

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

R.J. REYNOLDS VAPOR COMPANY,
Petitioner,

v.

FONTEM HOLDINGS 1 B.V.,
Patent Owner.

Case IPR2016-01692
Patent 9,326,548 B2

Before JO-ANNE M. KOKOSKI, KRISTINA M. KALAN, and
KIMBERLY MCGRAW, *Administrative Patent Judges*.

KALAN, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

R.J. Reynolds Vapor Company (“Petitioner”) filed a Petition requesting *inter partes* review of claims 1–14 of U.S. Patent No. 9,326,548 B2 (Ex. 1001, “the ’548 patent”). Paper 2 (“Pet.”). Fontem Holdings 1 B.V. (“Patent Owner”) filed a Preliminary Response. Paper 7 (“Prelim. Resp.”). We instituted an inter partes review of claims 1–14 on certain grounds of unpatentability alleged in the Petition. Paper 8 (“Dec.”).

After institution of trial, Patent Owner filed a Patent Owner Response. Paper 19 (“PO Resp.”). Petitioner filed a corrected Reply. Paper 24 (“Reply”). An oral hearing was held on October 26, 2017. A transcript of the hearing is included in the record. Paper 44 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Petitioner has not established by a preponderance of the evidence that claims 1–14 of the ’548 patent are unpatentable.

A. *Related Proceedings*

The parties indicate that the ’548 patent is asserted in *Fontem Ventures B.V. v. R.J. Reynolds Vapor Co.*, Civil Action No. 16-CV-1257 (M.D.N.C.). Pet. 3; Paper 6, 1.

B. *The ’548 Patent*

The ’548 patent, titled “Electronic Cigarette,” is directed to an electronic cigarette having a battery assembly and an atomizer assembly within a housing, with the battery assembly electrically connected to the atomizer assembly. Ex. 1001, at [54], [57]. A liquid storage component is in contact with a porous component of the atomizer assembly, and a heating

wire is in an air flow path through a run-through hole. *Id.* at [57].

According to the '548 patent, prior art devices had various disadvantages, including low atomizing efficiency, being structurally complicated, and not providing ideal aerosol effects. *Id.* at 1:36–38.

Figure 1 of the '548 patent is reproduced below:

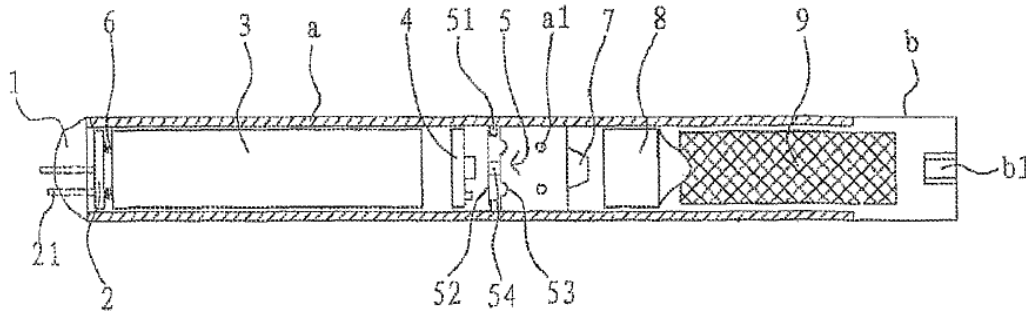


Figure 1

Figure 1 is a side section view of an electronic cigarette. *Id.* at 1:62. Hollow, integrally-formed shell (a) includes a battery assembly, atomizer assembly, and cigarette bottle assembly. *Id.* at 2:48–51. The battery assembly connects to the atomizer assembly in shell (a), and the detachable cigarette body assembly (which fits with the atomizer assembly) is located in one end of shell (a). *Id.* at 2:51–55. The battery assembly includes operating indicator 1, battery 3, electronic circuit board 4, and airflow sensor 5. *Id.* at 2:57–60. The atomizer assembly is atomizer 8, which includes a porous component and a heating rod. *Id.* at 3:25–27. The cigarette bottle assembly includes hollow cigarette shell holder (b), and perforated component for liquid storage 9. *Id.* at 4:2–4. Air channel (b1) is located in the center on the surface of one end of cigarette shell holder (b), and extends inward. *Id.* at 4:12–14.

Figures 17 and 18 of the '548 patent are reproduced below:

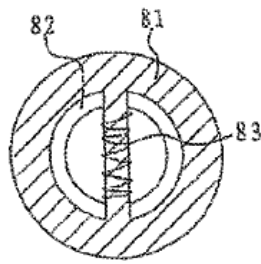


Figure 17

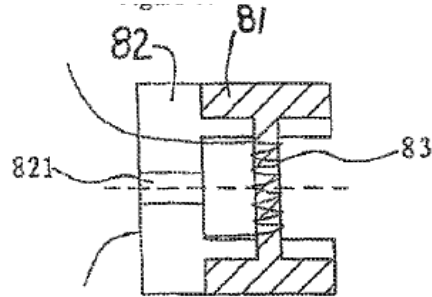


Figure 18

Figure 17 is a diagram of the axial structure of the atomizer in another embodiment, and Figure 18 is a side section view of the atomizer shown in Figure 17. *Id.* at 2:29–32. In this embodiment, the atomizer assembly includes “a frame (82), the porous component (81) set on the frame (82), and the heating wire (83) wound on the porous component (81).” *Id.* at 5:63–65. As described in the '548 patent, the “frame (82) has a run-through hole (821) on it. The porous component (81) is wound with heating wire (83) in the part that is on the side in the axial direction of the run-through hole (821). One end of the porous component (81) fits with the cigarette bottle assembly.” *Id.* at 5:65–6:2.

