure sensor exposed to ambient air to allow the differential pressure sensor to function. The wiring to Thorens electrical contacts 113 would connect with the sensor chip assembly 114 in Weigensberg's replacement tip, and the battery would connect to and power Weigensberg's control circuitry, pressure sensor and LED. *See* EX1006, [0080].



EX1006, Fig. 14

188. An example of modified connections in the battery portion of Thorens is below:



Modified Thorens

189. Weigensberg's design includes a sensor that outputs a range of pressure values. EX1006, [0087] ("Alternatively, the sensor S 167 may be realized as an analog circuit, with appropriate modification of the microcontroller 159 to accommodate an analog device, for example, by including an analog-to-digital converter as is known in the art."). The analog output in Weigensberg comprises a range of values that corresponds to the pressure that is sensed. Different functions can be performed, or components controlled, in an electronic cigarette using a pressure sensor with outputs that vary based on the pressure readings. *See* EX1021, Abstract ("The disclosure further provides methods for controlling operation of an aerosol delivery device through utilization of a variable output flow sensor. In particular, control of functional elements (e.g., a heating member, a fluid delivery member, and a sensory feedback member) can allow for real-time changes in the operation of the aerosol delivery device relative to airflow through the device."). Weigensberg's electrical circuitry could provide such functionality. EX1006, [0107] (Circuitry "associated with or incorporated in the sensor unit 209 may enable the aerosol generating device to perform various additional functions as may be required for the operation of the electronic cigarette 211.").

190. There are a number of reasons a POSA would have been motivated to modify Thorens in view of Weigensberg. As an initial matter, choosing a differential sensor is a design choice that is frequently selected for electronic cigarettes. EX1023,

[0083] (“Conventionally, e-vaping devices use a differential pressure sensor.”); *see also* EX1022, [0101]. Additionally, selecting a differential pressure sensor that uses ambient air as a reference was also frequently selected for electronic cigarettes. *Id.* One reason is that it better accommodates external pressure changes. For example, high altitudes would not trigger a false activation due to the decrease in pressure. Further, when a variable output pressure sensor like Weigensberg is used, additional features, like real-time changes in the operation of the device, can be added. EX1021, 25:4-7 (“At operation 720, the sensor outputs a signal that varies with the airflow rate. At operation 730, a microprocessor receives the variable signal and initiates an algorithm (operation 735) according to predefined programming to establish the predefined heater parameters relative to the airflow rate detected by the sensor.”). Moreover, a POSA would have understood that Weigensberg’s design reduces the space by combining the puff detector (pressure sensor) and the puff indicator (LED). EX1006, [0107] (“[T]he sensor unit 209 is now disposed inside the LED cap 207 in order to save space.”). Combining the pressure sensor and LED into the same enclosure frees up the space previously dedicated to two different enclosures in Thorens. Additionally, relocating the pressure sensor provides additional space. This would allow for a larger battery in the space freed-up by combining these components into a single enclosure at the tip of the device.

191. A POSA would have had a reasonable expectation of success

combining Thorens and Weigensberg for many reasons. First, the designs of these electronic cigarettes are similar. Thorens and Weigensberg both have a separable cartridge with a mechanically engaged coupler, air flow inlets, a pressure sensor, and a puff indicator. EX1006, [0058] (“...FIG. 1, which is a semi-schematic exploded view of a smoking device 10 in accordance with an embodiment of the invention....The battery section 12 may include power control circuitry 14, which is typically encased as a unit with a vacuum sensor 24, and which may be enclosed in a plastic holder.”). Second, relocating Thorens’ pressure sensor is a simple task because Weigensberg teaches that its combined pressure sensor and LED are available in a single enclosure. Extending the electrical lines from Weigensberg’s replacement tip to the electrical contacts 113 in Thorens’ shell would have been a trivial change. *See* ¶¶187-188, above. Third, such pressure sensors were known and commonly used in electronic cigarettes. EX1006, [0059] (“When smoke enters the device 10, an internal aperture (not shown) typically constricts the flow, thereby creating a pressure differential, which is sensed by a vacuum sensor 24 of known type.”); EX1023, [0083]; EX1022, [0101]. A POSA would have had the necessary skills to make these simple adjustments, and modified Thorens would continue to operate in substantially the same manner where the pressure sensor detects changes in pressure and manages the operation collectively with the control circuitry. EX1006, [0058] (“...FIG. 1, which is a semi-schematic exploded view of a smoking

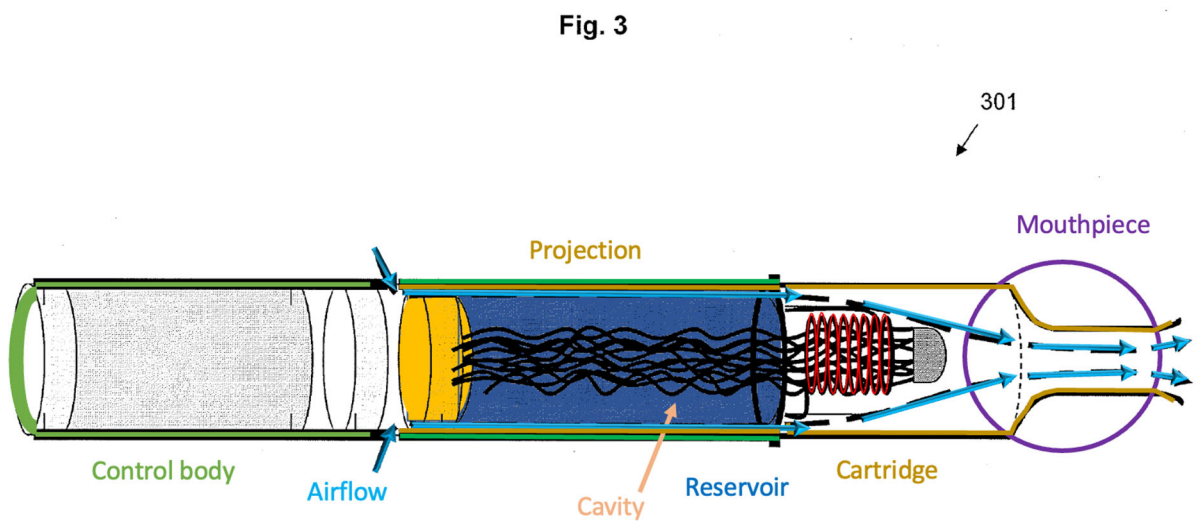
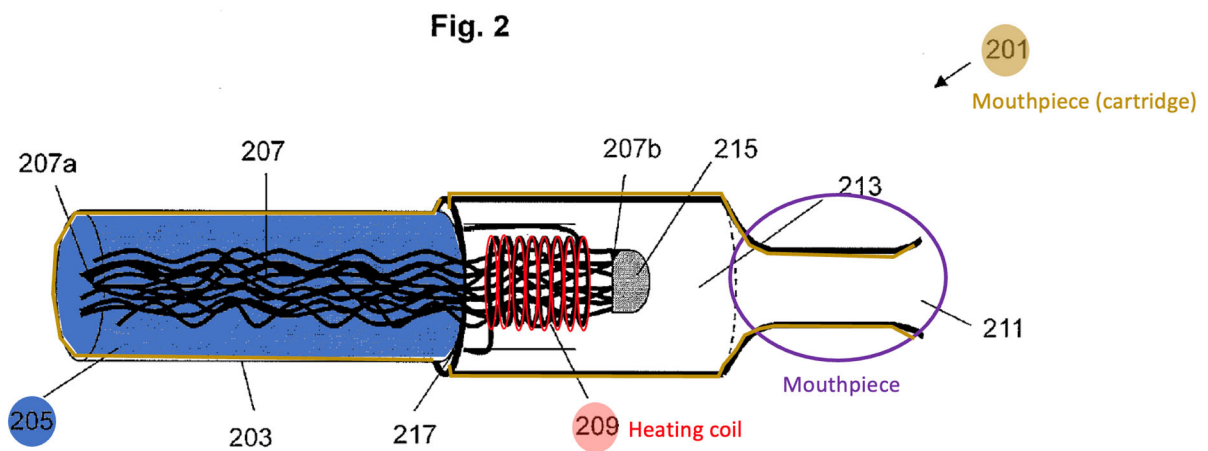
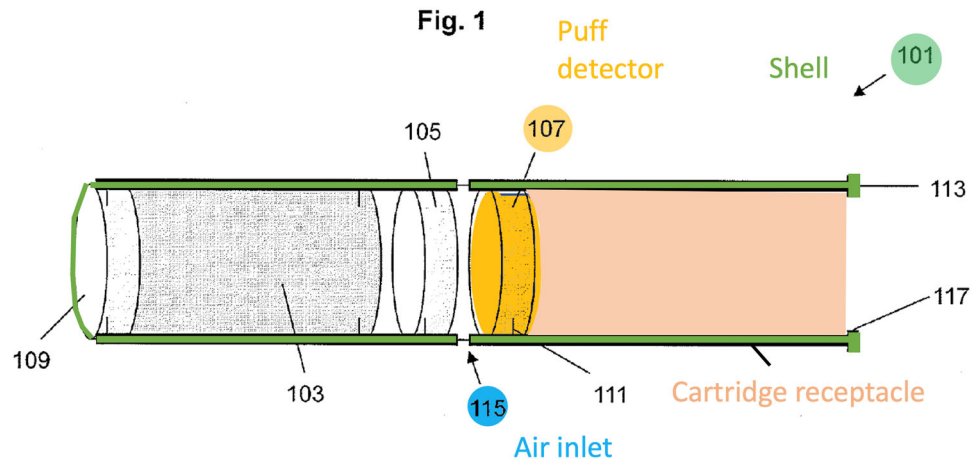
device 10 in accordance with an embodiment of the invention....The battery section 12 may include power control circuitry 14, which is typically encased as a unit with a vacuum sensor 24, and which may be enclosed in a plastic holder.”); EX1016, [0046] (“In this embodiment, the circuitry 105 and the puff detection system 107 are programmable. The circuitry 105 and puff detection system 107 can be used to manage the device operation. In this embodiment, when the puff detection system 107 senses the user taking a puff, the battery supplies a current pulse of a pre-determined time to the heating coil 209.”)

1. Claim 14

a. [14.A] A vaporizer device body comprising:

192. Thorens discloses a vaporizer device body.

193. Thorens discloses smoking system 301, which includes shell 101 and mouthpiece 20 that is inserted into the shell. EX1016, [0042] (“The shell 101 is designed to engage with the mouthpiece 201 of FIG. 2.”). The mouthpiece 201 includes a heating element and vaporizable material 205. EX1016, Abstract (“Liquid at the second end of the capillary wick is vaporized by the heating element.”).



EX1016, Figs. 1-3

b. **[14.B] a cartridge receptacle configured to insertably receive a cartridge containing a vaporizable material;**

194. Thorens discloses this limitation.

195. Figure 1 in Thorens discloses a shell 101 that includes a receptacle into which the cartridge portion 203 of Thorens' mouthpiece 201 is inserted. EX1016, [0042] ("The shell 101 is designed to engage with the mouthpiece 201 of FIG. 2.").

