

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMAZON.COM SERVICES LLC,

Petitioner,

v.

SMART SPEAKER LLC,

Patent Owner.

Patent No. 11,190,590

Filing Date: May 30, 2018

Issue Date: November 30, 2021

Inventors: Yehuda Binder and Benjamin Maytal

Title: SYSTEM AND METHOD FOR SERVER BASED CONTROL

PATENT OWNER'S RESPONSE

Case No. IPR2026-00148

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LIST OF EXHIBITS

Exhibit No.	Description of Document
2001	Plaintiff's Disclosure of Asserted Claims and Infringement Contentions in <i>Smart Speaker LLC v. Amazon.com Servs. LLC</i> , Case No. 2:25-cv-00707-JRG (E.D. Tex.), dated September 16, 2025
2002	Defendant's Invalidity and Subject Matter Eligibility Contentions in <i>Smart Speaker LLC v. Amazon.com Servs. LLC</i> , Case No. 2:25-cv-00707-JRG (E.D. Tex.), dated December 9, 2025
2003	Federal Register, Vol. 90, No. 199, dated Friday, October 17, 2025
2004	Second Amended Docket Control Order (Dkt. 33) in <i>Smart Speaker LLC v. Amazon.com Servs. LLC</i> , Case No. 2:25-cv-00707-JRG (E.D. Tex.), dated October 29, 2025
2005	Letter to Amazon.com, Inc. re May Patents Ltd. Patent Portfolio, dated July 23, 2024
2006	Appeal Statistics, Patent Trial and Appeal Board, dated October 31, 2025
2007	Patent Trial and Appeals Board (PTAB) data at a glance December 2025
2008	Declaration of Dr. Michael Shamos

I. INTRODUCTION

On November 22, 2025, Amazon.com Services LLC (“Petitioner”) filed a petition (Paper 2, “Petition” or “Pet.”) for *inter partes* review of U.S. Patent No. 11,190,590 (EX1001, the “’590 Patent”), challenging Claims 1-36 and 38-63 (the “Challenged Claims”) as obvious across fifteen grounds resting on two prior-art foundations: Chan (EX1004) for Grounds 1-10, and the combination of Seo (EX1005) and Chan for Grounds 11-15. Trial has been instituted on all grounds. Smart Speaker LLC (“Patent Owner”) submits this Response, supported by the Declaration of Dr. Michael Shamos (Ex. 2008), and respectfully requests that the Board issue a final written decision confirming the patentability of all Challenged Claims.

Claim 1 is the only independent claim, and every Challenged Claim depends from it. Claim 1 recites an appliance whose “*wireless transceiver*” both transmits “*digital data*” from two sensors “*to*” a wireless network and receives “*digital data*” “*from*” that same network, with all four recited components—the “*current sensor*,” the “*first sensor*,” the “*antenna*,” and the “*wireless transceiver*”—housed in “*a single enclosure*.” ’590 Patent, Claim 1. Neither prior-art foundation discloses that appliance.

First, Grounds 1-10 rely on Chan, but Chan’s appliance module does not communicate with its gateway over a wireless network. Chan states that “[g]ateway

300 sends and receives powerline signals across the premises wiring system in order to communicate with appliance module 400,” and that “[a]s appliance module is coupled to the premises wiring, it may send and receive powerline signals to gateway 300.” EX1004, [0073]. Chan’s wireless RF is what the module extends outward: the module “may communicate to client devices wirelessly via RF signal **past the premises wiring system**,” and the other wireless technologies Chan lists—“WiFi, ZigBee, Bluetooth, WPAN, RFID, UWB, infrared (IR)” —are likewise “used by appliance module 400 in communicating **past the premises wiring system**.” *Id.* (emphases added). Chan’s appliance module is a powerline-to-wireless bridge that “provide[s] a network backbone across premises wiring and allows wireless connectivity to such network backbone.” *Id.*, [0074]. The Petition’s premise, *i.e.*, that “the connection between gateway 101 and the appliance modules 111 is wireless,” is contradicted by the reference. Pet. at 17-18; Ex. 2008, ¶¶ 63-72.

Second, Ground 1 is a single-reference ground in name only. Chan’s FIG. 4 parts list contains no antenna, so the Petition supplies the claimed “*antenna*” from Elahi (EX1016), Adelstein (EX1018), Gorday (EX1022), and Dunko (EX1023). Chan never mentions an enclosure, housing, or casing, so the Petition supplies “*a single enclosure*” from a Jetlun product manual (EX1043). And Chan never discloses transmitting sensor data over a wireless network, so for the “*first sensor*” transmission limitation the Petition reaches to Seo (EX1005) (the Ground 11 primary

reference) and to Botega (EX1045), a reference in no ground at all. Pet. at 27-32, 35. Further, Claim 6 is supported by Botts (EX1006), the Ground 2 reference. Pet. at 39. Supplying claim elements from outside the stated ground is what 37 C.F.R. § 42.104(b)(4) and the July 31, 2025 Stewart Memorandum prohibit. Ex. 2008, ¶¶ 73-77.

Third, the Petition maps Chan’s two current transformers to Claim 1’s two separately recited sensors. But CT 425*a* and CT 425*b* are two inputs to one component: “[t]he power measure module 421 is connected to a power supply 437 and two (2) current transformers (CT) 425*a* and 425*b* that are connected to a standard AC socket 427.” EX1004, [0070]. Both monitor current on conductors of the same socket, and Chan discloses transmitting one type of information, *i.e.*, “power usage information.” *Id.*, [0075]. Ex. 2008, ¶¶ 78-85.

Fourth, Grounds 11-15 rely on Seo, and the Petition’s showing for the limitation that the appliance be “*controlled or activated in response to digital data received from the wireless network*” rests on a truncated quotation. The Petition asserts that Seo’s control device “automatically switches to a different type of energy source” on receiving data, quoting the second sentence of Seo paragraph 44. Pet. at 89-90. However, the first sentence of that paragraph, omitted from the Petition, reads: “In addition, **a user or the like can select one of the energy sources through the input unit 490.**” EX1005, [0044] (emphasis added). Seo’s FIG. 10 confirms it,

branching on “Choose another energy source?” Thus, Seo does not disclose any appliance control “*in response to digital data received from the wireless network,*” as required by Claim 1. The Petition’s remaining theory—that Seo’s display shows a computed number—identifies no control or activation of the appliance at all. Ex. 2008, ¶¶ 88-102.

Fifth, the grounds directed to the dependent claims fail for additional and independent reasons. Scherz does not disclose any cam, screw, or wheel and axle, yet Claim 54’s “*conversion mechanism*” is mapped to a cam that appears nowhere in the reference. The “sudden, very large voltage” the Petition calls Claim 57’s “*electrical signal generator*” is, in Scherz, a destructive inductive spike the reference teaches how to eliminate. Ozturk’s fan and heat sink are not Claim 59’s “*thermoelectric actuator*”—the word “thermoelectric” does not appear in Ozturk. And Botts’s efficiency indicator responds to the appliance’s own internal energy monitor, not to Claim 50’s “*digital data received from the wireless network.*” Ex. 2008, ¶¶ 104-114.

Sixth, the four grounds built on textbook excerpts fail on the excerpts themselves. Middelhoek’s galvanometer sentence is a historical note about an 1819 discovery, and the same paragraph teaches that modern digital current measurement is performed as voltage measurement through an analog-to-digital converter—the deficient architecture Chan already has. Middelhoek’s electro dynamometer, offered

for Claim 17, “cannot respond to high frequency signals,” is “inaccurate at low power factors,” and “is a dc instrument.” Rossing never classifies microphones as omnidirectional, unidirectional, or bidirectional at the page cited for Claim 49; it says the opposite—that “it is probably not possible to specify a single universally preferred pickup pattern.” Benesty’s sentence for Claim 34 is quoted with its operative words removed: the reference states that “steering a microphone array beamformer and scanning across a room for the highest-energy output leads to an estimate of the direction of an active speech source,” and the Petition’s ellipsis deletes the steering and the scanning. And Doherty, the sole reference offered for the addressing limitations of Claims 60-63, states that “IP addressing is a fundamental networking concept that is not covered in detail in this book.”