C. Challenged Claims

Petitioner challenges claims 1–14 of the '548 patent. Of challenged claims 1–14, claims 1, 8, and 11 are independent. Claims 2–7 depend, directly or indirectly, from claim 1. Claims 9 and 10 depend directly from claim 8. Claims 12–14 depend directly from claim 11.

Claim 1 is reproduced below:

1. An electronic cigarette, comprising:
a battery assembly having a cylindrical battery and an operating indicator;

an atomizer assembly in an elongated cylindrical housing, with the battery assembly electrically connected to the atomizer assembly, and with the cylindrical battery coaxial with the atomizer assembly;

a liquid storage component in the housing;

the atomizer assembly including a porous component set on a frame having a run-through hole;

a heating wire coil electrically connected to the battery;

an air flow path in the atomizer assembly parallel to a longitudinal axis of the housing, with the air flow path through the run-through hole to an outlet, with the heating wire coil wound on the porous component and in the air flow path and with the heating wire coil oriented perpendicular to the longitudinal axis; and

the porous component in contact with the liquid storage component.

Ex. 1001, 6:12–30.

D. Instituted Grounds of Unpatentability

We instituted *inter partes* review of claims 1–14 of the ’548 patent on the following grounds:

References	Basis	Claims Challenged
Hon ’043, ¹ Whittemore, ² and Voges ³	§ 103	1–10
Hon ’043, Whittemore, Voges, and Gehrer ⁴	§ 103	11–14

Petitioner relies on the declarations of Dr. Robert H. Sturges (Ex. 1015; Ex. 1026; Ex. 1039). Patent Owner relies on the declarations of Richard Meyst (Ex. 2001; Ex. 2030).

¹ Chinese Patent No. CN 2719043 Y (Ex. 1002 and 1003 (English translation), “Hon ’043”).

² U.S. Patent No. 2,057,353 (Ex. 1004, “Whittemore”).

³ U.S. Patent No. 5,894,841 (Ex. 1021, “Voges”).

⁴ U.S. Patent No. 5,703,633 (Ex. 1023, “Gehrer”).

II. ANALYSIS

A. *Claim Construction*

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable constructions in light of the specification of the patent in which they appear. *See* 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (upholding the use of the broadest reasonable interpretation standard). Under the broadest reasonable construction standard, claim terms are presumed to have their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Only those terms which are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“we need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Petitioner proposes that we construe the term “frame” to mean “rigid structure,” and that we construe “porous component set on a frame having a run-through hole” to mean that the porous component sits on the frame. Pet. 15–17. Patent Owner proposes that we construe “set on” to mean “held in place by.” PO Resp. 16.

In our Decision on Institution, we determined, based on the record at the time, that no claim term required express construction. Dec. 8. Because we decide this case on issues unrelated to any of the claim terms the parties ask us to construe, we need not construe them herein.

B. Level of Ordinary Skill in the Art

Petitioner and Patent Owner each propose a particular level of ordinary skill in the art. Pet. 15; PO Resp. 15. In light of the evidence before us, we find that the references themselves represent the level of ordinary skill in the art, and that we need not explicate it further. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the level of ordinary skill in the art usually is evidenced by the references themselves); *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (finding that the Board of Patent Appeals and Interferences did not err in concluding that the level of ordinary skill in the art was best determined by the references of record).

C. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103⁵ if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). A

⁵ The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. § 103. Because the ’548 patent has an effective filing date before the effective date of the applicable AIA amendments, throughout this Decision we refer to the pre-AIA versions of 35 U.S.C. § 103.

decision on the ground of obviousness must include “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). The obviousness analysis “should be made explicit” and it “can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *KSR*, 550 U.S. at 418. To prevail on its patentability challenge, Petitioner must establish facts supporting its challenge by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). We analyze the asserted grounds of unpatentability in accordance with the above-stated principles.

D. Overview of the Prior Art

1. Hon '043

Hon '043 is directed to an electronic atomization cigarette. Ex. 1003,
5. Figure 1 of Hon '043 is reproduced below:

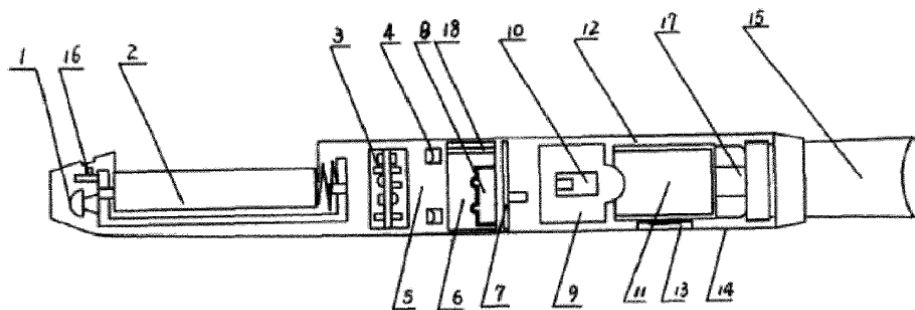


FIG. 1

Figure 1 is a schematic diagram of the structure of an electronic cigarette that includes air inlet 4, normal pressure cavity 5, sensor 6, vapor-liquid separator 7, atomizer 9, liquid-supplying bottle 11, and mouthpiece 15 within shell 14. *Id.* at 8–9.