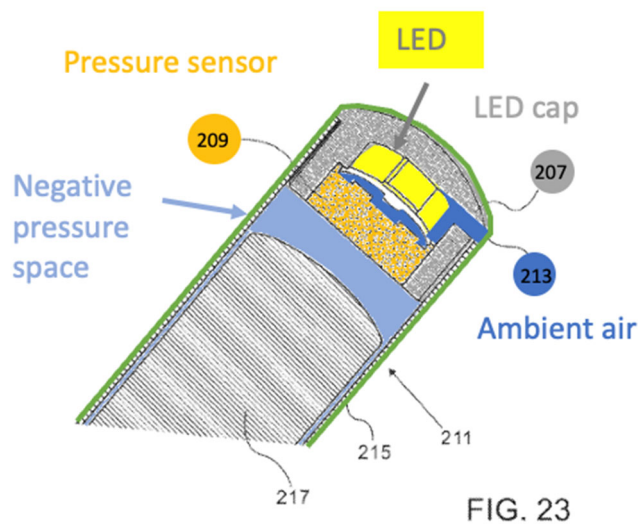
196. Figure 2 of Thorens illustrates mouthpiece 201 (cartridge), which includes a liquid storage area for liquid 205 that is vaporized by heating coil 209. EX1016, [0043] ("The mouthpiece 201 comprises a liquid storage portion in the form of cartridge 203 containing liquid 205, a capillary wick 207, a heating element in the form of heating coil 209, an air outlet 211 and an aerosol forming chamber 213."); Abstract ("Liquid at the second end of the capillary wick is vaporized by the heating element.").

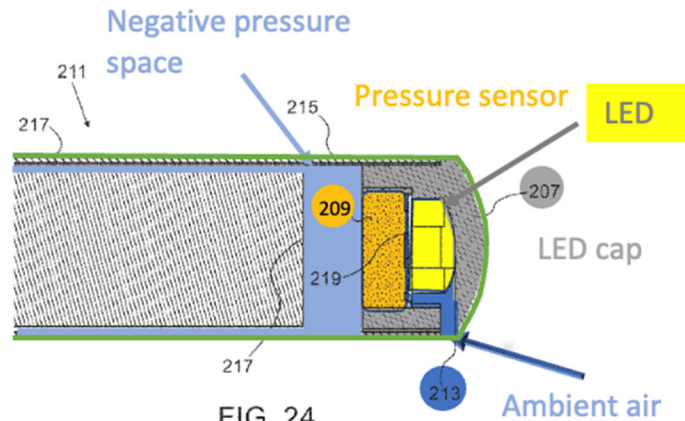
c. **[14.C] a pressure sensor configured to output sensor readings,**

197. Thorens in view of Weigensberg discloses this limitation.

198. Weigensberg discloses a sensor that outputs sensor readings that correspond to pressure values. EX1006, [0087] ("Alternatively, the sensor S 167 may be realized as an analog circuit, with appropriate modification of the microcontroller 159 to accommodate an analog device, for example, by including an analog-to-digital converter as is known in the art."). These outputs are used to

determine a drop in pressure that is used to control the device. EX1006, [0059] (“In one mode of operation the device 10 is capped by a tip 20. When smoke enters the device 10, an internal aperture (not shown) typically constricts the flow, thereby creating a pressure differential, which is sensed by a vacuum sensor 24 of known type.”); EX1023, [0083] (“Conventionally,...[t]he differential pressure sensor is generally set on an end of the device and put into a gasket that seals one side of the sensor from another side of the sensor.”); *see also* EX1022, [0101]. A POSA would have understood that Weigensberg’s analog output comprises a range of values corresponding to the pressure difference.





EX1006, Figs. 23, 24

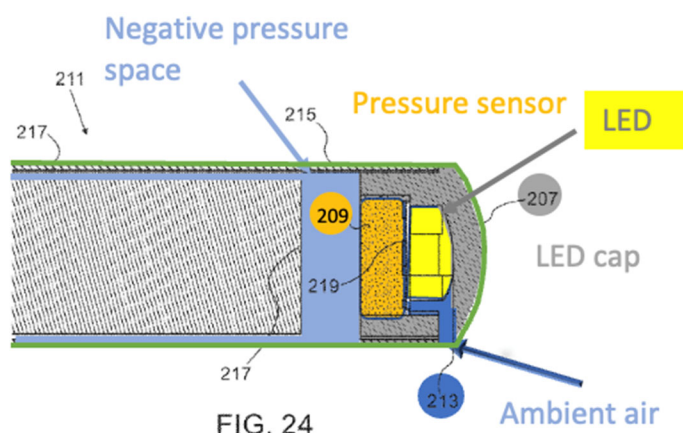
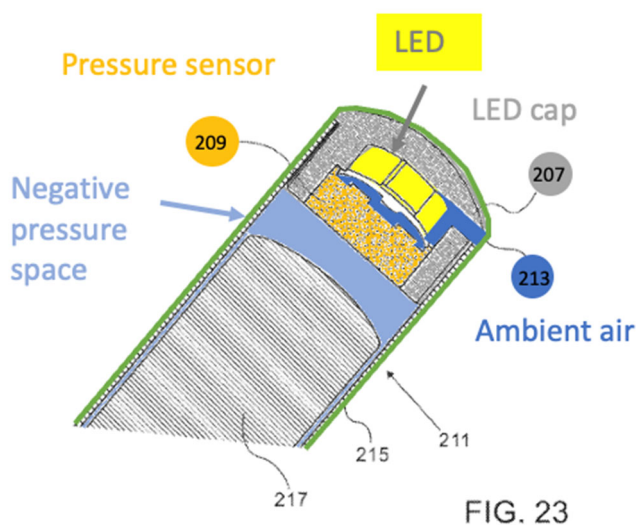
199. A POSA would have been motivated to include Weigensberg's tip pressure sensor for the reasons discussed in ¶¶175-185.

- d. **[14.D] wherein a first side of the pressure sensor is exposed to a sealed air flow path and a second side of the pressure sensor is exposed to a device air path open to ambient pressure,**

200. Thorens in view of Weigensberg discloses this limitation.

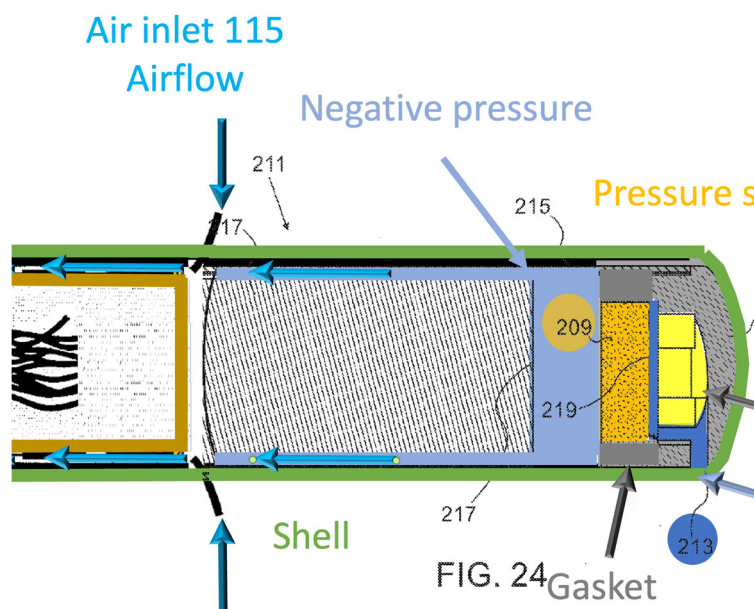
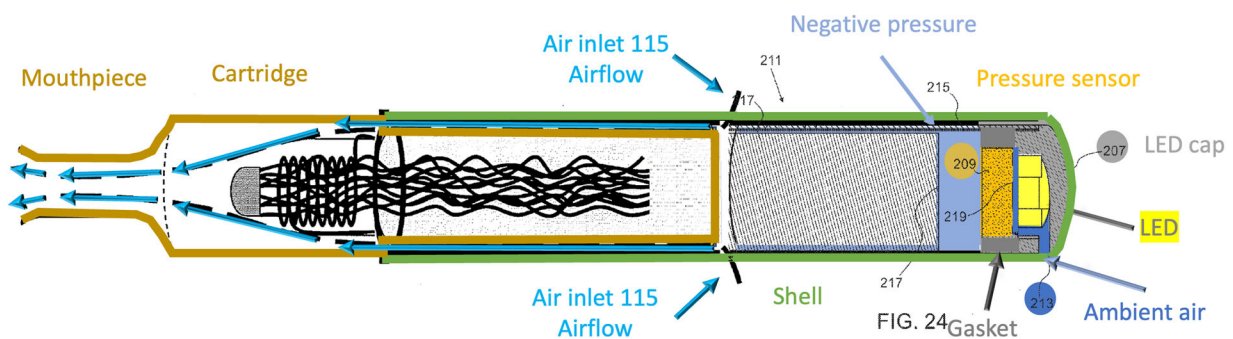
201. Weigensberg's sensor is exposed to two separate air paths. One is a device air path that is open to ambient air (dark blue, below) such as through perforations 213 in LED cap 207. EX1006, [0107] ("The LED cap 207 has a perforation 213 for communication between the sensor unit 209 and the ambient atmosphere."). A sealed air flow path is sensed on another side of the pressure sensor for detecting negative pressures (light blue, below). EX1006, [0059] ("In one mode of operation the device 10 is capped by a tip 20. When smoke enters the device 10, an internal aperture (not shown) typically constricts the flow, thereby creating a

pressure differential, which is sensed by a vacuum sensor 24 of known type.”). This is the conventional arrangement discussed in Jordan. EX1023, [0083] (“Conventionally, e-vaping devices use a differential pressure sensor. Differential pressure sensors measure two air pressures, one ambient and one that changes. The differential pressure sensor is generally set on an end of the device and put into a gasket that seals one side of the sensor from another side of the sensor.”).



EX1006, Figs. 23, 24

202. In modified Thorens, Weigensberg's tip with a differential sensor, circuitry, and LED replaces Thorens' tip portion. The perforations in Weigensberg's LED cap provide a device air flow path that is open to ambient air (dark blue). The sealed air flow path in modified Thorens starts at Thorens' air inlets 115 and goes through the channel between shell 101 and cartridge 203, past the heating coil before exiting out the opening in the mouthpiece into a smoker's mouth. EX1016, [0048] ("Thus, ambient air is drawn through air inlets 115 and passes around the cartridge 203 before reaching the second end 207b of the wick and the heating coil 209.").



Modified Thorens

203. During use, when a smoker draws on modified Thorens, one side of Weigensberg's pressure sensor is exposed to the negative pressure (e.g., partial vacuum) within a portion of the device as air is drawn towards the mouthpiece 201. EX1006, [0059] ("In one mode of operation the device 10 is capped by a tip 20. When smoke enters the device 10, an internal aperture (not shown) typically constricts the flow, thereby creating a pressure differential, which is sensed by a vacuum sensor 24 of known type."); *see also* EX1023, [0083] ("Conventionally, e-vaping devices use a differential pressure sensor. Differential pressure sensors measure two air pressures, one ambient and one that changes. The differential pressure sensor is generally set on an end of the device and put into a gasket that seals one side of the sensor from another side of the sensor."); EX1022, [0101].