Given that every ground rests on one of two defective foundations, because the missing limitations are common to every Challenged Claim, and because the grounds directed to the dependent claims independently fail, Petitioner has not shown that any Challenged Claim is unpatentable.

II. THE ’590 PATENT

The ’590 Patent, titled “System and Method for Server Based Control,” issued on November 30, 2021, from an application filed on May 30, 2018, and claims priority to a provisional application filed on January 9, 2012. Pet. at 4. Claim 1 is the only independent claim, and Claims 2-63 depend from it. Ex. 2008, ¶¶ 26-27.

Claim 1 recites “[a]n Alternating-Current (AC) powered appliance associated with food storage, handling, or preparation for use with a wireless network,” comprising “an AC connector,” “a current sensor coupled to the AC connector for measuring an AC current consumed by the appliance,” “a first sensor having an output that responds to a physical phenomenon,” “an antenna for communication over the wireless network,” “a wireless transceiver coupled to the antenna for transmitting digital data to, and for receiving digital data from, the wireless network,” and “a single enclosure housing the current sensor, the first sensor, the antenna, and the wireless transceiver.” ’590 Patent, Claim 1. Three wherein clauses follow: the first sensor must be “coupled to the wireless transceiver for transmitting digital data in response to the physical phenomenon to the wireless network”; “the appliance is controlled or activated in response to digital data received from the wireless network”; and the current sensor must be “coupled to the wireless transceiver for transmitting digital data in response to the measured AC current to the wireless network.” *Id.* Ex. 2008, ¶¶ 28-29.

Claim 1 thus describes a bidirectional wireless architecture in a single physical package. The same “wireless network” carries two distinct sensor outputs outward and carries inward the digital data to which the appliance responds, and the sensors, antenna, and transceiver are co-located in one enclosure. Ex. 2008, ¶¶ 30-33.

A. The Prosecution History

The Petition devotes its Introduction and section II.C to the prosecution history, arguing that the Board “determined that the independent claim recited mostly garden-variety limitations,” that the Board “never ‘allowed’” Claim 32, and that the “first sensor” added to Claim 1 was a “trivial addition.” Pet. at 1, 5. The record does not support Petitioner’s framing of Claim 1.

In *Ex parte Binder*, Appeal 2020-002710 (P.T.A.B. July 22, 2021), the Board affirmed in part and, over Sharood, sustained the rejection of Claims 1-5, 7, 12-19, 54, and 58, and reversed as to Claims 6, 9, 10, 32-34, 36, and 55-57. EX1003, 251. On August 12, 2021, the Applicant amended Claim 1 to add the “*first sensor*” element, to add that first sensor to the single-enclosure clause, and to add the wherein clause requiring the first sensor to transmit digital data in response to the physical phenomenon to the wireless network. *Id.*, 167. The Examiner then allowed the claims. *Id.*, 34.

The critical point is one the Petition ignores: the Claim 1 the Board construed did not contain any of those first-sensor limitations. As reproduced in the Board’s decision, Claim 1 then recited “*a single enclosure housing the current sensor, the antenna, and the wireless transceiver*”—three components. *Id.*, 185. The passage on which Petitioner and Dr. Houh rely says exactly that: “although open-ended, claim 1 requires only that the single enclosure houses ‘the current sensor, the antenna, and

the wireless transceiver.”” *Id.*, 193; *see* EX1002, ¶ 133. The Board’s enumeration was exhaustive of the claim before it. Issued Claim 1 requires a fourth component in the enclosure. Dr. Houh, nonetheless, quotes that sentence and concludes that “[t]hese findings support the same reading here.” EX1002, ¶ 133. They do not. Ex. 2008, ¶¶ 36-38.

The Board’s treatment of Claim 32 likewise cuts against the Petition. The Board reversed because the Examiner relied on a component in one Sharood embodiment (a magnetic latching mechanism within a forced-air damper 900), while relying on a different embodiment (retrofit plug 125) for Claim 1: “Given these disparate findings from different embodiments, Sharood does not disclose the recited elements arranged as claimed.” EX1003, 197. The Board applied the same reasoning to Claims 9 and 10, adding that similarity between two structures does not establish that a structure “necessarily” has the other’s features. *Id.*, 196-97. Ex. 2008, ¶ 39. The Examiner and the Board thus examined these claims closely, contrary to Petitioner’s characterization of the independent claim as having recited “mostly garden-variety limitations during prosecution.” Pet. at 1.

III. THE CITED PRIOR ART

A. Chan (EX1004)

Chan, U.S. Patent Publication No. 2010/0238003, is the primary reference for Grounds 1-10 and a secondary reference in Grounds 11-15. Chan describes “creating

the networking infrastructure for energy monitoring and control systems used for monitoring, controlling, and transmitting information via AC wiring or wirelessly, such as via the HomePlug™ or ZigBee™ standards.” EX1004, [0004]. A gateway 101 couples to client devices “through AC wiring 107 or wirelessly 109,” and among those client devices is an appliance module 111, which “can connect to a variety of appliances and devices such as refrigerator, washer and dryer, range, stove, microwave.” *Id.*, [0045], [0047]. Ex. 2008, ¶¶ 41-45

FIG. 4 is “a simplified block diagram of the appliance module 400.” EX1004, [0070]. Its enumerated elements are a CPU 401, a powerline chipset 403, a Zigbee wireless chipset 405, an RS232 serial interface 407, a temperature and humidity sensor 409, I/O ports 411, a reset circuit 413, GPIO ports 415, a crystal 417, a backup power module 419, a power measure module 421, a relay switch 423, two current transformers 425 a and 425 b, a standard AC socket 427, live, neutral, and ground wires 429, 431, and 433, an analog-to-digital interface 435, a battery, a power supply 437, an EMI filter 439, and a 12V 500 mA DC output 441. *Id.* No antenna is among them, and Chan nowhere describes an enclosure, housing, or casing for the module. Ex. 2008, ¶ 42.

As to how the module communicates, Chan is explicit: “Gateway 300 sends and receives powerline signals across the premises wiring system in order to communicate with appliance module 400. As appliance module is coupled to the

premises wiring, it may send and receive powerline signals to gateway 300. Furthermore, appliance module 400 may communicate to client devices wirelessly via RF signal past the premises wiring system.” EX1004, [0073]. Chan’s data output is described in one sentence: “Data measured by appliance module 400 as a preferred embodiment includes power usage information, such as instantaneous power, peak power, or average power,” which the module “sends . . . to gateway 300 via network infrastructure.” *Id.*, [0075]; Ex. 2008, ¶ 43.

B. Seo (EX1005)

Seo, Korean Patent Publication No. 10-2010-0083686, is the primary reference for Grounds 11-15. Seo describes a refrigerator control device 400 whose purpose is to inform the user: it detects “a plurality of internal and external states of a refrigerator,” calculates “predicted power consumption based on the detected states,” generates “one or more messages corresponding to the internal and external states,” and outputs “the predicted power consumption and the messages.” EX1005, Claim 1; *see id.*, [0012]. The messages Seo generates are advisory text shown on a screen—for example, “The temperature in the refrigerator compartment is below zero” or “Please reduce the amount of items in the freezer compartment.” *Id.*, [0067]; Ex. 2008, ¶ 46.

Seo’s state detection unit 430 comprises internal temperature detection units 431a and 431b, an external temperature detection unit 433, height detection units

435, and a frequency detection unit 437. *Id.*, [0057]-[0060]. Seo places these in the spaces they monitor: the internal temperature units detect “the temperature within one or more storage compartments provided inside the refrigerator”; the external temperature unit “detects the temperature outside the refrigerator, that is, the room temperature”; and the height detection units “may be installed in the refrigerator compartment 200 or the freezer compartment 300,” with “a plurality of height detection units . . . likewise . . . installed in each shelf.” *Id.* Seo’s current detection is performed “through a current detection unit (not shown).” *Id.*, [0055]. Communication unit 440 “is connected to the external device by wired or wireless communication methods such as serial communication, the Internet, power line communication, or wireless LAN.” *Id.*, [0051]. Ex. 2008, ¶¶ 47-49.