Figure 6 of Hon '043 is reproduced below:

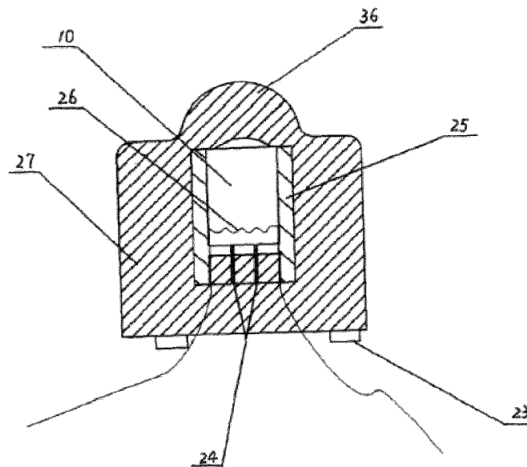


FIG. 6

Figure 6 is a structural diagram of an atomizer, which includes atomization cavity 10, long stream ejection hole 24, atomization cavity wall 25, heating element 26, porous body 27, and bulge 36. *Id.* at 9. Hon '043 states that “atomization cavity wall 25 is surrounded with the porous body 27, which can be made of foam nickel, stainless steel fiber felt, high molecule polymer foam and foam ceramic,” and that “atomization cavity wall 25 can be made of aluminum oxide or ceramic.” *Id.*

Hon '043 teaches that “[w]hen a smoker smokes, the mouthpiece 15 is under negative pressure, the air pressure difference or high speed stream between the normal pressure cavity 5 and the negative pressure cavity 8 will cause the sensor 6 to output an actuating signal,” which causes the cigarette to begin operating. *Id.* at 10. Air enters normal pressure cavity 5 through air inlet 4, proceeds through the through hole in vapor-liquid separator 7, and flows into atomization cavity 10 in atomizer 9. *Id.* “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.”

Id. at 10–11. After the atomization, large-diameter droplets stick to the wall and are reabsorbed by porous body 27 via overflow hole 29, and small-diameter droplets float in stream and form aerosols that are sucked out via aerosol passage 12, gas vent 17, and mouthpiece 15. *Id.* at 11.

2. Whittemore

Whittemore is directed to a vaporizing unit for a therapeutic apparatus. Ex. 1004, 1:1–2. Figure 2 of Whittemore is reproduced below:

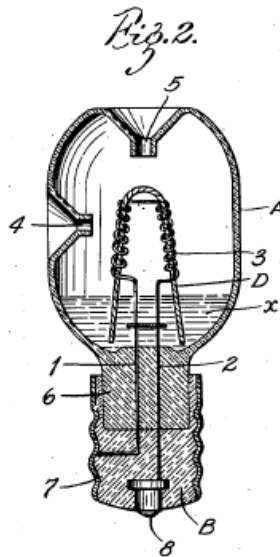


Figure 2 is an enlarged sectional view of a therapeutic apparatus equipped with a vaporizing unit as taught by Whittemore. *Id.* at 1:15–16. Vaporizing vessel A is a hollow glass container that holds liquid medicament x. *Id.* at 1:19–23. Conductors 1 and 2 are combined with heating element 3 such that, when conductors 1 and 2 are energized, heating element 3 is heated. *Id.* at 1:24–27. Wick D is combined with heating element 3 so that a portion of wick D is always in contact, or in approximate contact, with heating element 3, and a portion of wick D is also in contact with liquid medicament x. *Id.* at 1:53–2:5.

According to Whittemore, medicament x is carried on wick D by capillary action to a point where it will be vaporized by the heat from heating element 3. *Id.* at 2:5–8. Whittemore states that “wick D consists of a thread, string or [strand] of some suitable wick material doubled intermediate its ends so as to form a substantially inverted V-shaped device whose side portions are encased in and surrounded by coiled or looped portions” of heating element 3, with “the lower ends or free ends of the side pieces of the wick projecting downwardly into the medicament and terminating at or in close proximity to the closed bottom 6 of the vessel.” *Id.* at 2:9–18.

3. *Voges*

Voges discloses an electronic cigarette substitute having a “cigarette-shaped hollow tubular body 1 comprising connected body parts 2, 3,” container 10 holding nicotine in a suitable solvent, droplet ejection device 14, which can be “of the kind used in a bubble jet printer,” and a “hollow cylindrical battery 17.” Ex. 1021, 5:48–6:1. Voges discloses that the droplet ejection device may be a piezoelectric device of the kind used in ink jet printing or a thermal “bubble jet” device of the kind used in ink jet printing. *Id.* at 3:62–4:5.

4. *Gehrer*

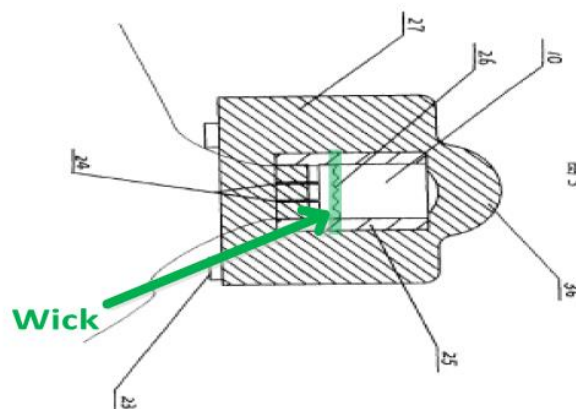
Gehrer is directed to an ink container with a capillary action member for use in ink jet printers. Ex. 1023, at [54]. Gehrer’s container includes ink reservoir 8, capillary body 18 connected to porous wick 37, and porous coupling member 20A at the liquid withdrawal port connected to porous wick 38. *Id.* at 6:14, 8:19–26, Fig. 3. Porous wicks 37 and 38, capillary

body 18, and coupling member 20A are made from wicking materials such as fibers. *Id.* at 2:4–7, 3:7–15, 6:33–36, 10:1–4.

E. Analysis

Petitioner contends that claims 1–14 would have been obvious under 35 U.S.C. § 103 over the combination of “Hon ’043 and Whittemore, and, if necessary, Voges and/or Gehrler.” Pet. 24–77. Petitioner presents arguments and claim charts for each of the challenged independent claims 1, 8, and 11, as well as for the challenged dependent claims. *Id.* at 34–77.