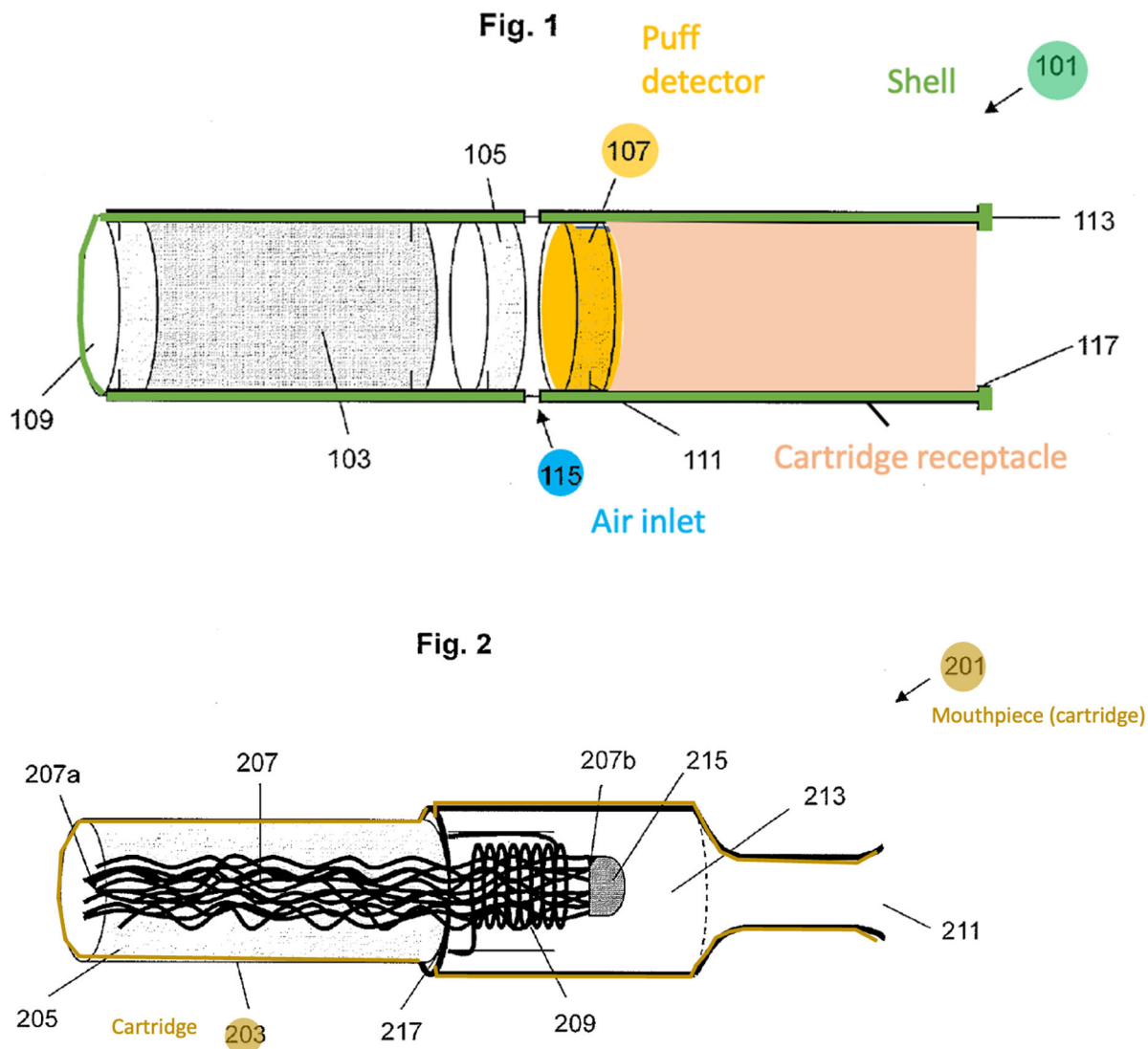
204. A POSA would have been motivated to modify Thorens to include Weigensberg's tip pressure sensor exposed to a sealed air flow path and an ambient air path for the reasons discussed in ¶¶175-185.

- e. **[14.E] the sealed air flow path comprising a channel formed between an interior surface of the cartridge receptacle and an exterior surface of the cartridge,**

205. Thorens discloses this limitation.

206. As discussed above for limitation [14.D], a sealed air flow path is disclosed (starting from Thorens' air inlets 115 in shell 101 and travel in the channel

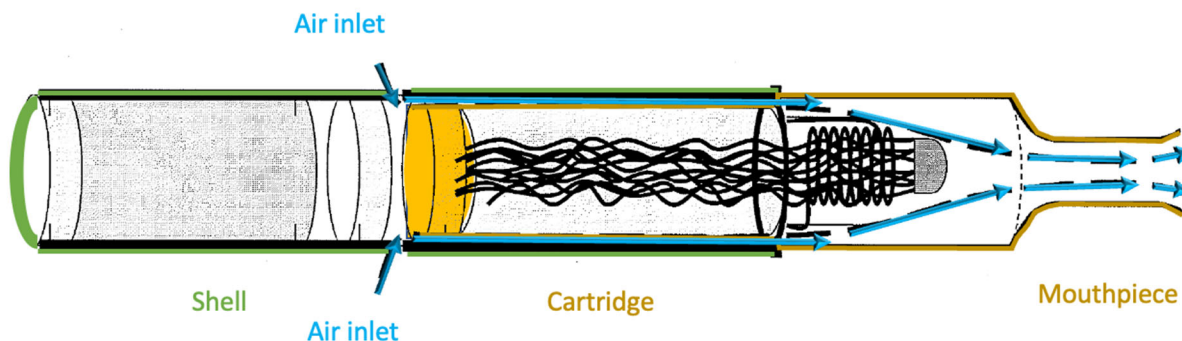
between cartridge 203 and shell 101 and out an opening in mouthpiece 201). As described above, the cartridge portion 203 of Thorens' mouthpiece 201 is inserted into the opening of shell 101.



EX1016, Figs. 1, 2

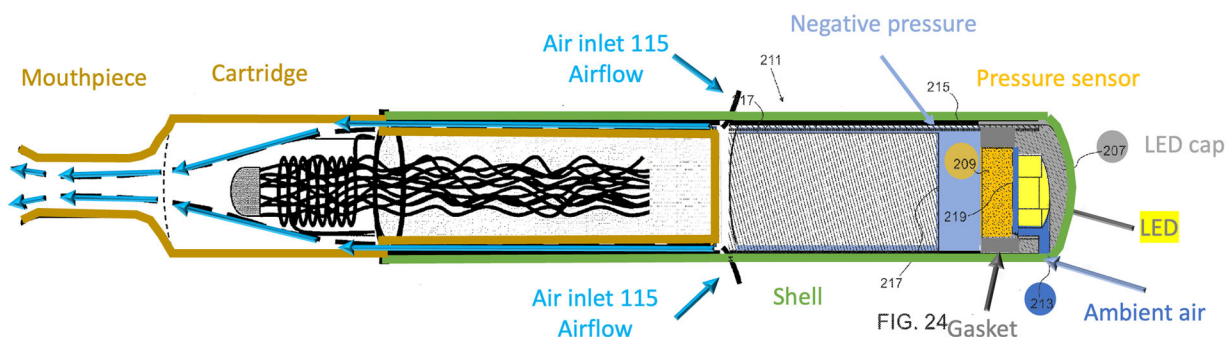
207. In modified Thorens, an air path is maintained between the walls of the receptacle and the cartridge portion 203, such that air from the air inlets 115 passes

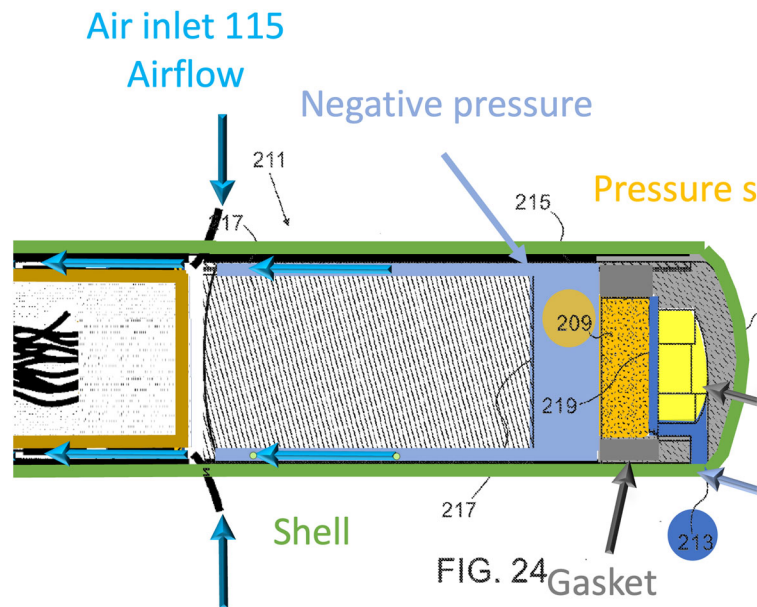
between the cartridge 203 and the shell 101 as illustrated in Figure 3.



EX1016, Fig. 3

208. This sealed air flow path, therefore, includes a channel between the interior surface of the receptacle in shell 101 (green, below) that receives cartridge 203 (brown, below). EX1016, [0048] (“Thus, ambient air is drawn through air inlets 115 and passes around the cartridge 203 before reaching the second end 207b of the wick and the heating coil 209.”); [0045] (“In the aerosol forming chamber 213, the vapor condenses to form an inhalable aerosol, which is carried towards the outlet 211 and into the mouth of a user.”). Modified Thorens with the air paths is shown below:





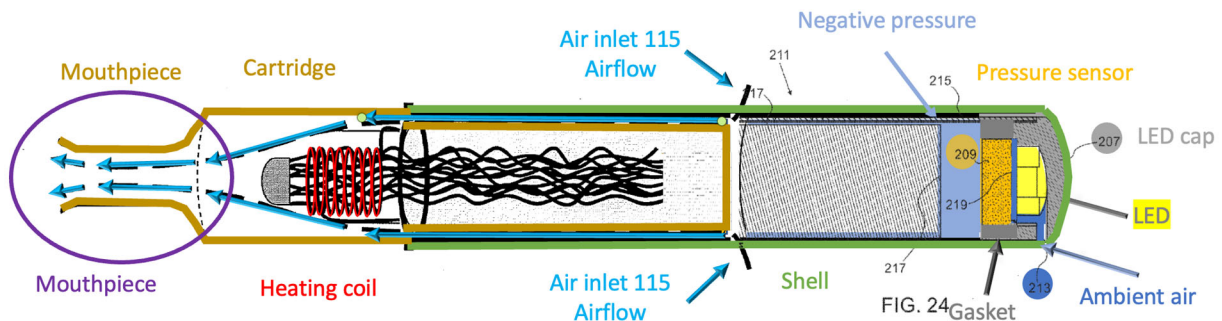
Modified Thorens

- f. **[14.F] the sealed air flow path passing from an air inlet, through the channel and to a heater and an outlet of a mouthpiece within the cartridge; and**

209. Thorens discloses this limitation.

210. As discussed above for limitation [14.D] and [14.E], a sealed air flow path is disclosed. Thorens further discloses that the sealed air flow path passes from an air inlet 115 through the channel between the walls of the shell and the exterior of the cartridge portion 203 of the mouthpiece 201. The sealed air path continues to the heating coil 209 and the outlet of the mouthpiece that is within the cartridge (what Thorens calls mouthpiece 201). EX1016, [0045] (“When the user draws on the device at the air outlet 211, ambient air is drawn through air inlets 115....The liquid in the second end 207b of the wick 207 is vaporized by the heating coil 209 to create a supersaturated vapor....The supersaturated vapor created is mixed with

and carried in the air flow from the air inlets 115 towards the aerosol forming chamber 213. In the aerosol forming chamber 213, the vapor condenses to form an inhalable aerosol, which is carried towards the outlet 211 and into the mouth of a user.”).