C. Botts (EX1006)

Botts, U.S. Patent No. 8,461,861, is cited in Ground 2 against Claims 50-52. Botts describes “a household appliance having an internal energy usage monitor.” EX1006, 1:65-2:1. Its indicator is driven by that internal monitor: “the indicator may be a green light (e.g., a green LED or symbol) when the energy usage of the appliance is within the predetermined energy efficient range,” and “a red light (e.g., a red LED or symbol) when the energy usage of the appliance is outside of the predetermined energy efficient range.” *Id.*, 10:56-67; Ex. 2008, ¶ 51.

D. Scherz (EX1007)

Scherz, *Practical Electronics for Inventors*, is cited in Ground 3 against Claims 8-11, 54, and 57. Section 3.4 states that “[r]elays are electrically actuated switches,” that “[t]he three basic kinds of relays include mechanical relays, reed relays, and solid-state relays,” and that “[f]or a typical mechanical relay, a current sent through a coil magnet acts to pull a flexible, spring-loaded conductive plate from one switch contact to another.” EX1007, 307. Section 3.4.2 addresses inductive kickback, explaining that an abruptly interrupted coil current produces “a sudden, very large voltage,” that the resulting “menacing voltage spikes (as high as 1000 V) . . . can have some nasty effects on neighboring devices within the circuit,” and that “[t]he trick to getting rid of spikes is to use what are called transient suppressors.” *Id.*, 310; Ex. 2008, ¶ 52.

E. Middelhoek (EX1008)

Middelhoek, *Handbook of Sensors and Actuators: Measuring Current, Voltage and Power*, is the sole secondary reference in Ground 4, cited against Claims 12, 17, and 18. Chapter 1 surveys sensors and transducers; Chapter 4 surveys instruments for measuring power, including the electro dynamometer and the thermal wattmeter. EX1008, 1, 123-126, 148, 154. Ex. 2008, ¶¶ 53-54.

F. Goldsmith (EX1009)

Goldsmith, *Wireless Communications*, is cited in Ground 5 against Claims 28 and 31 and in Ground 12 against Claims 20-22. Goldsmith is a survey text on wireless communication systems and protocols. The Petition draws from it the existence of satellite networks, WiMAX, the 802.11 and 802.15 families, the ISM bands, and 3G standards. Pet. at 58-60, 94-96; Ex. 2008, ¶ 55.

G. Rossing (EX1010)

Rossing, *Springer Handbook of Acoustics*, is cited in Ground 6 against Claims 33, 48, 49, 55, and 56. The cited pages come from Section 18.4, “Audio Components,” which surveys microphones at Section 18.4.1 and loudspeakers at Section 18.4.3, and from Section 22.1, “Dynamics of the Linear Single-Degree-of-Freedom (1-DOF) Oscillator,” a mathematical treatment of damped oscillators. EX1010, 757-765, 903. Rossing describes how microphones and loudspeakers work; it describes no appliance, energy monitor, or wireless network. Ex. 2008, ¶ 56.

H. Benesty (EX1011)

Benesty, *Springer Handbook of Speech Processing*, is cited in Ground 7 against Claim 34. The two cited pages are the opening of Chapter 50, “Microphone Arrays,” which addresses beamforming for hands-free communication and conferencing, and a page of Chapter 51 surveying speech-source-localization methods. EX1011, 1021, 1044. Benesty surveys techniques in the field; it does not

describe any particular device configuration. Ex. 2008, ¶ 57.

I. Fraden (EX1012)

Fraden, *Handbook of Modern Sensors*, is cited in Ground 8 against Claims 35, 36, 39, 40, 42, 43, and 47, and in Ground 13 against Claims 35 and 39. Fraden is a sensor textbook cataloguing sensing principles and device types. Ex. 2008, ¶ 58.

J. Doherty (EX1013)

Doherty, *Wireless Home Networking Simplified*, is cited in Ground 9 and Ground 15 against Claims 60-63. Doherty is a Cisco Press consumer guide that walks a reader through setting up a home wireless network with commercially available equipment—installing a wireless network interface card (Chapter 8), enabling security features such as MAC address locking (Chapter 9), troubleshooting a connection (Chapter 10), and configuring a Linksys video camera (Chapter 13). EX1013, 99, 166, 175, 210-211, 265, 277. Ex. 2008, ¶ 59.

K. Ozturk (EX1014)

Ozturk, *Forced Air Cooling of CPUs with Heat Sinks: A Numerical Study*, is the sole secondary reference in Ground 10, cited against Claim 59. Ozturk models “[a] common ATX form factor personal computer system” and numerically investigates “forced convection air cooling” of a CPU by a heat sink and fan. EX1014, 650. The word “thermoelectric” does not appear in Ozturk. Ex. 2008, ¶ 60.

L. Betts-LaCroix (EX1050)

Betts-LaCroix, U.S. Patent Publication No. 2010/0149163, is the sole secondary reference in Ground 14, cited against Claim 58. It concerns image processing to increase the perceived brightness of OLED displays, and observes in its background that “OLED displays do not require a backlight to function and thus consume far less power than LCDs.” EX1050, [0002]; Ex. 2008, ¶ 61.

IV. LEVEL OF ORDINARY SKILL IN THE ART

Petitioner proposes that a POSITA “would have a bachelor’s degree in electrical engineering, computer engineering, or equivalent, and two years of experience working on remote device control and/or networked devices,” and that “[a]n advanced graduate degree may make up for the work experience indicated above.” Pet. at 6 (citing EX1002, ¶ 63). For purposes of this Response, Patent Owner applies Petitioner’s definition. Dr. Shamos likewise applies Petitioner’s definition. Ex. 2008, ¶¶ 23-24.

V. CLAIM CONSTRUCTION

Petitioner contends that no claim construction is necessary and that claim terms carry their plain and ordinary meaning. Pet. at 6. Patent Owner agrees that the Board need not construe any term to resolve this proceeding because, as demonstrated below, the Petition fails under any reasonable interpretation of the claims, including Petitioner’s own reading. Ex. 2008, ¶ 25.

**VI. PETITIONER HAS NOT SHOWN BY A PREPONDERANCE
OF THE EVIDENCE THAT ANY CHALLENGED CLAIM IS
UNPATENTABLE**

In an instituted *inter partes* review, “the petitioner shall have the burden of proving a proposition of unpatentability by a preponderance of the evidence.” 35 U.S.C. § 316(e). “To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

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 skill in the art, and (4) so-called secondary considerations where in evidence. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1537 (Fed. Cir. 1983). The Board has held that a failure to identify the differences between the claimed subject matter and the prior art is fatal to an obviousness challenge. *See Apple, Inc. v. ContentGuard Holdings, Inc.*, IPR2015-00355, Paper 9 at 9–10 (P.T.A.B. June 26, 2015). The Board must sufficiently explain and support the conclusions that the prior-art references disclose all the elements recited in the challenged claims and that a skilled artisan not only could

have made, but would have been motivated to make, the combination in the way the patent claims, with a reasonable expectation of success. *Pers. Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 994 (Fed. Cir. 2017); *Los Angeles Biomedical Rsch. Inst. at Harbor-UCLA Med. Ctr. v. Eli Lilly & Co.*, 849 F.3d 1049, 1067 (Fed. Cir. 2017). The combinability determination requires a plausible rationale as to why the prior-art references would have worked together. *Broadcom Corp. v. Emulex Corp.*, 732 F.3d 1325, 1335 (Fed. Cir. 2013). Absent some articulated rationale, a “common sense” finding is no different than a mere conclusory statement that a combination “would have been obvious.” *In re Van Os*, 844 F.3d 1359, 1361 (Fed. Cir. 2017).art references would have worked together. *Broadcom Corp. v. Emulex Corp.*, 732 F.3d 1325, 1335 (Fed. Cir. 2013). And “knowledge of a problem and motivation to solve it are entirely different from motivation to combine particular references.” *Innogenetics, N.V. v. Abbott Lab ’ys*, 512 F.3d 1363, 1373 (Fed. Cir. 2008).