More particularly, Petitioner contends that “Hon ’043 discloses an electronic cigarette with every element of claims 1–14 of the ’548 patent, except that Hon ’043’s heating wire coil 26 is not wound on the porous body 27.” Pet. 24. Petitioner further contends that “Whittemore is directed to a vaporizing unit with a heating wire coil 3 wound around a porous wick D.” *Id.* Petitioner argues that it would have been obvious “to incorporate Whittemore’s wick D into the electronic cigarette of Hon ’043 for transporting liquid via capillary action from the porous body 27 to the heating coil 26” as demonstrated in Petitioner’s annotated Figure 6 from Hon ’043, reproduced below:



Id. at 25–26 (citing Ex. 1015 ¶¶ 55–69). Petitioner further argues that it would have been obvious to make the porous wick from fiber material, because Whittemore discloses that the wick can be “made from any suitable material” (citing Ex. 1004, 1:54–2:6), and one of ordinary skill in the art would have considered using Gehrer’s “inexpensive capillary wicking materials [such as] fibers, especially linear fiber materials” (citing Ex. 1023, 2:4–7) as a matter of routine design choice. Pet. 26. Petitioner relies on Voges to support its argument that one of ordinary skill in the art would have consulted the ink jet printing art. *Id.* at 26–27 n.4.

1. Thermal Efficiency Arguments

Petitioner argues that one of ordinary skill in the art readily would have appreciated that Whittemore’s porous wick/heating coil wire configuration provides more efficient heating than Hon ’043’s configuration, and that one of ordinary skill in the art “would have immediately appreciated the thermal inefficiencies associated with the configuration of Hon ’043.” Pet. 30–31 (citing Ex. 1015 ¶¶ 62–66).

Patent Owner argues that “[t]hermal efficiency would not have motivated the combination” because “Hon ’043 discloses direct contact of liquid with a heating element such that heating is by conduction, not convection,” and thus, Petitioner’s “purported motivation to improve the thermal efficiency of Hon ’043 by including direct liquid contact is simply not present.” PO Resp. 21 (citing Ex. 2030 ¶¶ 90–112). Patent Owner argues: “Atomization in Hon ’043 begins with liquid being forced from porous body 27 through the ejection holes into the atomization cavity when a user inhales by a high speed stream of air, which converts the liquid into small droplets.” *Id.* at 22 (citing Ex. 1003, 10–11; Ex. 2018, 68:3–6). The

ejection holes of Hon '043, argues Patent Owner, “form a simple ‘plain-orifice atomizer’” requiring no electricity or thermal energy. *Id.* (citing Ex. 2030 ¶¶ 37, 107; Ex. 2024, 22–47). Patent Owner further argues that Hon '043's teachings of (a) atomizing liquid by ejection from ejection holes and (b) (optionally) further atomizing the droplets by the heater are both more thermally efficient than Whittemore, because step (a) requires no heat and no electricity, and step (b) only heats pre-formed droplets of liquid, whereas Whittemore heats the “bulk” liquid without the prior benefit of forming droplets via the ejection holes. *Id.* at 22–23.

Petitioner replies that Patent Owner “inflates Hon 043's purported thermal efficiency” and “incorrectly portrays Hon 043.” Reply 6. Petitioner argues that the ejection holes are not atomizers, and that atomization occurs after the liquid droplets are ejected from holes 24. *Id.* (citing Ex. 1039 ¶¶ 37, 59–64).

As a preliminary matter, we are not persuaded that Petitioner successfully makes its point that the ejection holes of Hon '043 do not atomize. Patent Owner presents a dictionary definition of “atomize”—“convert (a substance) into very fine particles or droplets.” PO Resp. 8 (citing Ex. 2020, 101); *see also* Ex. 1039 ¶ 59 (Petitioner's expert referring to the same definition). In Hon '043, the “high speed stream passing through the ejection hole” ejects nicotine solution into the atomization cavity “in the form of droplet[s]” which are then subject to “ultrasonic atomization” by piezoelectric element 23 and are “further atomized” by heating element 26. Ex. 1003, 10–11. Mr. Meyst testifies that the ejection holes are one of the ways in which Hon '043 converts the liquid into “small droplets” by a high speed stream of air passing through ejection holes 24 or 30.

Ex. 2030 ¶ 37 (citing Ex. 2024, 22–47). Petitioner does not persuasively demonstrate that the liquid coming out of the ejection holes of Hon ’043 is converted only into droplets so large that they disqualify the ejection holes from “atomizer” status. In support of its assertion that “ejection holes are not atomizers,” Petitioner relies on the testimony of Dr. Sturges that a person of ordinary skill in the art would have understood from Hon ’043 that “large diameter droplets (relative to Hon 043’s small diameter droplets that float in stream and form an aerosol) are emitted from Hon 043’s ejection holes and then atomized into ‘small diameter droplets’ by at least one of heating element 26 or second piezoelectric element 35, which are then carried away as an aerosol to be inhaled by the user.” Ex. 1039 ¶ 37. However, Dr. Sturges provides no additional support for this assertion, and concedes that Hon ’043 “does not disclose the size of droplets after ejection.” *Id.* at ¶¶ 37, 59; *see* Ex. 1003, 10–11. Further, in response to the question “So you would believe that most of the droplets coming out of the ejection holes [of Hon ’043] would be small droplets?” Dr. Sturges replied, “Yes.” Ex. 2018, 68:3–6. Dr. Sturges also discusses a situation in which “even if some of the droplets emitted by Hon 043’s ejection holes were sufficiently small to be considered atomized” Ex. 1039 ¶ 37. Thus, we are more persuaded by Patent Owner’s arguments and Mr. Meyst’s testimony, and unpersuaded by Petitioner’s argument that the ejection holes of Hon ’043 do not function as atomizers.