Modified Thorens

211. Thorens’ mouthpiece 201, which includes the vaporizable liquid 205 and heating coil 209, is the claimed cartridge in the ’123 Patent. Thorens’ mouthpiece 201 (cartridge) includes a portion that is used by the smoker’s mouth (mouthpiece) that includes the air outlet 211. EX1016, [0043] (“The mouthpiece 201 comprises a liquid storage portion in the form of cartridge 203 containing liquid 205, a capillary wick 207, a heating element in the form of heating coil 209, an air outlet 211 and an aerosol forming chamber 213.”); Abstract (“...a flowpath for air is defined from at least one air inlet to the air outlet via the aerosol forming chamber.”).

- g. **[14.G] a gasket around the pressure sensor, the gasket configured to seal the device air path from the sealed air flow path.**

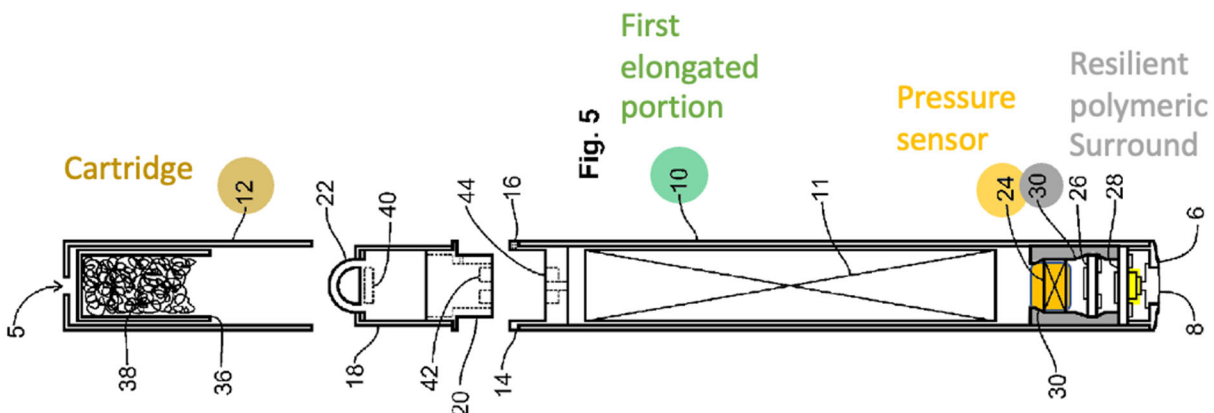
212. Thorens and Weigensberg alone or in view of the knowledge of a POSA

discloses this limitation.

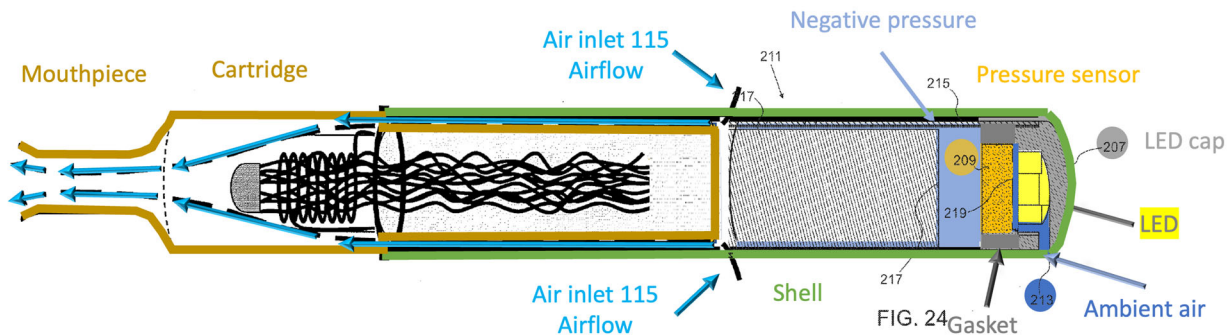
213. Weigensberg's tip has control circuitry and an LED, in addition to the pressure sensor with a space-saving design. EX1006, [0107] ("A sensor unit 209 occupies the interior of the LED cap 207, and is an embodiment of the sensor 24 (FIG. 1), but instead of being inside a plastic housing of its own, the sensor unit 209 is now disposed inside the LED cap 207 in order to save space."). Weigensberg's plastic LED cap acts as a gasket that isolates the ambient air pressure path from the device path to allow the pressure sensor to detect differences from ambient air. *See* EX1006, [0107] ("The LED cap 207 is mostly inset into the end of the barrel 215....The LED cap 207 may be constructed of a plastic material as described for the member 193 (FIG. 20)."); [0104]-[0105] ("The member 193 has a first function: it acts as an electrical insulator between the two contacts, band 189 and plug 191. It is formed of an electrically non-conductive material. The member 193 has a second function: placing the interior of the body 195 into fluid communication with ambient air as seen in FIG. 21, so as to facilitate operation of a pressure sensor, e.g., sensor 24 (FIG. 1). The member 193 achieves this using a groove or channel 197 formed therein, which emerges onto the exterior of the tip at a point 199 and debouches into the interior of the body 195 at point 201.").

214. If it is argued that Weigensberg does not disclose the claimed gasket, a POSA would have understood that Weigensberg's pressure sensor would have a

surrounding gasket, as was conventional, to isolate the pressure on the ambient side of the pressure sensor from the other side that senses the negative pressure within a portion of the device. It was well-known that a differential pressure sensor would have included a gasket to seal the different air paths sensed by the differential pressure sensor from each other. EX1023, [0083] (“Conventionally, e-vaping devices use a differential pressure sensor. Differential pressure sensors measure two air pressures, one ambient and one that changes. The differential pressure sensor is generally set on an end of the device and *put into a gasket that seals one side of the sensor from another side of the sensor.*”); see also EX1022, [0101]; see, e.g., EX1009, 6:6-9 (“The polymeric surround 30 also acts as a pressure seal to insure the draw pressure sensor 24 is properly coupled to detect the negative pressure of the draw.”).

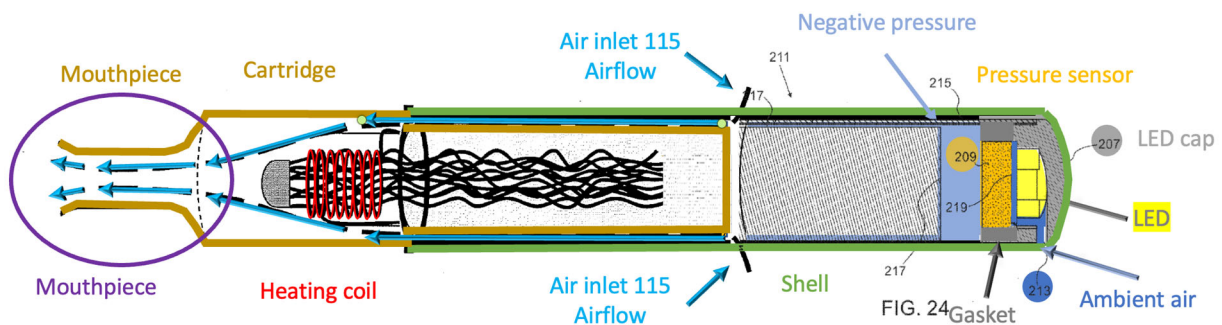


EX1009, Fig. 5 (illustrating a gasket around the differential pressure sensor)



Modified Thorens (illustrating a gasket around the differential pressure sensor)

215. Therefore, a POSA would have known to include a gasket around Weigensberg's sensor when modifying Thorens to use Weigensberg's pressure sensor to ensure that the ambient air path is isolated from the sealed air path so that it could properly detect the pressure differential. A POSA would have known that a gasket will maintain the seal through different environmental factors. For example, if the device was subjected to thermal expansion caused by external temperatures or pressures, a compressible gasket will maintain the seal between the different air paths. Including a gasket around the sensor would have been trivial and without the need for substantial modification of the device.



Modified Thorens

216. A POSA would have been motivated to include Weigensberg's LED cap or another gasket for the reasons discussed in ¶¶175-185.

2. Claim 27

a. [27.A] A vaporizer device comprising:

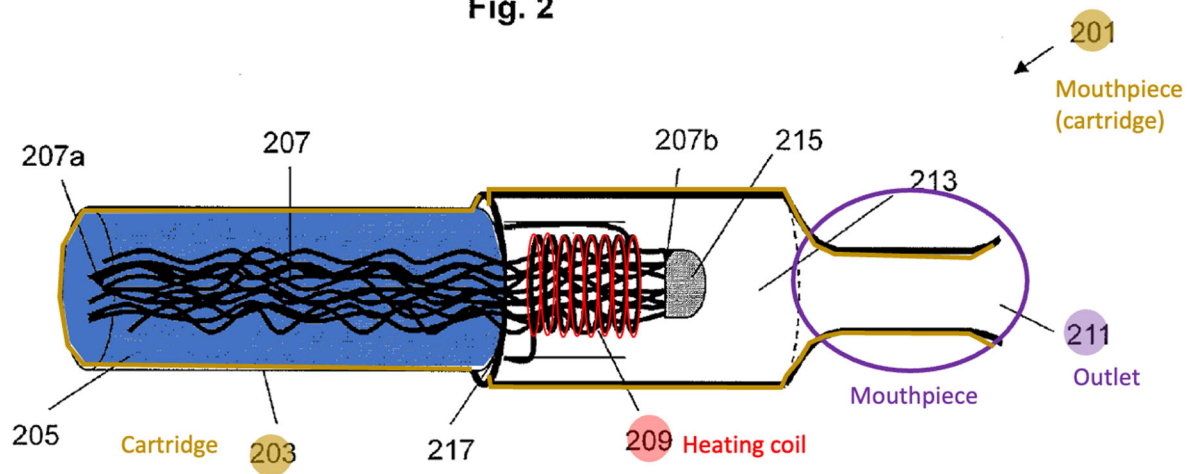
217. Thorens discloses this limitation. *See* limitation [14.A].

b. [27.B] a cartridge comprising a reservoir configured to hold a vaporizable material, a heater configured to heat the vaporizable material, and a mouthpiece in fluid communication with the heater; and

218. Thorens discloses this limitation.

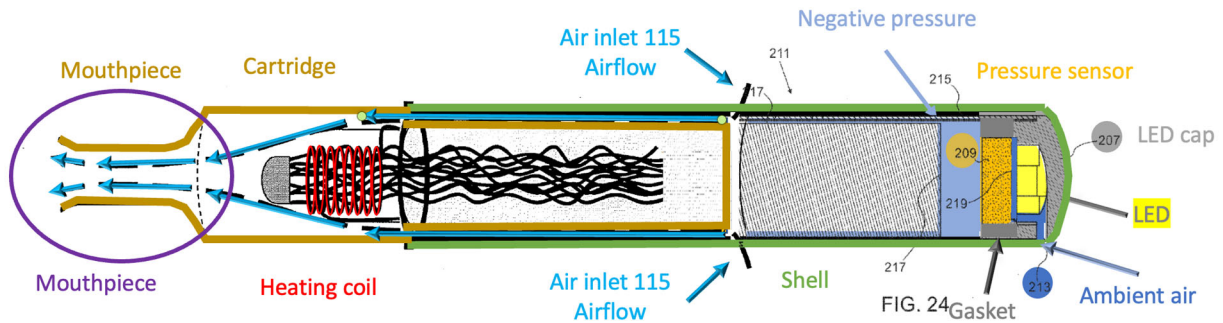
219. As discussed above, Thorens' mouthpiece 201 is the claimed cartridge in the '123 Patent. Mouthpiece 201 (cartridge) includes cartridge 203 with a liquid storage for vaporizable liquid 205 as shown in Figure 2 of Thorens. Figure 2 also discloses that mouthpiece 201 (cartridge) includes a heating coil 209 that heats the vaporizable liquid 205 accessed through wick 207. EX1016, [0043] ("The mouthpiece 201 comprises a liquid storage portion in the form of cartridge 203 containing liquid 205, a capillary wick 207, a heating element in the form of heating coil 209, an air outlet 211 and an aerosol forming chamber 213.").