A petition must identify, “in writing and with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim.” 35 U.S.C. § 312(a)(3). And a petition “must specify where each element of the claim is found in the prior art patents or printed publications relied upon.” 37 C.F.R. § 42.104(b)(4). General knowledge, expert testimony, common sense, and other evidence that is not prior art consisting of patents or printed publications identified in the ground may

not be used to supply a missing claim limitation. *See* July 31, 2025 Memorandum from Acting Director Stewart Regarding Enforcement and Non-Waiver of 37 C.F.R. § 42.104(b)(4). Nor may the Board adopt a multi-reference theory that Petitioner did not raise. *Magnum Oil*, 829 F.3d at 1380-81.

A. Grounds 1-10: Petitioner Has Not Shown that Chan Discloses an Appliance that Communicates “to” and “from” a “wireless network” (Elements 1[PR3], 1[E], 1[G], 1[H], 1[I]), or “a single enclosure” (Element 1[F])

Claim 1 requires an appliance “*for use with a wireless network*” (1[PR3]) comprising “*a wireless transceiver coupled to the antenna for transmitting digital data to, and for receiving digital data from, the wireless network*” (1[E]). Each of the three wherein clauses is tied to that same network: the first sensor transmits “*to the wireless network*” (1[G]); the appliance is controlled or activated “*in response to digital data received from the wireless network*” (1[H]); and the current sensor transmits “*to the wireless network*” (1[I]). ’590 Patent, Claim 1. Chan discloses none of this, because in Chan the appliance module and the gateway talk over the premises wiring. Ex. 2008, ¶¶ 62-87.

1. Chan’s Appliance Module Communicates with the Gateway Over the Powerline; Its Wireless RF Reaches Devices “past the premises wiring system”

Chan describes the appliance module’s two communication paths in a single paragraph, and they are not interchangeable. Toward the gateway, the path is the

wiring: “Gateway 300 sends and receives powerline signals across the premises wiring system in order to communicate with appliance module 400. As appliance module is coupled to the premises wiring, it may send and receive powerline signals to gateway 300.” EX1004, [0073]. Away from the gateway, the path is RF: “Furthermore, appliance module 400 may communicate to client devices wirelessly via RF signal past the premises wiring system.” *Id.* The sentence the Petition relies on describes a bridge, not a wireless uplink: “The powerline data signal sent between appliance module 400 and gateway 300 may be further transmitted by appliance module 400 as a wireless RF signal.” *Id.* The signal “sent between appliance module 400 and gateway 300” is a powerline signal; what the module does with it is retransmit it onward. Ex. 2008, ¶¶ 63-72.

The list of alternative technologies the Petition quotes is expressly limited the same way: “other signal media may be used by appliance module 400 in communicating past the premises wiring system such as other wireless technologies, WiFi, ZigBee, Bluetooth, WPAN, RFID, UWB, infrared (IR), or other media.” EX1004, [0073]. The Petition reproduces this sentence without the qualifier that defines it. Pet. at 18; Ex. 2008, ¶ 67.

Chan states its own architecture plainly: “In bridging various wireless network media to powerline or other premises wiring networking technology, appliance module 400 functions to provide a network backbone across premises wiring and

allows wireless connectivity to such network backbone. Appliance module 400 enhances the coverage and range of ZigBee or wireless network infrastructure by providing a bridge to the premises wiring network backbone.” EX1004, [0074]. The backbone is the wiring; the module’s wireless side extends that backbone to devices the wiring cannot reach. Ex. 2008, ¶ 68.

The control path is the same. The Petition maps Element 1[H] to Chan’s statement that “a low-bandwidth signal may carry command or control information from gateway 300 to appliance module 111 and turn the connected appliance on or off,” and asserts that “[s]uch data signals are transmitted using ‘wireless signal technology.’” Pet. at 13; *see also id.* at 36-37, 41 (quoting EX1004, [0057]). But Chan says that “[c]oupling by gateway 300 to client devices is accomplished with powerline **or** wireless signal technology,” and then specifies which: “The low-bandwidth signal may be generated by low-speed powerline chipset 319 and individually coupled to premises wiring at a certain location near gateway 300.” EX1004, [0057]-[0058]. The Petition’s quotation drops the disjunction and the answer. Ex. 2008, ¶ 69.

Chan’s data path outward fails for the same reason. The only data Chan discloses the module sending is “power usage information, such as instantaneous power, peak power, or average power,” which the module “sends . . . to gateway 300 via network infrastructure.” EX1004, [0075]. The infrastructure between the module

and the gateway is the premises wiring. Chan therefore does not disclose either sensor actually “*transmitting digital data . . . to the wireless network*,” as Elements 1[G] and 1[I] require. Ex. 2008, ¶ 70.

The Petition’s fallback is that wireless connectivity between gateway and module “would have been obvious” as “an obvious design choice to reduce cabling, simplify installation, and allow flexible placement of appliance modules.” Pet. at 18. That rationale runs against Chan. There is no cabling to reduce—the module is “plugged into an electrical outlet” and communicates over the wiring it is already plugged into. EX1004, [0071]. Chan’s stated reason for centralizing signaling in the gateway is interference: “Previous attempts at connecting client devices to network controllers utilized wireless or powerline technologies that were not centrally controlled. . . . Interference between wireless and powerline technologies commonly occurs across multiple deployments of separate networking technology.” *Id.*, [0056]. The Petition identifies no design need in Chan that its proposed modification would answer, and the asserted benefits appear nowhere in the reference. *In re Van Os*, 844 F.3d at 1361; *Magnum Oil*, 829 F.3d at 1380. Ex. 2008, ¶¶ 71-72.

2. Chan’s Two Current Transformers Are Two Inputs to One Power Measure Module, Not the Separately Recited “*current sensor*” and “*first sensor*”

Claim 1 recites two sensors with different functions: “*a current sensor coupled to the AC connector for measuring an AC current consumed by the*

appliance” (1[B]) and “*a first sensor having an output that responds to a physical phenomenon*” (1[C]). Element 1[F] requires the enclosure to house both, and Elements 1[G] and 1[I] impose parallel but distinct transmission requirements on each. The Petition’s primary mapping assigns CT 425*a* to the current sensor and CT 425*b* to the first sensor. Pet. at 23-25.

Chan describes both transformers as merely inputs to a single component: “The power measure module 421 is connected to a power supply 437 and two (2) current transformers (CT) 425*a* and 425*b* that are connected to a standard AC socket 427.” EX1004, [0070]. Both are connected to the same socket, and both sense current in conductors of the same circuit—“One CT 425*a* measures current on the live wire 429 and the other CT 425*b* measures current leakage on the neutral wire 431.” *Id.* A current transformer is a passive electromagnetic device that produces a proportional secondary current; the processing and the measurement output come from module 421. Ex. 2008, ¶¶ 79-82.

The consequence is not merely definitional. Elements 1[G] and 1[I] each require digital data to be transmitted to the wireless network in response to a different input—“*the physical phenomenon*” and “*the measured AC current.*” Chan discloses a single output for both: “power usage information, such as instantaneous power, peak power, or average power.” EX1004, [0075]. Chan nowhere discloses transmitting the leakage current sensed by CT 425*b*. Its only statement about leakage

is that the module “may also be used for determining or locating client devices responsible for ‘vampire’ current and how much such leaks cost.” *Id.* That is a use to which measured data may be put—it is not the disclosure of a second, separately transmitted sensor output. Ex. 2008, ¶ 83.

The Petition maps as an alternative first sensor the “temperature and humidity sensor 409.” Pet. at 25, 33-35. But even to the extent sensor 409 responds to a different physical phenomenon, it carries the same Element 1[G] and Element 1[F] problems described above: Chan discloses no transmission of its output to any wireless network, and Chan discloses no enclosure housing it together with the current sensor, the antenna, and the transceiver. The further sensors on which the Petition relies come from Chan’s claims 3-16 and from FIG. 11’s “temperature/fog/brightness/infrared sensor 1107”—different disclosures in a different part of the reference, which the Petition never explains how a POSITA would assemble into the FIG. 4 module. Pet. at 25, 50. Ex. 2008, ¶¶ 84-85.