Overall, Petitioner proposes a combination of references that purports to show the claimed invention would have been obvious on the basis of thermal efficiency. In particular, Petitioner argues that one of ordinary skill in the art would have readily appreciated that “the porous wick/heating coil

wire configuration of Whittemore provides more efficient heating than the arrangement disclosed in Hon '043" and that "the Hon '043 configuration is thermally inefficient." Pet. 30. Thus, "to compensate for the poor thermal transfer properties of air," Petitioner argues, "one of ordinary skill in the art "would have appreciated that the heating coil wire 26 would need to be at relatively higher temperatures to vaporize the nicotine droplets than would be required with respect to nicotine solution in direct contact with the heating element." *Id.* at 31. According to Petitioner, in the Whittemore configuration, "the heating element can be run at lower temperatures" such that "less energy is required to vaporize the liquid." *Id.* at 32.

Patent Owner notes that Petitioner's arguments regarding the alleged thermal inefficiencies of the Hon '043 atomizer are based on Dr. Sturges's hypothesis "that a 'large majority of the spray would . . . never touch the heating wire,'" noting that Dr. Sturges assumes an insignificant amount of liquid would contact the heating element based on the dimensions of the figures in Hon '043. PO Resp. 23 (citing Ex. 2015 ¶ 62 n.2). Petitioner, however, does not provide adequate explanation as to why a person having ordinary skill in the art would think that to be the case. In reaching that determination, we credit Mr. Meyst's testimony over that of Dr. Sturges. For example, Mr. Meyst identified a number of factors that would affect the determination of the percentage of entrained droplets that contact the wire in the Hon '043 atomizer, stating that,

[w]hile it is true that some liquid droplets will not touch the heater, there is no way to know what percentage will come into direct contact without knowing a number of other factors, such as the heater's dimensions, the cavity's dimensions, the size of the ejection holes, and the spray pattern. A person of ordinary skill would have understood these factors, and would have made

selections that would result in most of the liquid coming into direct contact with the heating element. For example, Hon '043 discloses that the ejection holes may be “long” or [“]short,” may employ a “slot structure” or a “circular hole structure” ranging from 0.1 mm to 1.3 mm, and that “single” or “multiple” holes may be used. A skilled person could have calculated or used commercially available Computational Fluid Dynamics software such as FLUENT to model the path of droplets ejected from the ejection holes and focus them at the heating element.

Ex. 2030 ¶ 99 (internal citations omitted). We are unable to discern, from any of the portions of Dr. Sturges’s testimony cited by Petitioner, any calculations to determine how factors such as the speed and pressure of the airstream, and the rate of change of pressure of the airstream as it travels through the ejection holes and into the atomization chamber, would affect the dispersion of the droplets ejected from the ejection holes towards the heating wire in Hon '043. Reply 7–8 (citing Ex. 1026 ¶¶ 7–11; Ex. 1039 ¶ 52). Dr. Sturges also presents a slip stream example to argue that the vast majority of the flow slips past the heating wire (Ex. 1026 ¶ 10), but Patent Owner argues that this example is not applicable to the ejected liquid droplets disclosed in Hon '043 (citing Ex. 2030 ¶¶ 102–106), and that Dr. Sturges confirmed this in his deposition (citing Ex. 2031, 106:14–107:10). PO Resp. 26. In light of the variables that can affect how the droplets could disperse upon ejection from the ejection holes, Petitioner has not explained adequately why a person having ordinary skill in the art would understand that only a small amount of droplets would contact Hon '043’s heating wire and that the atomization described in Hon '043 is inefficient.

Moreover, Petitioner and Dr. Sturges do not identify objective evidence to support Dr. Sturges’s conclusion that one of ordinary skill would have recognized that the thermal efficiency of Hon '043 needed

improvement. As an initial matter, we note that Petitioner does not direct us to, nor do we discern, any statements in Hon '043 or Whittemore with respect to the thermal efficiency—or thermal inefficiency—of atomization within the described articles. Dr. Sturges identifies one page from a thermodynamics textbook listing heat coefficients for convection and conduction (Ex. 1015 ¶ 63 (citing Ex. 1016, 3)), but does not identify any other evidence in the prior art or otherwise that identifies thermal or atomization inefficiency as a generally known problem in the field, or that specifically discusses the thermal efficiency of atomization within electronic cigarettes. While it is true that, when a claimed invention involves a combination of elements, “any need or problem known in the relevant field of endeavor at the time of the invention can provide a reason to combine,” that need or problem must nevertheless be identified sufficiently. *Tyco Healthcare Grp. LP v. Ethicon Endo-Surgery, Inc.*, 774 F.3d 968, 977 (Fed. Cir. 2014).

Petitioner’s arguments and Dr. Sturges’s testimony with respect to the modification of Hon '043 leave an analytical gap that does not sufficiently apprise us of why one of ordinary skill in the art would have modified Hon '043 with Whittemore’s wire-wrapped wick. Petitioner’s and Dr. Sturges’s assertions that a person having ordinary skill in the art would have been motivated to modify Hon '043 based on thermodynamics principles do not adequately address why a person having ordinary skill would have wanted to provide more efficient heating in the Hon '043 electronic cigarette.