Fig. 2



EX1016, Fig. 2

220. Mouthpiece 201 further includes a portion used by the mouth of a smoker (mouthpiece) that includes air outlet 211. The supersaturated vapor generated by heating coil 209 is transported to (in fluid communication with) outlet 211 of mouthpiece 201. EX1016, [0045] (“The liquid in the second end 207b of the wick 207 is vaporized by the heating coil 209 to create a supersaturated vapor....The supersaturated vapor created is mixed with and carried in the air flow from the air inlets 115 towards the aerosol forming chamber 213. In the aerosol forming chamber 213, the vapor condenses to form an inhalable aerosol, which is carried towards the outlet 211 and into the mouth of a user.”); Abstract (“...a flowpath for air is defined from at least one air inlet to the air outlet via the aerosol forming chamber.”). The fluid communication via this air flow path is shown with blue arrows in modified Thorens:



Modified Thorens

c. **[27.C] a device body comprising:**

221. As discussed above with respect to limitation [14.A], Thorens discloses this limitation.

d. **[27.D] a cartridge receptacle configured to insertably receive the cartridge;**

222. As discussed above with respect to limitation [14.B], Thorens discloses this limitation.

e. **[27.E] a pressure sensor configured to output sensor readings,**

223. As discussed above with respect to limitation [14.C], Thorens and Weigensberg disclose this limitation.

f. **[27.F] wherein a first side of the pressure sensor is exposed to a sealed air flow path and a second side of the pressure sensor is exposed to a device air path open to ambient pressure,**

224. As discussed above with respect to limitation [14.D], Thorens and Weigensberg disclose this limitation.

- g. **[27.G] the sealed air flow path comprising a channel formed between an interior surface of the cartridge receptacle and an exterior surface of the cartridge,**

225. As discussed above with respect to limitation [14.E], Thorens discloses this limitation.

- h. **[27.H] the sealed air flow path passing from an air inlet, through the channel and to the heater and an outlet in the mouthpiece of the cartridge; and**

226. As discussed above with respect to limitation [14.F], Thorens discloses this limitation.

- i. **[27.I] a gasket around the pressure sensor, the gasket configured to seal the device air path from the sealed air flow path.**

227. As discussed above with respect to limitation [14.G], Thorens and Weigensberg alone or in view of the knowledge of a POSA disclose this limitation.

3. Claim 32: The vaporizer device of claim 27, wherein the cartridge comprises the vaporizable material, and wherein the vaporizable material comprises a nicotine formulation.

228. As discussed above, Thorens and Weigensberg alone or further in view of the knowledge of a POSA disclose every limitation of claim 27. Additionally, Thorens and Weigensberg disclose this limitation.

229. As discussed above for limitation [27.B], Thorens discloses a cartridge with a vaporizable liquid. Thorens also discloses the vaporizable liquid preferably includes “tobacco-containing material comprising volatile tobacco flavour compounds which are released from the liquid upon heating.” EX1016, [0023] (“The

liquid preferably comprises a tobacco-containing material comprising volatile tobacco flavour compounds which are released from the liquid upon heating.”). Thorens further teaches that a POSA should look to other references for potentially suitable aerosol formers. EX1016, [0023] (“Additional examples of potentially suitable aerosol formers are described in EP-A-0 277519 and U.S. Pat. No. 5,396,911.”). One of the references identified by Thorens is EP0277519 (“Roberts”; EX1017), which discloses the use of nicotine as a volatile flavoring agent in an aerosol generating substance. EX1017, 25:31-36 (“The aerosol generating substance also can include one or more volatile flavoring agents, such as menthol, vanillin, artificial coffee, tobacco extracts, tobacco particles (e.g., a charge of tobacco), nicotine, caffeine, liquors, and other agents which impart flavor to the aerosol.”). Therefore, Thorens discloses a precursor liquid (vaporizable material) with a nicotine formulation.

230. If it is argued that Thorens does not disclose a vaporizable material with a nicotine formulation, Weigensberg teaches the use of nicotine in the vaporizable liquid. Weigensberg incorporates by reference (EX1006, [0004]) EP1736065 (“Hon065”; EX1024), which discloses an electronic cigarette that uses a nicotine solution. EX1024, [0017] (“The high speed stream passing through the ejection hole drives the nicotine solution in the porous body 27 to eject into the atomization cavity 10 in the form of droplet, where the nicotine solution is subjected to the ultrasonic

atomization by the first piezoelectric element 23 and is further atomized by the heating element 26.”). A POSA would have been motivated to include Weigensberg’s nicotine solution in Thorens’ precursor liquid based on Thorens’ preference for a tobacco-containing material in its precursor liquid and identifying an example that uses nicotine. A POSA would have had a reasonable expectation of success because nicotine was a known and popular ingredient in precursor liquids in electronic cigarettes.

231. Thus, in summary, claims 14, 27 and 32 of the ’123 Patent are rendered obvious over Thorens in view of Weigensberg alone or further in view of the knowledge of a POSA.

E. Grounds 5-8: Grounds 1-4, further in view of Lamb, Render Obvious Claims 14, 15, 16, 18, 27, 28, 29, 31, and 32 of the ’123 Patent

232. Independent claims 14 and 27 require “a pressure sensor configured to output sensor readings” and “a gasket around the pressure sensor...to seal the device air path from the sealed air flow path,” dependent claims 15 and 28 require a capacitive pressure sensor, dependent claims 16 and 29 require a MEMS sensor, dependent claims 18 and 31 require a pressure sensor that outputs pressure values, and dependent claim 32 requires a nicotine formulation.

233. Lamb discloses an aerosol delivery device, which can be an electronic cigarette. EX1005, [0015]. Lamb teaches the use of a MEMS-based pressure sensor

that outputs sensor readings corresponding to pressure values. EX1005, [0006] (“In some examples, the MEMS-based sensor may be configured to convert the pressure to the *electrical signal that varies with a corresponding variation in the pressure* relative to an ambient pressure on the MEMS-based sensor. In these examples, the corresponding variation may be caused by variation in the airflow such as a variation in the rate of airflow.”); [0004] (“The MEMS-based sensor is within the housing and configured to detect a pressure on the MEMS-based sensor caused by airflow through at least a portion of the housing. The MEMS-based sensor is configured to *convert the pressure to an electrical signal*, and output the electrical signal.”); [0007] (“The change in capacitance causes a change in an output voltage across the variable capacitor. And the MEMS microphone is configured to output the output voltage or a digital representation thereof as the electrical signal.”); [0008] (“The change in resistance causes a change in an output voltage across the piezoresistor(s). And the MEMS pressure sensor is configured to output the output voltage or a digital representation thereof as the electrical signal.”); Abstract (“The MEMS-based sensor is configured to *convert the pressure to an electrical signal*, and output the electrical signal.”); Fig. 5.

234. Thus, Lamb: 1) discloses the claim 14 and claim 17 limitations “a pressure sensor configured to output sensor readings” under either construction proposed in the ITC investigation (*see* Section IV.D above; EX1019) and “gasket

around the pressure sensor, the gasket configured to seal the device air path from the sealed air flow path”; 2) discloses the claim 18 and claim 31 limitation that requires a pressure sensor that outputs pressure values; 3) discloses multiple types of MEMS-based pressure sensors, satisfying the claim 16 and claim 29 limitation that requires a MEMS pressure sensor; and 4) discloses the claim 15 and claim 28 limitation that requires the pressure sensor to include a capacitive membrane.

235. Further, Lamb describes in more detail a MEMS pressure sensor with a “micromachined, pressure-sensitive diaphragm 306a and a backplate 306b that form a *variable capacitor 306*.” EX1005, [0047]. A POSA would have understood that this sensor is a MEMS pressure sensor that includes a capacitive membrane. Lamb describes that pressure causes the pressure-sensitive diaphragm (“membrane”) 306a to move, which changes the capacitance. EX1005, [0047] (“...the pressure causes movement of the diaphragm and thereby a change in a capacitance of the variable capacitor. The change in capacitance causes a change in the output voltage across the variable capacitor. The MEMS microphone may then output the output voltage or a digital representation of the output voltage as the electrical signal.”). This capacitance change allows the sensor to detect the change in pressure. This pressure sensor satisfies the claim 15 and 28 requirement that the pressure sensor include a capacitive membrane.

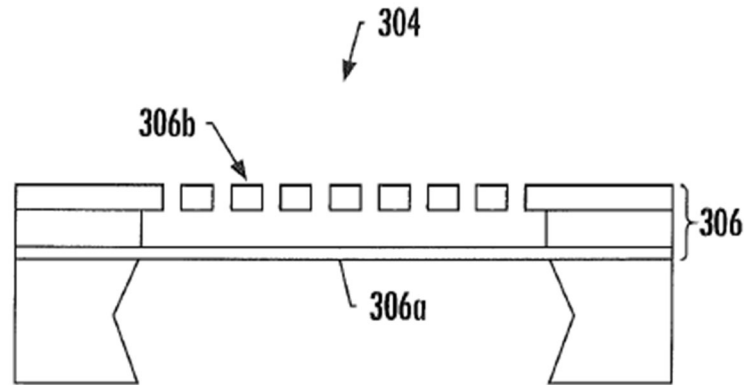


FIG. 3

EX1005, Fig. 3

236. Lamb also discloses a cartridge with a reservoir 118 that holds vaporizable liquid (an aerosol precursor composition). EX1005, [0026]. This disclosure thus satisfies the claim 32 limitation of a cartridge comprising a vaporizable material.