3. The Prosecution History Relied on by Petitioner Addressed a Claim that Did Not Contain the First-Sensor Limitations

Petitioner and Dr. Houh rely on the Board’s July 22, 2021 decision for the proposition that the claimed enclosure may be “separate from” the appliance, and Dr. Houh reasons that the Board’s “findings support the same reading here.” Pet. at 4-5; EX1002, ¶ 133. As set out in Section II above, however, the Claim 1 before the

Board recited a single enclosure housing three components, and the Board’s sentence—“claim 1 requires only that the single enclosure houses ‘the current sensor, the antenna, and the wireless transceiver’”—enumerated them. EX1003, 185, 193. Issued Claim 1 requires a fourth. The Board made no finding about the first sensor, its co-location, or its transmission to a wireless network, because none of those limitations was before it. Ex. 2008, ¶¶ 38-39, 86.

What the Board did hold is instructive in the other direction. It reversed as to Claims 9, 10, and 32 because the Examiner relied on a component drawn from a different embodiment than the one relied on for Claim 1, and it declined to treat two similar structures as interchangeable: “[a]lthough the damper 900 *may* be similar to the retrofit plug, and have all of the same features corresponding to the features of claims 1 and 7, that does not mean at least *on this record*, that this is necessarily the case.” EX1003, 197. The Petition asks the Board to do here what it declined to do then—to treat a block diagram, a product manual, a claim list, and a second figure as one integrated disclosure. Ex. 2008, ¶¶ 38-39, 86.

4. All Grounds Relying on Chan Fail for the Same Reasons

Ground 1 challenges Claims 1-7, 13-16, 19-27, 29, 30, 32, 38, 41, 44-46, and 53, each of which incorporates every limitation of Claim 1. Grounds 2-10 rest on the same Chan foundation and add one secondary reference each—Botts, Scherz,

Middelhoek, Goldsmith, Rossing, Benesty, Fraden, Doherty, and Ozturk—to address dependent-claim features. Pet. at 51-70. None of those references is cited for, or remedies, Chan’s failure to disclose an appliance that transmits to and receives from a wireless network, an antenna, or a single enclosure housing all four recited components. Grounds 1-10 therefore fail in their entirety. The additional, ground-specific defects of Grounds 2-10 are addressed in Sections VI.C through VI.L below. Ex. 2008, ¶ 87.

B. Grounds 11-15: Petitioner Has Not Shown that the Seo-Chan Combination Discloses “a single enclosure” (Element 1[F]) or an Appliance “controlled or activated in response to digital data received from the wireless network” (Element 1[H])

Grounds 11-15 rest on Seo as the primary reference, with Chan purportedly supplying additional control functionality. Pet. at 70-99. The combination discloses neither the single enclosure nor the claimed control relationship, and the Petition’s antenna and transceiver again come from references outside the ground. Ex. 2008, ¶¶ 88-103.

1. Seo’s Current Detection Unit Is “(not shown),” and its State Detection Units Are Distributed Throughout the Refrigerator

The Petition asserts that “FIG. 4 of Seo expressly shows that the control device 400 encloses the power consumption detection unit 450 (including ‘current detection unit’), the various first sensors, and the communication unit 440 (including the

wireless transceiver and antenna).” Pet. at 82. Seo says otherwise. The current detection is performed “through a current detection unit (not shown) and a voltage detection unit (not shown).” EX1005, [0055]. A component Seo expressly declines to show cannot be expressly shown by FIG. 4 to be enclosed anywhere at any specific location. Seo discloses nothing about the current detection unit’s location, form factor, or physical relationship to any housing. Ex. 2008, ¶¶ 89-90.

The sensors the Petition maps to the “*first sensor*” are, by Seo’s own description, located in the spaces they monitor. The internal temperature detection units 431a and 431b detect “the temperature within one or more storage compartments provided inside the refrigerator,” and where a refrigerator has multiple compartments, “multiple internal temperature detection units may be respectively installed.” EX1005, [0057]. The external temperature detection unit 433 “detects the temperature outside the refrigerator, that is, the room temperature.” *Id.*, [0058]. The height detection units 435 “may be installed in the refrigerator compartment 200 or the freezer compartment 300,” and “when each compartment includes multiple shelves, a plurality of height detection units may likewise be installed in each shelf.” *Id.*, [0060]. The frequency detection unit 437 detects the driving frequency of the compressor. *Id.*, Claim 3. None of these can perform its disclosed function from inside a control device housing the communication unit. Ex. 2008, ¶¶ 91-92.

FIG. 4 does not close the gap. Seo describes it as “a block diagram schematically illustrating the configuration of a refrigerator control device.” EX1005, [0133]. The schematic, however, merely depicts a configuration of functional units; it does not depict a physical housing, and it cannot depict the location of a unit the specification says is “not shown.” Ex. 2008, ¶ 93.

The Petition’s alternative, *i.e.*, that “the refrigerator itself is also a single enclosure,” reads the limitation out of the claim. Pet. at 83. Claim 1 recites “*a single enclosure housing the current sensor, the first sensor, the antenna, and the wireless transceiver*” as a component of the claimed appliance. Treating the appliance’s outer shell as that component would mean every appliance with a sensor and a radio anywhere inside it satisfies Element 1[F], and would also fail on Seo’s own facts, because Seo’s external temperature detection unit measures the temperature of the room—*i.e.*, outside of the purported “*single enclosure*.” EX1005, [0058]. Ex. 2008, ¶ 94.

2. Seo’s Refrigerator Is Not “controlled or activated in response to digital data received from the wireless network”

Element 1[H] requires that “*the appliance is controlled or activated in response to digital data received from the wireless network*.” The Petition offers three theories, and each fails on Seo’s text.

The display theory: the Petition maps the claimed control to Seo’s “output unit 470 [that] includes a screen display unit,” reasoning that a display is an actuator and that its content depends on received data. Pet. at 87-89. But what Seo’s communication unit receives from the external power device is “information such as the type of energy source and the greenhouse gas index corresponding to the energy source.” EX1005, [0049]. A greenhouse-gas index is a reference value. Seo’s control unit 410 then performs its own calculation with it (“the estimated carbon dioxide emissions can be calculated by multiplying the carbon dioxide index of the energy source by the predicted power consumption or the supplied power consumption”), and the output unit displays the result of that internal computation. *Id.*, [0065], [0040]. The messages the display shows are likewise generated **internally**: control unit 410 “generates one or more messages corresponding to the internal and external states of the refrigerator detected by the state detection unit 430.” *Id.*, [0067]. Received reference data that the appliance’s own firmware consumes as an input to its own calculation is not digital data in response to which the appliance is controlled or activated. Ex. 2008, ¶¶ 96-97.

The energy-source switch theory: the Petition asserts that “the control device 400 receives energy source information wirelessly, uses that data to calculate expected greenhouse-gas emissions, and automatically switches to a different type of energy source accordingly,” quoting the second sentence of Seo paragraph 44.

Pet. at 89-90. However, the first sentence of paragraph 44, which the Petition omits, states: “In addition, **a user or the like can select** one of the energy sources **through the input unit 490.**” EX1005, [0044] (emphasis added). The sentence the Petition quotes merely describes what happens when the user makes that selection: “the control device may replace the energy source with one having a relatively lower greenhouse gas index when the estimated greenhouse gas emissions exceed, or are expected to exceed, a certain amount.” EX1005, [0044]; *see also id.*, [0077] (repeating the same passage, likewise preceded by the user-selection sentence). Seo’s FIG. 10 confirms the sequence: after “Calculate estimated greenhouse gas emissions” and “Display of estimated greenhouse gas emissions,” the flow reaches the decision block “Choose another energy source?” and proceeds to “Connect to other energy sources” only on “Yes.” EX1005, FIG. 10. There is thus nothing suggesting that “*the appliance is controlled or activated in response to digital data received from the wireless network.*” Ex. 2008, ¶¶ 98-99.