In an obviousness determination, we must avoid analyzing the prior art through the prism of hindsight. Instead, we must “cast the mind back to

the time the invention was made” and “occupy the mind of one skilled in the art who is presented with only the references, and who is normally guided by then-accepted wisdom in the art.” *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553 (Fed. Cir. 1983); *see also Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1368 (Fed. Cir. 2012) (quoting *Innogenetics, N.V. v. Abbott Labs.*, 512 F.3d 1363, 1374 n.3 (Fed. Cir. 2008) (“We must still be careful not to allow hindsight reconstruction of the references to reach the claimed invention without any explanation as to how or why the references would be combined to produce the claimed invention.”)). Here, we interpret Petitioner’s position as an attempt to imbue one of ordinary skill in the art with knowledge of the claimed invention, without adequately demonstrating that a prior art reference, references of record, or other evidence conveys or suggests that knowledge. Petitioner’s proposed rationale relies upon general and conclusory statements from Dr. Sturges regarding thermodynamics that are not sufficiently supported in the record, and instead appear to be based on impermissible use of hindsight after review of the ’548 patent, rather than on a supported reason to modify the heating configuration in Hon ’043’s atomizer. *See KSR*, 550 U.S. at 421 (stating that the fact finder must be aware “of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning”). In order to establish a motivation to combine the references, Petitioner needed to explain sufficiently what would have led a person of ordinary skill in the art at the time of the invention to consider modifying the Hon ’043 atomizer to include a “heating wire coil wound on” the porous component, on the first section of the porous component, or on the fiber

member as recited in claims 1–14, and Petitioner failed to provide such an explanation.

2. Additional Motivation to Combine Arguments

Petitioner presents five arguments based on the “numerous Patent Office and Supreme Court endorsed rationales for Petitioner’s proposed combination.” Pet. 27–29 (citing MPEP § 2143(I)(A)–(E); *KSR*, 550 U.S. at 416).

Patent Owner argues that Petitioner’s five arguments for combining Hon ’043 with Whittemore simply list “unsupported conclusions with scarce discussion of how each rationale applies to the prior art and the claims.” PO Resp. 31. We agree with Patent Owner that Petitioner’s discussion is scarce, and the paucity of the argument alone is reason for us to give less weight to these five arguments. Petitioner cites to one paragraph of Dr. Sturges’s testimony, respectively, to support each of the five arguments; each corresponding paragraph of Dr. Sturges’s testimony also is characterized by brevity, as well as being conclusory and duplicative of Petitioner’s arguments. *See* Ex. 1015 ¶¶ 57–61. Therefore, we also give little weight to the testimony supporting Petitioner’s five arguments. Simply because a rationale is “Patent Office and Supreme Court endorsed” does not mean that endorsement necessarily extends to the combination proposed by Petitioner. Petitioner maintains the burden of demonstrating that one of ordinary skill in the art would have been motivated to combine the references as proposed. We address each of Petitioner’s five arguments in turn, below.

a. MPEP § 2143(I)(A)

Petitioner argues that the proposed combination is the combination of prior art elements according to known methods to yield predictable results,

namely, “transporting a liquid solution via capillary action from a liquid source to a spaced apart heating element for subsequent vaporization.”

Pet. 27 (citing Ex. 1015 ¶ 57).

Patent Owner argues that Whittemore’s wick and Hon ’043’s heating element perform different functions in the proposed combination than they do in the prior art—in Hon ’043, the heating element functions to further atomize droplets, whereas in the proposed combination, “only the heater atomizes liquid.” PO Resp. 32. Patent Owner also faults Petitioner for not explaining what happens to Hon ’043’s ejection hole in the proposed combination. *Id.* at 32–33. Petitioner replies that whether the heating wire “further atomizes” or “solely” atomizes, “the heating wire atomizes liquid.” Reply 13.

We are not persuaded by Petitioner’s argument that the elements in the combination perform the same function as they would separately. The heating element has a different function in the proposed combination than in Hon ’043, where it further atomizes droplets in an airflow rather than directly atomizing liquid delivered to it via capillary action. Additionally, Petitioner does not account for the discrepancy highlighted by Patent Owner regarding Hon ’043’s ejection hole, which either remains an ejection hole and results in the absence of a “run-through hole” in the combination, or becomes the “run-through hole” but then has a different function in the proposed combination than in Hon ’043. PO Resp. 32–33. Finally, Petitioner does not clarify how the heating element in the proposed combination is “spaced apart” from the liquid source when the heating element is wound around the liquid source. Thus, we do not find that in Petitioner’s proposed combination, “one skilled in the art could have

combined the elements as claimed by known methods with no change in their respective functions, and the combination yielded nothing more than predictable results to one of ordinary skill in the art.” MPEP § 2143(I)(A).

b. MPEP § 2143(I)(B)

Petitioner argues that the proposed combination is the simple substitution of one known element for another to obtain predictable results, namely, “transporting liquid solution via capillary action from Hon ‘043’s porous body 27 to a spaced apart heating coil for subsequent vaporization.” Pet. 28 (citing Ex. 1015 ¶ 58).

Patent Owner argues that “[a] ‘simple substitution’ would be to remove the entire atomizer in Hon ‘043 and replace it with Whittemore’s wire-wrapped wick dipped directly into liquid-supplying bottle 11,” such that “liquid would be transported directly from Hon ‘043’s liquid-supplying bottle 11 via Whittemore’s wick D to Whittemore’s filament 3 for vaporization.” PO Resp. 34. According to Patent Owner, “[t]here would be no reason (other than hindsight) to retain Hon ‘043’s porous body 27 ‘arranged outside around’ and upstream from atomization cavity wall 25, or the ejection holes 24 and 30.” *Id.* (citing Ex. 1003, 7, 9–11; Ex. 2030 ¶¶ 95–98). Patent Owner also argues that combining Hon ‘043 and Whittemore as proposed would have required a major redesign. PO Resp. 39. According to Patent Owner, Petitioner does not explain why one skilled in the art would redesign the atomizer “to atomize primarily (or exclusively) by heating a wire wrapped around a wick instead of by forcing liquid through ejection holes with optional “further” atomization through piezoelectric and heating elements.” *Id.* Petitioner replies that Patent Owner’s proposed “simple”

substitution “would involve a major redesign” that would not be considered “to be an improvement over Hon 043.” Reply 13–14.