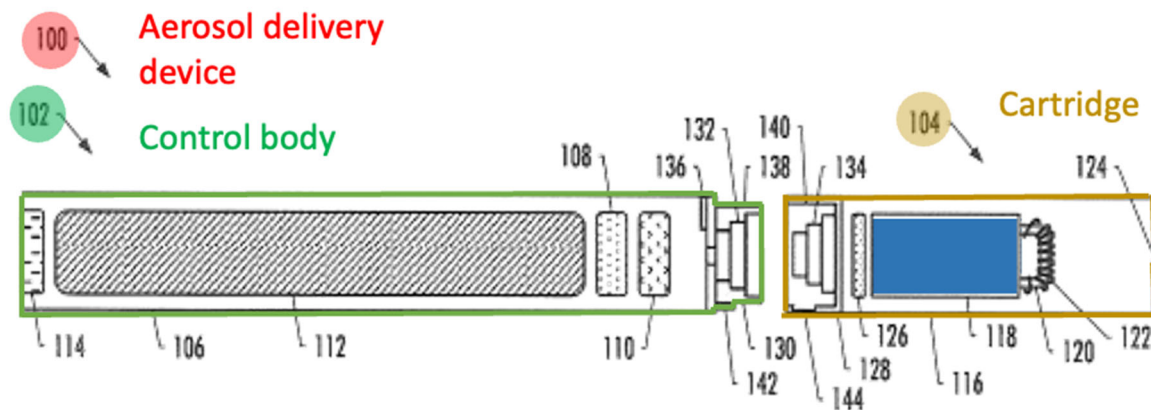


FIG. 1

EX1005, Fig. 1

Lamb's liquid aerosol precursor composition (vaporizable material) may include a nicotine component. EX1005, [0040] ("The aerosol precursor composition, also referred to as a vapor precursor composition, may comprise a variety of components including, by way of example, a polyhydric alcohol (e.g., glycerin, propylene glycol or a mixture thereof), nicotine, tobacco, tobacco extract and/or flavorants."). This disclosure satisfies the claim 32 limitation of the vaporizable material comprising a nicotine formulation.

1. Motivation to Combine each of Grounds 1-4 with Lamb

237. Lamb is titled "MEMS-Based Sensor For An Aerosol Delivery Device." The main focus of Lamb is the use of a MEMS-based pressure sensor to detect the negative pressure caused by the air flow during a draw by a smoker on the device. EX1005, [0004] ("The aerosol delivery device includes a housing, microelectromechanical systems-based (MEMS-based) sensor and microprocessor. The MEMS-based sensor is within the housing and configured to detect a pressure on the MEMS-based sensor caused by airflow through at least a portion of the housing."). Lamb, like Worm and Weigensberg, teaches that its differential pressure sensor measures the pressure of the variable air flow path relative to ambient air. EX1005, [0006] ("In some examples, the MEMS-based sensor may be configured to convert the pressure to the electrical signal that varies with a corresponding variation in the pressure relative to an ambient pressure on the MEMS-based

sensor.”). Lamb also similarly discloses detecting the pressure change based on air flow within a portion of the housing. EX1005, [0004] (“The MEMS-based sensor is within the housing and configured to detect a pressure on the MEMS-based sensor caused by airflow through at least a portion of the housing.”).

238. There are also structural similarities between Lamb, Worm and Weigensberg. Lamb discloses an electronic cigarette that includes a battery portion and a detachable cartridge that holds vaporizable liquid, like both Worm and Weigensberg. EX1005, [0026] (“The cartridge 104 can be formed of a cartridge shell 116 enclosing a reservoir 118 that is in fluid communication with a liquid transport element 120 adapted to wick or otherwise transport an aerosol precursor composition stored in the reservoir housing to a heater 122 (sometimes referred to as a heating element).”); [0031] (“The control body 102 and the cartridge 104 may include components adapted to facilitate a fluid engagement therebetween.”).

239. Lamb also provides pressure sensor outputs that vary with the changes in pressure such that the outputs reflect the variation in airflow. EX1005, [0045].

240. A POSA would have found it obvious to modify either Worm or Weigensberg to use Lamb’s MEMS-based pressure sensor. Lamb’s MEMS-based pressure sensor performs the same function as the pressure sensors in Worm and Weigensberg—it measures the pressure difference on one side of the sensor relative to ambient air. *See* EX1005, [0006], [0045] *compared with* EX1004, [0077] (“In this

manner, a pressure differential can be created across the pressure sensor between the first end of the pressure sensor in the pressure reduction space and the second end of the pressure sensor in the normal pressure space within the shell.”); *and with* EX1006, [0059] (“When smoke enters the device 10, an internal aperture (not shown) typically constricts the flow, thereby creating a pressure differential, which is sensed by a vacuum sensor 24 of known type.”); [0064] (“The air communication ensures that the top part of sensor 24 (FIG. 1) is exposed to ambient pressure, which is necessary for its proper operation.”). Lamb, Worm and Weigensberg also have their pressure sensor mounted to an electronic circuit board or included with power control circuitry. EX1005, [0030]; EX1004, [0007]; EX1006, [0058]. Accordingly, it would have been a simple substitution of a component that operates in the same manner for the same purpose and yields predictable results.

241. Consistent with this understanding, the ’123 Patent admits that any differential pressure sensor can be used for the sensors disclosed in the patent. EX1001, 4:49-60 (“In general, the pressure sensors described herein may be *any differential pressure sensor*, such as MEMS, capacitive pressures sensors (e.g., including a capacitive membrane), or any force collector type pressure sensors that use a transducer to measure pressure or pressure differences (e.g., diaphragm, piston, etc.), piezoresistive, electromagnetic, piezoelectric, optical, potentiometric, resonant (including MEMS), etc. Differential pressure sensors may measure the distance

between two pressures, one connected on different sides of the sensor. This includes pressure sensors in which one side is open/connected to ambient atmosphere (pressure).”).

242. A POSA would have been motivated to modify Worm and/or Weigensberg to include Lamb’s MEMS-based pressure sensor because MEMS-based pressure sensors have advantageous features for electronic devices. For example, MEMS pressure sensors have better responsiveness, a small footprint, and are easy to integrate into the device. *See* EX1022, [0102] (“Moreover, the MEMS pressure sensor 525 occupies less space than a differential pressure sensor because the MEMS pressure sensor 525 can be mounted directly on the PCB 116.”). MEMS pressure sensors also offer low power consumption, low cost, high reliability, and higher precision. EX1015, 3:3-7 (“The most significant advantage of MEMS is their ability to communicate easily with electrical elements in semiconductor chips. Other advantages include small size, compact structure, lower power consumption, lower cost, increased reliability, and higher precision.”). A capacitive sensor in particular has advantages over mechanical sensors and conventional capacitor sensors, including high sensitivity than mechanical sensors and better reliability, lower cost, and more easily manufactured compared to conventional capacitor sensors. *See* EX1028, [0003] (“Capacitor sensors and optical sensors may be employed as an alternative to mechanical sensors for higher sensitivity. A conventional capacitor

sensor includes a permanently charged membrane which forms a capacitor with a metal plate. This type of sensor is vulnerable to humidity, moisture, liquid leakage, dirt or other environmental factors which can cause a fault by shorting out and discharging the two sides of the membrane. In addition, to permanently charge the membrane, a voltage of around 10,000 V needs to be applied to the membrane, making such a sensor costly and difficult to manufacture and unsuitable for many applications.”). Capacitive MEMS pressure sensors were contemplated for electronic cigarettes. *Id.*

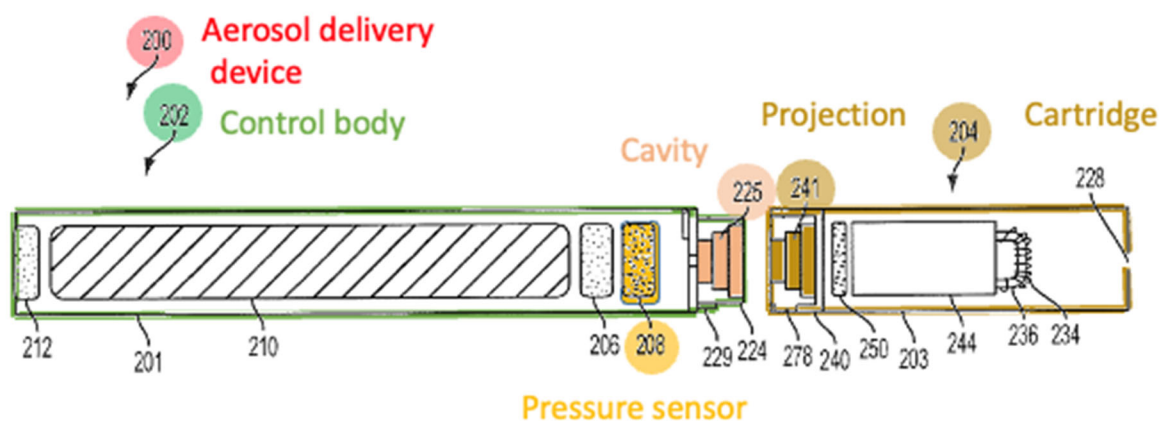
243. A POSA would have understood that these characteristics of a MEMS pressure sensor are especially important for battery powered devices and consumer products like electronic vaporizing devices. For example, reducing the costs of manufacturing through lower cost components and easy integration is important to reducing the commercial price of the device. Further, power consumption is important to portable battery powered devices like electronic cigarettes and a device that needs fewer charges is more desirable to the consumer. Moreover, since the power sensor controls the actuation of the device, responsiveness / high sensitivity to a smoker’s inhalation is important as is reliability of the pressure sensor’s performance. As taught by Lamb, a POSA would also have taken advantage of the lower costs and higher reliability that MEMS pressure sensors offer.

244. A POSA would also have been motivated to modify Worm and/or

Weigensberg to use Lamb's MEMS-based pressure sensor that outputs pressure values to take advantage of providing additional feature that are based on the variation of the air flow detected by the MEMS pressure sensor. For example, varying the indicator light with the change in pressure differential, controlling the heating element, or controlling the amount of fluid delivery. EX1021, 23:25-28 ("The variable signal output from the flex/bend sensor can be used by one or more control elements of the aerosol delivery device to control the operation of the device. Such operation can encompass a variety of functional elements of the device, such as a heating member, a fluid delivery member, a sensory feedback member, and the like."). Another example is using the measurements of pressure changes to create profiles to control access to the device. EX1014, Abstract; [0011].

245. It also would have been obvious to combine Lamb's disclosure of a nicotine formulation with Worm and/or Thorens to include a nicotine formulation as part of the vaporizable precursor liquid disclosed in each reference. Lamb discloses nicotine as a component in its aerosol precursor composition. EX1005, [0040]. As discussed for claim 32 in Section IX.A.3, Worm incorporates Sebastian by reference, which discloses using nicotine as an ingredient. EX1004, [0029] (citing EX1008); EX1008, [0059]. And as discussed for claim 32 in IX.C.3 for claim 32, Thorens identifies Robertson as having suitable aerosol formers. Robertson discloses an exemplary aerosol generating liquid that uses nicotine. EX1016, [0023] (citing

EX1017); EX1017, 25:31-36 (“The aerosol generating substance also can include one or more volatile flavoring agents, such as menthol, vanillin, artificial coffee, tobacco extracts, tobacco particles (e.g., a charge of tobacco), nicotine, caffeine, liquors, and other agents which impart flavor to the aerosol.”).