The “control commands” theory: the Petition’s third theory rests on Seo’s statement that the communication unit, “as necessary, receives various information or control commands.” EX1005, [0051]. Dr. Houh opines that a POSITA “would have understood (and found it obvious) that these received ‘control commands’ would be used by the control unit 410 to perform corresponding control or activation actions within the refrigerator system.” EX1002, ¶ 507. Seo says no such thing. The

same sentence places the communication unit “between the output unit 470 and an external device,” and Seo’s enumeration of what the unit handles is a list of information to be displayed and reported. EX1005, [0051], [0083]. Seo never identifies a command, a recipient, an actuator, or any resulting operation. An expert’s unsupported, bare assertion of what a POSITA “would have understood” cannot supply a disclosure the reference does not contain. *Magnum Oil*, 829 F.3d at 1380. Ex. 2008, ¶ 100.

Chan does not cure the deficiency, for the reasons given in Section VI.A: Chan’s command and control information travels from the gateway to the appliance module over the premises wiring, not over a wireless network. And the Petition’s motivation to combine is that the combination “provides more ways to control or activate Seo’s refrigerator” and would “expand Seo’s remote-control functionalities.” Pet. at 73-74. An aspiration to generally expand capabilities just restates the desire to combine without supplying a reason to do so or explanation how. *In re Van Os*, 844 F.3d at 1361. Ex. 2008, ¶ 101.

3. Seo’s Antenna and Wireless Transceiver Come from References Outside Ground 11

Ground 11 is Seo in view of Chan. Pet. at 9. Seo discloses a “communication unit 440” and says it “is connected to the external device by wired or wireless communication methods such as serial communication, the Internet, power line

communication, or wireless LAN.” EX1005, [0051]. Seo describes no antenna and no transceiver. For Elements 1[D] and 1[E] the Petition therefore relies on Adelstein (EX1018, 369), Gorday (EX1022, 3:17-20, 3:38-40), and Dunko (EX1023, [0013]-[0015]) for the proposition that wireless communication requires a transmitter and receiver with antennas. Pet. at 80-81. None is a Ground 11 reference. 37 C.F.R. § 42.104(b)(4); *Magnum Oil*, 829 F.3d at 1380-81. Ex. 2008, ¶ 102.

4. All Grounds Relying on the Seo-Chan Combination Fail for the Same Reasons

Ground 11 challenges Claims 1, 23-24, 26-27, 38, 41, 53, and 59, each of which incorporates every limitation of Claim 1. Grounds 12-15 rest on the same Seo-Chan foundation and add Goldsmith, Fraden, Betts-LaCroix, and Doherty, respectively. Pet. at 94-99. None of those references is cited for, or remedies, the combination’s failure to disclose the single enclosure or the claimed control relationship. Grounds 11-15 therefore fail in their entirety. Ex. 2008, ¶ 103.

C. Ground 2 Does Not Show that Claims 50-52 Are Unpatentable

Ground 2 challenges Claims 50-52 over Chan and Botts. Pet. at 51-53. Claim 50 requires a light source “*in the single enclosure*” that is “*coupled to the wireless transceiver for illumination or indication in response to digital data received from the wireless network.*” ’590 Patent, Claim 50.

Botts's indicator does not operate that way. In Botts, the light reports the output of the appliance's own internal monitor: it "may be a green light (e.g., a green LED or symbol) when the energy usage of the appliance is within the predetermined energy efficient range," and "a red light (e.g., a red LED or symbol) when the energy usage of the appliance is outside of the predetermined energy efficient range." EX1006, 10:56-67. The comparison is **local**, and the light reflects its result. Ex. 2008, ¶ 105.

The Petition supplies the missing relationship by assertion: the light "would also be coupled to Chan's wireless transceiver, such that it emits light based on digital data received from the wireless network, such as control settings or efficiency thresholds transmitted by the gateway." Pet. at 52 (citing EX1002, ¶¶ 271-273). Neither Chan nor Botts discloses transmitting a control setting or an efficiency threshold to an indicator, and a threshold consumed by a local comparison is not data in response to which the light illuminates—it is a parameter of the appliance's own determination. Neither the Petition nor Dr. Houh identifies any disclosure otherwise. *Pers. Web Techs.*, 848 F.3d at 994. Ex. 2008, ¶ 106.

The proffered motivation—*i.e.*, that a POSITA would add "conventional LED(s)/light(s) to indicate energy usage, thereby improving usability of the device"—describes adding an indicator, not adding the network-responsive indicator Claim 50 recites. Pet. at 52. Claims 51 and 52 depend from Claim 50 and add the

current-sensor coupling and LED species; neither cures the Claim 50 defect. Thus, Petitioner has not shown by a preponderance of the evidence that any claim challenged in Ground 2 is unpatentable. Ex. 2008, ¶ 107.

D. Ground 3 Does Not Show that Claims 8-11, 54, and 57 Are Unpatentable

Ground 3 challenges Claims 8-11, 54, and 57 over Chan and Scherz. Pet. at 53-56. Claims 8-11 depend from Claim 7 and recite features of the electrically actuated switch; Claims 54 and 57 depend from Claim 53 and recite actuator types. Two of the mappings are unsupported by Scherz. Ex. 2008, ¶ 108.

1. Claim 54's Cam Does Not Appear in Scherz

Claim 54 requires that the actuator “*consists of, or comprises, a motion actuator that causes linear or rotary motion,*” and that the appliance “*further compris[e] a conversion mechanism for respectfully converting to rotary or linear motion based on a screw, a wheel and axle, or a cam.*” ’590 Patent, Claim 54. The Petition maps this to Chan’s relay switch 423, asserting that “[a]s shown in Scherz, the relay switch converts linear motion (e.g., of the spring) to rotary motion (e.g., of the moving contact arm) based on the cam.” Pet. at 55-56 (citing EX1002, ¶ 295).

Scherz shows no such thing. Scherz’s description of a mechanical relay is a single sentence: “For a typical mechanical relay, a current sent through a coil magnet acts to pull a flexible, spring-loaded conductive plate from one switch contact to

another.” EX1007, 307. There is no cam in that description, no rotary motion, and no conversion mechanism. The words “cam,” “screw,” and “wheel and axle” do not appear in the cited pages, and Scherz’s only reference to anything rotary is an unrelated “rotary switch” used to select among resistors. *Id.* Neither the Petition nor Dr. Houh identifies where in Scherz the asserted cam is disclosed, because it is not. A claim limitation cannot be supplied by an expert’s description of a structure the reference does not describe. *Magnum Oil*, 829 F.3d at 1380. Ex, 2008, ¶¶ 109-111.

**2. The Voltage Spike Scherz Teaches How to Eliminate
Is Not Claim 57’s “*electrical signal generator*”**

Claim 57 requires that the actuator “*consists of, or comprises, an electrical signal generator.*” ’590 Patent, Claim 57. The Petition asserts that “the relay switch 423 can produce a ‘sudden, very large voltage’ (i.e., ‘electrical signal’) responsive to interrupted current flow.” Pet. at 56 (citing EX1007, 310; EX1002, ¶¶ 298-299).

The quoted phrase of Scherz, however, describes a failure mode. Scherz’s subject in that passage is inductive kickback: “[i]f the flow of current through a coil is suddenly interrupted, say, a switch is opened, the coil will respond by producing a sudden, very large voltage across its leads, causing a large surge of current through it.” EX1007, 310. Scherz then explains why this is a problem—the resulting “menacing voltage spikes (as high as 1000 V) . . . can have some nasty effects on neighboring devices within the circuit,” and are “also damaging to the relay’s switch

contacts”—and devotes the remainder of the section to eliminating it: “[t]he trick to getting rid of spikes is to use what are called transient suppressors.” *Id.* A parasitic transient that the reference instructs the reader to suppress is not a disclosure of a generator for providing an electrical signal. The ’590 Patent describes a signal generator as an actuator “for providing an electrical signal (such as a voltage or current),” which may be “an analog or digital signal generator.” ’590 Patent, 26:32-38. Ex. 2008, ¶¶ 112-114.