In this matter, we credit Patent Owner’s contention, supported by testimony from Mr. Meyst, that “a ‘simple substitution’ would be to remove the entire atomizer in Hon ’043 and replace it with Whittemore’s wire-wrapped wick dipped directly into liquid-supplying bottle 11.” PO Resp. 34. Mr. Meyst explains that in Hon ’043, porous body 27 moves liquid from the solution storage body for vaporization: “The solution storage porous body 28 in the liquid-supplying bottle 11 will be in contact with the bulge 36 on the atomizer 9, thereby achieving the capillary infiltration liquid-supplying.” Ex. 2030 ¶ 95 (quoting Ex. 1003, 11). He further explains:

In Whittemore the wick D performs this function. Substituting the wick/heating wire configuration of Whittemore for the heating wire 26 of Hon ’043 results in a redundant design having both the porous body 27 of Hon ’043 and the wick D of Whittemore. On the other hand, if the porous body 27 and the heating wire 26 of Hon ’043 are removed in making the modification, then the atomizer of Hon ’043 is entirely discarded and replaced with something else having little relation to the atomizer disclosed in Hon ’043.

Id. ¶ 96.

Petitioner’s response to Patent Owner’s contention fails to explain adequately why the proposed “simple substitution” would add Whittemore’s wick and retain Hon ’043’s porous body, when, as Mr. Meyst notes, Whittemore’s wick performs the same function as the porous body in Hon ’043. Instead, Petitioner reiterates that “the simplest and most straightforward substitution” and one that does not involve a major design change would be simply to “substitute Whittemore’s wire wrapped wick for the heating wire of Hon 043.” Reply 14. Likewise, Dr. Sturges’s testimony

in support of Petitioner’s argument does not provide any reasoning for retaining Hon ’043’s porous body other than that it “would be the simplest and most straightforward approach.” Ex. 1039 ¶ 48. We disagree, particularly in view of Patent Owner’s redesign argument; we credit Mr. Meyst’s testimony that the proposed combination would require a redesign of numerous elements and considerable effort to ensure success. Ex. 2030 ¶ 112.

Because neither Petitioner nor Dr. Sturges explains sufficiently why one would substitute only Whittemore’s wick—and not the wire wrapped wick dipped directly into the liquid supply as taught by Whittemore—into Hon ’043’s atomizer, Petitioner does not establish that replacing Hon ’043’s heating wire with Whittemore’s wire wrapped wick as proposed is a simple substitution that would have been obvious to a person having ordinary skill in the art.

c. MPEP § 2143(I)(C)

Petitioner argues that the proposed combination is the use of a known technique to improve similar devices in the same way, in that the “porous wick provides a reliable means for transporting liquid from a liquid supply to a heating element for subsequent vaporization.” Pet. 28 (citing Ex. 1015 ¶ 59).

Patent Owner argues that “reliable liquid transport” cannot motivate the combination, because Hon ’043 already relies on capillary action to transport liquid. PO Resp. 29. According to Patent Owner, Hon ’043 already transports liquid via “capillary infiltration” from liquid-supplying bottle 11 through porous body 27 to an ejection hole. *Id.* Regarding air flow, Patent Owner argues, “Hon ’043 relies on airflow to atomize liquid at

ejection holes 24 or 30,” and then those droplets “can be ‘further atomized’ by an optional heating element in certain embodiments.” *Id.* (quoting Ex. 1003, 11). “Because Hon ’043 already discloses porous body 27 that transports liquid via capillary action,” Patent Owner argues, one of ordinary skill in the art “would not have looked to Whittemore’s porous wick.” *Id.* at 30. Thus, according to Patent Owner, “Petitioner’s proposed combination does not “improve” liquid transport—instead, it changes part of the way Hon ’043 atomizes liquid.” *Id.* (citing Ex. 2030 ¶¶ 110–112). Petitioner reiterates in its Reply that one of ordinary skill in the art “would have been motivated to insert Whittemore’s wick so that liquid is reliably transported from Hon 043’s porous body to the heating element for atomization by direct heating.” Reply 11.

Petitioner does not account for the clear teaching of Hon ’043 that employs capillary action to reliably transmit liquid to ejection holes. In view of this disclosure, Petitioner’s explanation fails to explain why one of ordinary skill in the art would have looked to Whittemore’s wick to improve the operation of Hon ’043. Petitioner has not shown why one of ordinary skill in the art would require additional or different capillary action to deliver liquid to the heating element. Rather, the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, and therefore, the teachings of the references are not sufficient to render the claims obvious. *In re Ratti*, 270 F.2d 810, 813 (CCPA 1959).

Patent Owner also argues that Petitioner fails to identify what “base” device Whittemore improved, or the way that device was improved. PO Resp. 35 (citing *KSR*, 550 U.S. at 417; MPEP § 2143(I)(C)). Patent

Owner argues that, unlike the base device (Tiffany) improved upon by Whittemore (Ex. 1004, 1), Hon '043's liquid "need not be maintained in close proximity to a heater" and "does not require a heater at all." *Id.* at 36. Petitioner replies that "Hon 043 is the 'base' device and Whittemore is the 'comparable' device," and Whittemore's wick "provides for the reliable delivery of liquid to a heating element for atomization by direct heating." Reply 14.

Petitioner does not persuasively explain why one of ordinary skill in the art would have sought to modify the "base" device of Hon '043 when Hon '043 already provides a "reliable means for transporting liquid." In this regard, we again find that Petitioner does not persuasively explain away Hon '043's existing and presumably reliable delivery of liquid to the ejection holes via capillary action, or the existence and delivery of droplets to Hon '043's heating element. Because Hon '043 already discloses a reliable means for transporting liquid from a liquid supply to a heating element, we do not find that one of ordinary skill in the art would have been motivated to use the technique of Whittemore to improve Hon '043.

d. MPEP § 2143(I)(D)

Petitioner argues that the proposed combination is the application of a known technique to a known device ready for improvement to yield predictable results, specifically, "using Whittemore's technique of transporting liquid via the capillary action of a porous wick" to improve Hon '043's electronic cigarette. Pet. 28 (citing Ex. 1015 ¶ 60).