EX1004 (Worm), Fig. 2

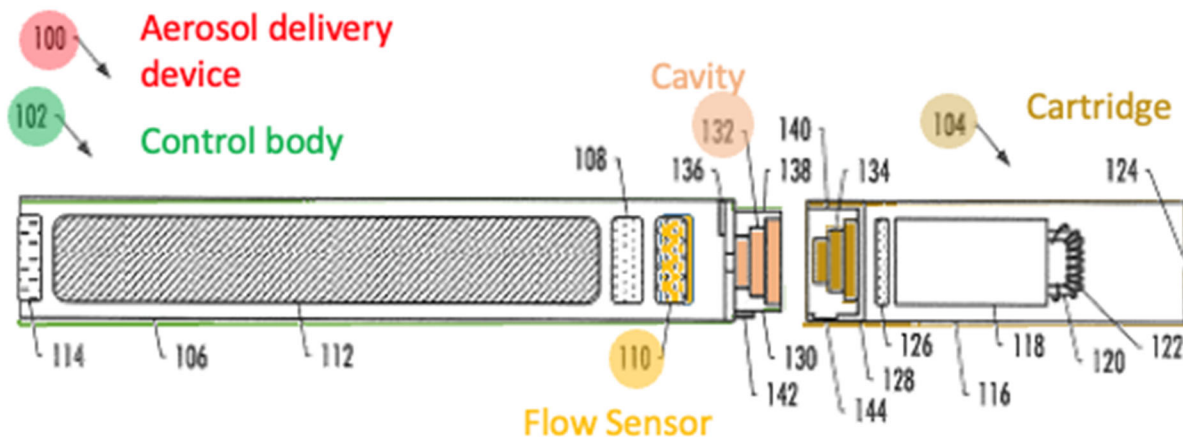


FIG. 1

EX1005 (Lamb), Fig. 1

247. As can be seen from the figures above, both patents have similar electronic cigarette architectures and operate in fundamentally the same manner.

248. Independently and specifically for Ground 8, Thorens suggests that a MEMS pressure sensor could be an alternative for its puff sensor. EX1016, [0015] (“Alternatively, the sensor may be any of: a mechanical device, an optical device, an opto-mechanical device and a micro electro mechanical systems (MEMS) based sensor.”).

249. A POSA would have had a reasonable expectation of success in combining Lamb with each of Worm, Thorens, and/or Weigensberg because the architectures for these electronic cigarettes are similar, and Lamb and Worm appear to be the same devices. As discussed above, Lamb, Worm, Thorens, and Weigensberg disclose two-piece designs with a removable cartridge that is

mechanically engaged with the battery portion, at least one air flow inlet and a pressure sensor. In each of Lamb, Worm, Thorens, and Weigensberg, the pressure sensor detects air flow generated by a smoker drawing on the device and Lamb, Worm, and Weigensberg disclose detection through a negative pressure in a sealed portion of the device from ambient and that detection is used to control various functions in the devices. Weigensberg already includes circuitry for performing various additional functionalities and Thorens' circuitry and puff detection system are programmable. EX1006, [0107] (Circuitry "associated with or incorporated in the sensor unit 209 may enable the aerosol generating device to perform various additional functions as may be required for the operation of the electronic cigarette 211."); EX1016, [0046]. Further, pressure sensors that output pressure values for use in electronic cigarettes were known and available. *See, e.g.*, EX1020 (datasheet referenced in EX1023, [0085]; EX1022, [0103]); EX1028, [0003] (capacitive MEMS pressure sensors).

2. Claims 14 and 27: a pressure sensor configured to output sensor readings,

250. Lamb in combination with Worm (Grounds 1-3) and/or Weigensberg (Ground 4) discloses this limitation (Grounds 5-8, respectively).

251. As discussed above, Worm (Grounds 1-3) and Weigensberg (Ground 4) discloses this limitation. If it is argued that Worm or Weigensberg do not disclose a pressure sensor configured to output sensor readings, Lamb discloses that its

pressure sensor outputs sensor readings. EX1005, [0043] (“The MEMS-based sensor may be configured to detect a pressure on the MEMS-based sensor caused by airflow through at least a portion of the housing, convert the pressure to an electrical signal, and output the electrical signal.”); [0045] (“In other examples, the MEMS-based sensor may be configured to convert the pressure to the electrical signal that varies with a corresponding variation in the pressure relative to an ambient pressure on the MEMS-based sensor.”); [0046] (“The change in the electrical property causes a change in an output voltage across the micromachined sensor. This output voltage may be output by the MEMS-based sensor as the electrical signal. Or in some examples, the MEMS-based sensor (e.g. on the second die) may include an appropriate analog-to-digital converter (ADC) or other circuitry configured to convert the output voltage to a digital representation, which the MEMS-based sensor may then output as the electrical signal.”).

252. Thus, Lamb discloses a pressure sensor configured to output sensor readings.

253. As discussed in Section V.E.1, it would have been obvious to modify Worm and/or Weigensberg to include Lamb’s pressure sensor that outputs sensor readings. A POSA would have been motivated to use Lamb’s MEMS pressure that outputs variable sensor readings to provide additional features based on the variation in airflow rates. For example, varying the indicator light with the change in pressure

differential, controlling the heating element, or controlling the amount of fluid delivery. EX1021, 23:25-28 (“The variable signal output from the flex/bend sensor can be used by one or more control elements of the aerosol delivery device to control the operation of the device. Such operation can encompass a variety of functional elements of the device, such as a heating member, a fluid delivery member, a sensory feedback member, and the like.”); Abstract (“The disclosure further provides methods for controlling operation of an aerosol delivery device through utilization of a variable output flow sensor. In particular, control of functional elements (e.g., a heating member, a fluid delivery member, and a sensory feedback member) can allow for real-time changes in the operation of the aerosol delivery device relative to airflow through the device.”). Another example is using the variable pressure measurements to create profiles to control access to the device. EX1014, Abstract, [0011]. A POSA would have had a reasonable expectation of success because MEMS sensors are easy to integrate into the device and indeed offer a smaller footprint at a low cost so they could be substituted into existing designs. EX1022, [0102]; EX1015, 3:3-7. Additionally, the structure and function of Worm, Weigensberg and Lamb are similar, as described above. Weigensberg already includes circuitry for performing various additional functionalities and Thorens’ circuitry and puff detection system are programmable. EX1006, [0107] (Circuitry “associated with or incorporated in the sensor unit 209 may enable the aerosol

generating device to perform various additional functions as may be required for the operation of the electronic cigarette 211.”); EX1016, [0046]. MEMS pressure sensors that could be used in electronic cigarettes were commercially available. *See, e.g.*, EX1020 (datasheet referenced in EX1023, [0085]; EX1022, [0103].

254. Therefore, each of Worm (Grounds 1-3) and/or Weigensberg (Ground 4) further in view of Lamb disclose a pressure sensor that outputs sensor readings (Grounds 5-8, respectively). For the reasons stated in Grounds 1-4 and here, claims 14 and 27 (and claim 32 by dependency) of the '123 Patent are rendered obvious over each of Worm (Grounds 1-3) and/or Weigensberg (Ground 4) further in view of Lamb.

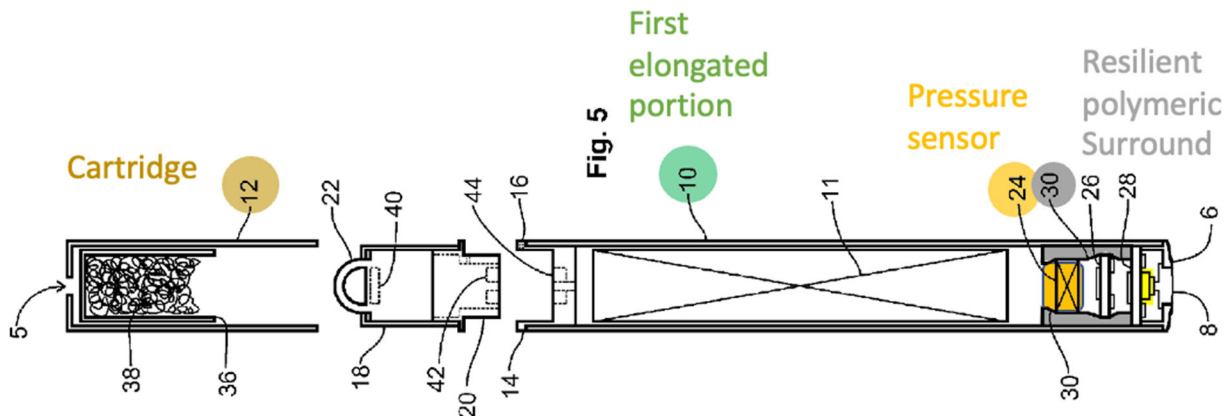
3. Claims 14 and 27: a gasket around the pressure sensor, the gasket configured to seal the device air path from the sealed air flow path.

255. Lamb in combination with each of Worm (Grounds 1-3) and/or Weigensberg alone or in view of the knowledge of a POSA (Ground 4) discloses this limitation (Grounds 5-8, respectively).

256. As discussed above, each of Worm (Grounds 1-3) and Weigensberg alone or in view of the knowledge of a POSA (Ground 4) discloses this limitation. If it is argued that Worm or Weigensberg and the knowledge of a POSA do not disclose the claimed gasket, Lamb discloses a sealing member that surrounds a pressure sensor and seals the sealed air flow path from the other side of the sensor.

EX1005, [0041].

257. Lamb discloses representative components that yield visual cues or indicators, such as LEDs and related components are disclosed in a number of references. One such reference is Newton766, which is incorporated by reference. EX1005, [0041] (identifying Newton766). As discussed above, Newton766 discloses the use of a gasket surrounding the pressure sensor at the tip of the electronic cigarette with the circuitry and LED.



EX1009, Fig. 5

EX1009, 6:6-9 (“The polymeric surround 30 also acts as a pressure seal to insure the draw pressure sensor 24 is properly coupled to detect the negative pressure of the draw.”)

258. Therefore, Lamb discloses a gasket around the pressure sensor that seals the device air path from the sealed air flow path.

259. As discussed in Section V.E.1, it would have been obvious to modify

Worm and/or Weigensberg to include a gasket such as Newton766's gasket incorporated into Lamb's disclosure.

260. Therefore, each of Worm (Grounds 1-3) and/or Weigensberg (Ground 4) further in view of Lamb disclose a gasket around the pressure sensor that seals the device air path from the sealed air flow path (Grounds 5-8, respectively). For the reasons stated in Grounds 1-4 and here, claims 14 and 27 (and claim 32 by dependency) of the '123 Patent are rendered obvious over each of Worm (Grounds 1-3) and/or Weigensberg (Ground 4) further in view of Lamb.

4. Claims 16 and 29: The vaporizer device [body] of claim [14] / [27], wherein the pressure sensor comprises a MEMS pressure sensor.

261. As discussed above for Grounds 1-4, every limitation of claims 14 and 27 are met, including a pressure sensor. Lamb in combination with Worm (Grounds 5-7) and/or Weigensberg (Ground 8) discloses this limitation.

262. Lamb discloses a MEMS-based pressure sensor. EX1005, [0046] ("FIG. 2 illustrates a MEMS-based sensor 200 that in some examples may correspond to a flow sensor such as the flow sensor 110 of FIG.1."); [0004] ("The MEMS-based sensor is within the housing and configured to detect a pressure on the MEMS-based sensor caused by airflow through at least a portion of the housing.").