3. Claims 8-11 Rest on a Menu of Relay Types with No Reason to Select Any

For Claims 8-11, the Petition offers Scherz’s disclosure that relay designs include “mechanical relays, reed relays, and solid-state relays,” that mechanical relays come “in many of the standard manual switch arrangements (e.g., SPST, SPDT, DPDT, etc.),” that they “come with a latching feature that gives them a kind of memory,” and that solid-state relays “include . . . thyristors (SCRs, triacs, diacs, etc.).” Pet. at 54-55 (quoting EX1007, 307-309). The Petition concludes that “[i]t would thus have been obvious to try them when implementing Chan’s relay switch 423.” *Id.* “Obvious to try” has force only “[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions.” *KSR*, 550 U.S. at 421. The Petition identifies no design need in Chan, no finite set of identified solutions, and no reason to select any particular relay

configuration, it merely walks through the claims' own lists. Ex. 2008, ¶¶ 115.

E. Ground 4 Does Not Show that Claims 12, 17, and 18 Are Unpatentable

Ground 4 challenges Claims 12, 17, and 18 over Chan and Middelhoek. Pet. at 56-58. Middelhoek is the only reference offered for the added limitations, and each of the three showings rests on an excerpt that does not survive being read in context. Ex. 2008, ¶ 116.

Claim 12 requires that “*the current sensor*”—the component Element 1[B] requires to be coupled to the AC connector and Element 1[I] requires to transmit to the wireless network—“*comprises an ampermeter, galvanometer, or a hot-wire ampermeter.*” ’590 Patent, Claim 12. The Petition’s entire showing is that “Middelhoek discloses that ‘[g]alvanometers made accurate analogue current measures possible.’” Pet. at 57. The sentence actually reads that “Galvanometers made accurate analogue current *measurements* possible,” and it is the second half of a historical note: “Galvanometers date from the discovery of the interaction between an electric current and a magnetic needle by Oersted in 1819.” EX1008, 1. Ex. 2008, ¶ 117.

The sentences that immediately follow are the ones that matter, and the Petition omits them. Middelhoek explains that the historical practice has since been inverted: “For digital measurements the contrary is true. The analog-to-digital

voltage converter (ADC) is the most commonly used analog-to-digital interface. Thus, most digital current measurements are done as voltage measurements.” *Id.* Chan’s appliance module is a digital instrument built that way—its power measure module 421 reports through an “analog to digital interface 435” to CPU 401. EX1004, [0070]. Read as a whole, the page the Petition cites teaches a POSITA to do what Chan already does, not to replace Chan’s current transformer with a needle-deflection galvanometer. A reference that points away from the proposed modification does not supply a reason to make it. *Innogenetics*, 512 F.3d at 1373. Ex. 2008, ¶ 118.

Claim 17 requires that “*the wattmeter comprises a bolometer, or ... the wattmeter accumulates or averages readings.*” ’590 Patent, Claim 17. The Petition offers the electro dynamometer, supported by a proposition assembled from two pages: “[E]lectro dynamometers [are] another type of averaging wattmeter,” which ‘is a most commonly used wattmeter.’” Pet. at 57-58 (quoting EX1008, 154, 148). The first fragment is lifted from a sentence with a different subject and an opposite point: “In comparison with e.g. electro dynamometers, another type of averaging wattmeter, thermal multipliers have a large error (short term instability, low output voltage).” EX1008, 154. Middelhoek is describing the shortcomings of thermal multipliers. Ex. 2008, ¶ 119.

The second fragment is cut off one sentence early. Middelhoek's passage reads in full: "It is a most commonly used wattmeter. It cannot respond to high frequency signals and is inaccurate at low power factors due to instrument or transformer phase shift. The just cited [233] eliminates the phase problem by rectifying the signals. The meter is a dc instrument." *Id.*, 148. An electro dynamometer is a moving-coil instrument with a pointer and a scale, obtained by "replac[ing] the permanent magnet in a moving coil instrument (d'Arsonval) with coil(s)." *Id.* Middelhoek thus identifies the instrument the Petition proposes to install in Chan's plug-in module as a dc meter that cannot respond to high frequency signals, while the module the Petition would install it in measures alternating current on the live wire of a standard AC socket. EX1004, [0070]. Neither the Petition nor Dr. Houh addresses the omitted sentences. Ex. 2008, ¶ 120.

Claim 18 requires that "*the wattmeter comprises the current sensor, or ... the wattmeter is based on multiplying a measured voltage and the current measured by the current sensor.*" '590 Patent, Claim 18. The Petition quotes Middelhoek's statement that "[s]tandard methods for measuring power" include "measuring current and voltage separately, and multiplying the values." Pet. at 58 (quoting EX1008, 126, 123). Middelhoek lists five standard methods, and multiplication is the last of them; the others are "[m]easuring a non electric effect of power absorption," "[m]easuring an electric effect of power absorption," "[u]sing the

exponential or square-law characteristics of semiconductors, and applying Ohm's law," and "[m]easuring current or voltage, knowing the impedance." EX1008, 126. The Petition offers no reason a POSITA would select the fifth. And the selection it proposes requires an input Chan does not have: Chan discloses two current transformers and no measurement of voltage anywhere in the appliance module. EX1004, [0070]. Ex. 2008, ¶ 121.

Claims 17 and 18 depend from Claim 15, which requires a wattmeter "*in the single enclosure*" "*connected to the AC connector*" for "*measuring the magnitude of the active AC power or an electrical energy consumed by the appliance.*" '590 Patent, Claim 15. The Petition maps that wattmeter to Chan's power measure module 421, which is the same module to which both current transformers report. Pet. at 45. Petitioner cannot simultaneously treat module 421 as the wattmeter of Claim 15 and treat its two inputs as the separate "*current sensor*" and "*first sensor*" of Claim 1. *Supra* § VI.A.3. Ex. 2008, ¶¶ 122-123.

The rationale offered for the ground as a whole is that the combination "would have obvious [sic] to try among a finite number of sensor and wattmeter configurations, yielding predictable results and with a reasonable expectation of success." Pet. at 57. That is the *KSR* formula recited, not applied. "Obvious to try" has force only "[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions." *KSR*, 550 U.S. at

421. The Petition identifies no design need in Chan and no bounded solution set, and the chapters it cites catalogue a large and heterogeneous body of instruments. Thus, Petitioner has not shown by a preponderance of the evidence that any claim challenged in Ground 4 is unpatentable. Ex. 2008, ¶ 122.

F. Grounds 5 and 12 Do Not Show that Claims 20-22, 28, and 31 Are Unpatentable

Ground 5 challenges Claims 28 and 31 over Chan and Goldsmith; Ground 12 challenges Claims 20-22 over Seo, Chan, and Goldsmith. Pet. at 58-60, 94-96. Each claim specifies what “*the wireless network*” of Claim 1 must be: a satellite network with a satellite antenna and satellite modem (Claim 28); a 3G or 4G cellular network of the recited types (Claim 31); and a WPAN with a WPAN antenna and WPAN modem, according to Bluetooth or IEEE 802.15.1-2005 (Claim 21) or Zigbee, IEEE 802.15.4-2003, or Z-Wave (Claim 22). Ex. 2008, ¶ 123.

Goldsmith is a survey. It establishes that satellite networks, cellular standards, and the 802.15 WPAN family existed. But Claim 1 requires more of “*the wireless network*” than that its protocol existed: it is the network over which the appliance’s transceiver transmits both sensors’ digital data and receives the digital data to which the appliance responds. A textbook showing that a protocol existed does not show the claimed appliance configured to perform those operations over it—particularly where, as shown above, the reference on which the network mapping rests routes the

appliance module's data over the premises wiring. *Supra* § VI.A.1. Ex. 2008, ¶ 124.

The combination rationale is that a POSITA would have found it obvious to use these technologies “when implementing Chan” because “there were a finite number of wireless networking technologies available at the time.” Pet. at 58-59. The Petition identifies no design need and no reason to select any particular standard. *KSR*, 550 U.S. at 421. For Claim 28 the disconnect is clearest: nothing in Chan, Seo, or Goldsmith suggests putting a satellite antenna and satellite modem in a plug-in appliance module or a refrigerator control device, and the Petition's only bridge is Chan's catch-all reference to “other media.” Pet. at 59 (quoting EX1004, [0073]). Ex. 2008, ¶ 125.