Patent Owner argues that Petitioner identifies Whittemore's "transporting liquid via the capillary action of a porous wick" as the "known technique" and Whittemore's wick as "a more 'reliable means for

transporting liquid’ to the heater.” PO Resp. 37. Patent Owner refers to its arguments about “reliable liquid transport” to reiterate that Hon ’043 uses capillary action to transport liquid to a plain-orifice ejection hole atomizer, and the “capillary action of Whittemore’s wick is not applicable to Hon ’043’s air stream.” *Id.* at 38.

Petitioner again replies that Patent Owner’s argument is based on the “mischaracterization of Hon 043” of ejection holes being atomizers, when instead, “the droplets ejected from holes 24 are atomized in the atomization cavity by convective heat from the heating wire.” Reply 15.

Hon ’043 already reliably employs capillary action for transporting liquid, without any apparent need for further improvements related to its capillary action, and thus, we are not persuaded by Petitioner’s “reliable means for transporting liquid” rationale that it presents here and elsewhere. Also, as discussed above, we are persuaded that Hon ’043’s ejection holes are part of Hon ’043’s atomization method. Because Hon ’043 already discloses a reliable means for transporting liquid from a liquid supply to a heating element, Whittemore’s “known technique” of transporting liquid via the capillary action of a porous wick is not applicable to the known device of Hon ’043. Accordingly, we do not find that one of ordinary skill in the art would have been motivated to use the technique of Whittemore to improve Hon ’043.

e. MPEP § 2143(I)(E)

Petitioner argues that the proposed combination is obvious to try, because the proposed combination “merely involves choosing from a finite number of identified, predictable solutions for transporting – and ultimately

vaporizing – a liquid from a liquid source to a spaced apart heating element with a reasonable expectation of success.” Pet. 29 (citing Ex. 1015 ¶ 61).

Patent Owner argues that MPEP § 2143(I)(E) requires recognition of a “problem or need in the art” with “a finite number of identified, predictable potential solutions.” PO Resp. 38. Petitioner, according to Patent Owner, mischaracterizes Hon ’043 as having a “problem” in that “Hon ’043 discloses transporting the liquid in droplet form via airflow.” *Id.* (citing Pet. 29). This technique, Patent Owner argues, is not a “recognized problem,” but rather, an atomization method. *Id.* at 39.

Petitioner replies that Whittemore’s “wire-wrapped wick was one of a finite number of identified, predictable solutions, for solving Hon 043’s thermal inefficiency problem,” and that “Hon 043’s ejection holes are not atomizers” but an inefficient means for delivering liquid to a heating wire for atomization. Reply 15.

As discussed above, we are not persuaded that Hon ’043 has a thermal efficiency problem that one of ordinary skill in the art would be motivated to solve. Also as discussed above, we are persuaded that Hon ’043’s ejection holes are part of Hon ’043’s atomization method, rather than a problem to be solved. Accordingly, we are not persuaded by Petitioner’s assertions that it would have been obvious to try Whittemore’s wick in Hon ’043’s atomizer.

3. Conclusion

All of the grounds in this case are based on the combination of Hon ’043 and Whittemore. We have determined that Petitioner has not established that one of ordinary skill in the art would have been motivated to combine Hon ’043 and Whittemore. None of Petitioner’s reasons for further combining Hon ’043 and Whittemore with Voges (claims 1–10) and Voges

and Gehrer (claims 11–14) overcome the shortcomings of Petitioner’s case-in-chief based on Hon ’043 and Whittemore. Accordingly, our finding that one of ordinary skill in the art would not have been motivated to combine Hon ’043 and Whittemore extends to all of the grounds at issue in this proceeding.

III. PATENT OWNER’S MOTION TO EXCLUDE

Patent Owner moves to exclude (1) the three declarations of Dr. Robert H. Sturges (Ex. 1030; Ex. 1031; Ex. 1039); (2) the exhibits cited to support Dr. Sturges’s declarations (Ex. 1033; Ex. 1034; Ex. 1036; Ex. 1038); and (3) Exhibits 1005–1012, 1017–1020, and 1022. Paper 36. We do not reach the merits of Patent Owner’s Motion to Exclude because our Decision does not rely on Exhibits 1005–1012, 1017–1020, and 1022, and, as explained above, even if we consider the disputed Sturges declarations and evidence, Petitioner has not shown by a preponderance of the evidence that claims 1–14 are unpatentable. Accordingly, we dismiss Patent Owner’s Motion to Exclude as moot.

IV. CONCLUSION

Petitioner must demonstrate obviousness by a preponderance of the evidence. 35 U.S.C. § 316(e); *see also Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). Having considered the parties’ arguments and evidence, we evaluate all of the evidence together to make a final determination relating to obviousness. *In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.*, 676 F.3d 1063, 1075 (Fed. Cir. 2012) (stating that a fact finder must

consider all evidence relating to obviousness before finding patent claims invalid). After considering the parties' arguments and evidence, however, we are not persuaded that Petitioner has made a sufficient showing that a person having ordinary skill in the art would have combined the teachings in the manner proposed by Petitioner. We conclude that Petitioner has not satisfied its burden of demonstrating, by a preponderance of the evidence, that the subject matter of claims 1–10 of the '548 patent would have been obvious over the combined teachings of Hon '043, Whittemore, and Voges, or that claims 11–14 of the '548 patent would have been obvious over the combined teachings of Hon '043, Whittemore, Voges, and Gehrler.

V. ORDER

In consideration of the foregoing, it is hereby

ORDERED that, Petitioner has not shown by a preponderance of the evidence that claims 1–14 of the '548 patent are unpatentable;

FURTHER ORDERED that Patent Owner's Motion to Exclude (Paper 36) is *dismissed*; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of this Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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