263. As discussed in Section V.E.1, it would have been obvious to modify Worm and/or Weigensberg to include Lamb's MEMS pressure sensor. As described

in detail above in Section V.E.1, MEMS pressure sensors perform the same function as Worm and Weigensberg's differential pressure sensors. A POSA would have been motivated to use Lamb's MEMS pressure sensor because MEMS pressure sensors have better responsiveness, offer low power consumption, high reliability, and higher precision. EX1022, [0102]; EX1015, 3:3-7. These characteristics of a MEMS sensor would make them attractive components for battery-powered electronic cigarette as disclosed in Worm and Weigensberg as described in more detail in Section V.E.1. A POSA would have had a reasonable expectation of success because MEMS sensors are easy to integrate into the device and indeed offer a smaller footprint at a low cost so they could be substituted into existing designs. EX1022, [0102]; EX1015, 3:3-7. Additionally, the structure and function of Worm, Weigensberg and Lamb are similar, as described above, and MEMS pressure sensors that could be used in electronic cigarettes were commercially available. *See, e.g.*, EX1020 (datasheet referenced in EX1023, [0085]; EX1022, [0103]).

264. Therefore, each of Worm (Grounds 1-3) and/or Weigensberg alone or in view of the knowledge of a POSA (Ground 4) further in view of Lamb disclose a MEMS pressure sensor (Grounds 5-8, respectively). For the reasons stated in Grounds 1-4 and here, claims 16 and 29 of the '123 Patent are rendered obvious over each of Worm (Grounds 1-3) and/or Weigensberg alone or in view of the knowledge of a POSA (Ground 4) further in view of Lamb.

5. Claims 15 and 28: The vaporizer device [body] of claim [14] / [27], wherein the pressure sensor comprises a capacitive membrane.

265. As discussed above for Grounds 1-4, every limitation of claims 14 and 27 are met, including a pressure sensor. Lamb in combination with each of Worm (Grounds 5-7) and/or Weigensberg (Ground 8) additionally discloses this limitation.

266. Lamb discloses a MEMS pressure sensor with a “micromachined, pressure-sensitive diaphragm 306a and a backplate 306b that form a *variable capacitor 306*.” EX1005, [0047]. Lamb explains that a change in pressure causes the diaphragm to move, leading to a change in capacitance in the MEMS pressure sensor. EX1005, [0047] (“...the pressure causes movement of the diaphragm and thereby a change in a capacitance of the variable capacitor. The change in capacitance causes a change in the output voltage across the variable capacitor. The MEMS microphone may then output the output voltage or a digital representation of the output voltage as the electrical signal.”). A POSA would have understood that the diaphragm 308a in Lamb’s MEMS pressure sensor is a capacitive membrane because movement of the diaphragm due to a change in pressure causes a change in capacitance that is used to detect the pressure change.

267. As discussed in Section V.E.1 and V.E.4, it would have been obvious to modify Worm or Weigensberg to include Lamb’s MEMS pressure sensor. Additionally, a capacitive MEMS sensor in particular has advantages over other

types of capacitors, including high sensitivity, lower power, and better temperature performance. *See* EX1028, [0003]. A POSA would have had a reasonable expectation of success because MEMS sensors are easy to integrate into the device and indeed offer a smaller footprint at a low cost so they could be substituted into existing designs. EX1022, [0102]; EX1015, 3:3-7. Additionally, the structure and function of Worm, Weigensberg and Lamb are similar, as described above, and MEMS pressure sensors that could be used in electronic cigarettes were known and commercially available. *See, e.g.*, EX1020 (datasheet referenced in EX1023, [0085]; EX1022, [0103]; EX1028, [0003] (capacitive MEMS pressure sensors for electronic cigarettes.)

268. Therefore, each of Worm (Grounds 1-3) and/or Weigensberg alone or in view of the knowledge of a POSA (Ground 4) further in view of Lamb disclose a pressure sensor with a capacitive membrane (Grounds 5-8, respectively). For the reasons stated in Grounds 1-4 and here, claims 15 and 28 of the '123 Patent are rendered obvious over each of Worm (Grounds 1-3) and/or Weigensberg alone or in view of the knowledge of a POSA (Ground 4) further in view of Lamb.

6. Claims 18 and 31: The vaporizer device [body] of claim [14] / [27], wherein the sensor readings output by the pressure sensor comprise pressure values.

269. As discussed above for Grounds 1-4, every limitation of claims 14 and 27 are met, including a pressure sensor that outputs sensor readings. Lamb in

combination with Worm (Grounds 5-7) and/or Weigensberg (Ground 8) discloses this limitation.

270. Lamb discloses that the sensor readings output by the pressure sensor comprise pressure values. Lamb discloses a MEMS-based pressure sensor that outputs pressure sensor readings with pressure values. EX1005, [0043] (“The MEMS-based sensor may be configured to detect a pressure on the MEMS-based sensor caused by airflow through at least a portion of the housing, convert the pressure to an electrical signal, and output the electrical signal.”); [0045] (“In other examples, the MEMS-based sensor may be configured to convert the pressure to the electrical signal that varies with a corresponding variation in the pressure relative to an ambient pressure on the MEMS-based sensor.”); [0046] (“The change in the electrical property causes a change in an output voltage across the micromachined sensor. This output voltage may be output by the MEMS-based sensor as the electrical signal. Or in some examples, the MEMS-based sensor (e.g. on the second die) may include an appropriate analog-to-digital converter (ADC) or other circuitry configured to convert the output voltage to a digital representation, which the MEMS-based sensor may then output as the electrical signal.”).

271. A POSA would have understood from Lamb’s disclosure that the detected pressure would be output directly or converted to a representation of the pressure as electrical signals. In either case, the output would be a numeral value

indicative of pressure.

272. Thus, Lamb discloses that its pressure sensor outputs its sensor readings that comprise pressure values under either Parties' construction in the ITC Investigation. *See* Section IV.D above; EX1019.

273. As discussed in Section V.E.1, it would have been obvious to modify Worm or Weigensberg to include Lamb's pressure sensor that outputs sensor readings comprising pressure values. A POSA would have been motivated to use Lamb's MEMS pressure sensor to use the variable output of the MEMS sensor to provide additional features based on the variation in airflow rates. For example, varying the indicator light with the change in pressure differential, controlling the heating element, or controlling the amount of fluid delivery. EX1021, 23:25-28 ("The variable signal output from the flex/bend sensor can be used by one or more control elements of the aerosol delivery device to control the operation of the device. Such operation can encompass a variety of functional elements of the device, such as a heating member, a fluid delivery member, a sensory feedback member, and the like."); Abstract ("The disclosure further provides methods for controlling operation of an aerosol delivery device through utilization of a variable output flow sensor. In particular, control of functional elements (e.g., a heating member, a fluid delivery member, and a sensory feedback member) can allow for real-time changes in the operation of the aerosol delivery device relative to airflow through the device.").

Another example is using the variable pressure measurements to create profiles to control access to the device. EX1014, Abstract, [0011].

274. A POSA would have had a reasonable expectation of success because MEMS sensors are easy to integrate into the device and indeed offer a smaller footprint at a low cost so they could be substituted into existing designs. EX1022, [0102]; EX1015, 3:3-7. Additionally, the structure and function of Worm, Weigensberg and Lamb are similar, as described above. Weigensberg and Thorens are capable of providing functions based on variable pressure data. Weigensberg includes circuitry for performing various additional functionalities and Thorens' circuitry and puff detection system are programmable. EX1006, [0107] (Circuitry "associated with or incorporated in the sensor unit 209 may enable the aerosol generating device to perform various additional functions as may be required for the operation of the electronic cigarette 211."); EX1016, [0046]. Pressure sensors that output pressure values for use in electronic cigarettes were known and available. *See, e.g.*, EX1020 (datasheet referenced in EX1023, [0085]; EX1022, [0103].

275. Therefore, each of Worm (Grounds 1-3) and/or Weigensberg alone or in view of the knowledge of a POSA (Ground 4) further in view of Lamb disclose a pressure sensor that outputs sensor reading that comprise sensor values (Grounds 5-8, respectively). For the reasons stated in Grounds 1-4 and here, claims 18 and 31 of the '123 Patent are rendered obvious over each of Worm (Grounds 1-3) and/or

Weigensberg alone or in view of the knowledge of a POSA (Ground 4) further in view of Lamb.

7. Claim 32: The vaporizer device of claim 27, wherein the cartridge comprises the vaporizable material, and wherein the vaporizable material comprises a nicotine formulation.

276. As discussed above for Grounds 1-4, every limitation of claim 27 is met, including a cartridge with vaporizable material. Lamb in combination with Worm (Grounds 1-3) and/or Thorens (Ground 4) discloses this limitation (Grounds 5-8, respectively). Lamb discloses that its vaporizable liquid precursor can include a nicotine compound. EX1005, [0040] (“The aerosol precursor composition, also referred to as a vapor precursor composition, may comprise a variety of components including, by way of example, a polyhydric alcohol (e.g., glycerin, propylene glycol or a mixture thereof), nicotine, tobacco, tobacco extract and/or flavorants.”).

277. As discussed in Section V.E.1, it would have been obvious to modify Worm and/or Thorens to include Lamb’s nicotine formulation as part of either aerosol precursor. Sebastian lists nicotine as preferred tobacco extract and teaches that “highly preferred tobacco extracts are highly aromatic and flavorful, and hence introduce desirable sensory characteristics to the aerosol produced by the smoking articles incorporating those extracts.” EX1008, [0056]. A POSA would have had a reasonable expectation of success because nicotine was a known and popular ingredient in precursor liquids in electronic cigarettes.

278. Therefore, each of Worm (Grounds 1-3) and/or Thorens (Ground 4) further in view of Lamb disclose a vaporizable material with a nicotine formulation under Grounds 5-8, respectively. For the reasons stated in Grounds 1-4 and here, claims 15 and 28 of the '123 Patent are rendered obvious over each of Worm (Grounds 1-3) and/or Weigensberg (Ground 4) further in view of Lamb.

279. Therefore, in summary, Worm and/or Weigensberg alone or further in view of the knowledge of a POSA (Grounds 1-3) each further in view of Lamb, renders obvious claims 14, 16, 18, 27, 29, 31 and 32 of the '123 Patent. Worm and Thorens (Ground 4) further in view of Lamb renders obvious claims 15 and 28 of the '123 Patent.

VI. THE PRIOR ART WAS NOT PREVIOUSLY CONSIDERED

280. Primary reference Thorens (Grounds 4 and 8) and secondary references Levitz (Ground 3 and 6), Weigensberg (Grounds 4 and 8), and Lamb (Grounds 5-8) were not previously considered by the Patent Office. Primary reference Worm (Grounds 1-3 and 5-7) was identified by the Applicant in an IDS during prosecution of the '123 Patent on August 14, 2018. EX1002, 345. However, Worm was not discussed by the Examiner or Applicant during the prosecution of the application leading to the '123 Patent, nor were any of the combinations of prior art set forth in this Petition addressed during prosecution of the '123 Patent.

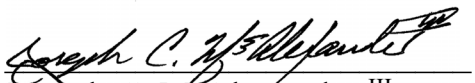
VII. SECONDARY CONSIDERATIONS OF NONOBVIOUSNESS

281. The references described in the grounds in this Petition, such as Thorens, Levitz, Weigensberg and Lamb, indicate to a POSA that there are no secondary indicia of nonobviousness. For example, in light of these references and other information discussed, there is no failure by others or long-felt, but unsolved need since the claimed features in the challenged claims were known and available in the prior art. Indeed, in some cases, the references identify commercially available pressure sensors that could be used. EX1026.001 (160PC Low Pressure Sensors Datasheet for differential pressure sensor model 163PC01D36); EX1020 (datasheet referenced in EX1023, [0085]; EX1022, [0103]).

VIII. DECLARATION

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

Dated: November 27, 2023

By: 
Joseph C. McAlexander III