G. Ground 6 Does Not Show that Claims 33, 48, 49, 55, and 56 Are Unpatentable

Ground 6 challenges Claims 33, 48, 49, 55, and 56 over Chan and Rossing. Pet. at 60-63. The mapping begins from a premise Chan does not supply. The Petition asserts that “Chan's microphones are first sensors,” citing Chan's claim 10. *Id.* at 61. Chan's FIG. 4 module contains no microphone; the microphone appears in a claim reciting sensor options for the module, and the Petition never explains how a POSITA would build one into the FIG. 4 module or how its output would reach a wireless network. *Supra* § VI.A. Ex. 2008, ¶ 126.

Claim 33 requires a piezoelectric first sensor that “*includes single crystal material or a piezoelectric ceramics and uses a transverse, longitudinal, or shear effect mode of the piezoelectric effect.*” ’590 Patent, Claim 33. Rossing supplies the material and nothing of the mode. Rossing points a POSITA away from the claimed limitation. Immediately after describing the crystal microphone, Rossing observes that “[t]he low compliance of the piezoelectric element typically limits the performance of such a microphone, especially the extent of its frequency response.” EX1010, 758. Rossing identifies a different architecture as the one an artisan would reach for: electret condenser microphones “are used almost universally in cell phones, as well as other applications,” “are probably the most popular type in current use,” and are “practical for multi-microphone arrays.” *Id.*, 759. Ex. 2008, ¶¶ 127-128.

Claim 49 is conjunctive. It requires that “*the electroacoustic sensor is an omnidirectional, unidirectional, or bidirectional microphone that is based on the sensing an incident sound-based motion of a diaphragm or a ribbon, and the microphone consists of, or comprises, a condenser, an electret, a dynamic, a ribbon, a carbon, or a piezoelectric*” microphone. ’590 Patent, Claim 49. For the first requirement the Petition states: “That is, microphones are omnidirectional, unidirectional, or bidirectional. (EX1010, 759 . . . *see also* EX1020, 118-119.)” Pet. at 62. Ex. 2008, ¶ 129.

Rossing's page 759 does not say that. Under the heading "Microphone Pickup Pattern," Rossing says something closer to the opposite of a three-way classification: a microphone "responds to the sound at essentially just one point, so its output represents a spatial sample of the total sonic event," and while "most microphones exhibit some directional bias, whether or not intended," "it is probably not possible to specify a single universally preferred pickup pattern." EX1010, 759. The words omnidirectional, unidirectional, and bidirectional do not appear on the page. The only support the Petition offers for the classification is Sinclair (EX1020, 118-119), a reference in no ground. 37 C.F.R. § 42.104(b)(4); *Magnum Oil*, 829 F.3d at 1380-81. Ex. 2008, ¶¶ 130-131.

The Petition's citations to Rossing are unreliable on their face. The quotations that "[a] microphone is an audio device inextricably tied to spatial considerations" and that "most microphones exhibit some directional bias" are attributed to page 757. Pet. at 62. Both sentences appear on page 759. EX1010, 757, 759.

Claims 55 and 56 depend from Claim 53 and add a sounder and an electromagnetic coil. The Petition's premise is Chan's claim 11 recitation that the "appliance module compris[es] one or more audio devices," from which it reasons that "like Chan's other actuators, the sounder would be coupled to the wireless transceiver to operate (e.g., to output an alarm in response to received data)." Pet. at 62. Chan discloses no such coupling and no such alarm; the parenthetical is the

Petition's own. Ex. 2008, ¶ 132.

Claim 55 requires “*a sounder for converting an electrical energy to omnidirectional, unidirectional or bidirectional pattern emitted, audible or inaudible, sound waves.*” ’590 Patent, Claim 55. The Petition’s support is a sentence spliced from two separated passages of Rossing: “Sound radiates from a loudspeaker in all directions . . . and . . . almost unavoidably omni-directional at low frequencies.” Pet. at 62 (quoting EX1010, 765). Read in place, Rossing is describing a problem, not a capability. Rossing explains that a loudspeaker’s output varies “depending on angle and frequency”; that “[i]t is rare for a speaker to have truly constant directionality across its entire pass-band”; that most speakers are “at least somewhat directional at mid and high frequencies”; and that “because of the long wavelengths involved,” a speaker is “almost unavoidably omnidirectional at low frequencies.” EX1010, 765. Rossing adds that “a loudspeaker system and its associated radiation pattern is a fiendishly complicated device that does not readily lend itself to characterization by traditional audio metrics or specifications,” and that “the exact optimal specification has not been established.” *Id.* An unavoidable low-frequency artifact is not a sounder that converts electrical energy *to* a selected radiation pattern. Ex. 2008, ¶¶ 133-134.

Finally, the Petition’s analogous-art showing cites “EX1010, 757-758, 763, 765, 903.” Pet. at 60. Page 903 is the opening of Section 22.1, “Dynamics of the

Linear Single-Degree-of-Freedom (1-DOF) Oscillator,” which derives the Laplace-transform solution for a damped mass-spring system. EX1010, 903. Thus, Petitioner has not shown by a preponderance of the evidence that any claim challenged in Ground 6 is unpatentable. Ex. 2008, ¶¶ 134-135.

H. Ground 7 Does Not Show that Claim 34 Is Unpatentable

Ground 7 challenges Claim 34 over Chan and Benesty. Pet. at 63-64. Claim 34 requires “*multiple sensors arranged as a directional sensor array operative to estimate the number, magnitude, frequency, Direction-Of-Arrival (DOA), distance, or speed of the physical phenomenon impinging the sensor array.*” ’590 Patent, Claim 34. Ex. 2008, ¶ 137.

The Petition’s showing is a single quoted excerpt: “[a] microphone array beamformer . . . [can] lead to an estimate of the direction of an active speech source.” Pet. at 64 (quoting EX1011, 1044). Benesty’s sentence reads: “Therefore, steering a microphone array beamformer and scanning across a room for the highest-energy output leads to an estimate of the direction of an active speech source.” EX1011, 1044. The ellipsis removes the two operative steps, and the bracketed “[can]” converts a description of what a technique accomplishes into a capability of the hardware. What produces the estimate in Benesty is a scanning procedure performed on the array’s outputs, not the array. Locating the source requires more still: “Using two arrays and by intersecting the two corresponding direction estimates, the source

location is determined.” *Id.* Ex. 2008, ¶¶ 137-138.

The same page forecloses a reasonable expectation of success. Benesty reports that the high-resolution direction-of-arrival algorithms “were found to be incompetent for speech source localization, particularly in reverberant acoustic environments.” Ex. 1011, 1044. Beam scanning “has some intrinsic drawbacks”: because speech is broadband, “ideally a broadband beamformer whose beam pattern would be the same across the entire speech spectrum needs to be developed, which is a technically challenging problem”; most beamforming algorithms assume a far-field source, so “[w]hen the speech source is close to the microphone array, performance degradation can be expected”; and if the source is in the far field, “the localization resolution may not be satisfactory as the source direction is only selected from a set of discrete beam scanning angles.” *Id.* A reference that catalogues the ways a technique falls short does not establish that a POSITA would have achieved the claimed capability by applying it. *Pers. Web Techs.*, 848 F.3d at 994. Ex. 2008, ¶139.

Benesty’s other cited page confirms the mismatch. Chapter 50 addresses “[h]ands-free audio communication . . . in mobile communication systems as well as audio and video conferencing systems,” and the benefit it identifies is signal quality: arrays “offer directional gains that can significantly improve the quality of signal pickup in reverberant and noisy environments,” yielding “similar audio

performance to that of closely placed microphones.” EX1011, 1021. Improving how well an array picks up a talker is not an array “*operative to estimate*” the number, magnitude, frequency, direction of arrival, distance, or speed of an impinging phenomenon. Ex. 2008, ¶ 140.

The motivation offered—*i.e.*, that a POSITA “would have been motivated to apply Benesty’s microphone arrays when implementing Chan to allow audio capture with higher clarity and spatial accuracy”—tracks the benefit Benesty describes for conference telephony and says nothing about why a POSITA would build a direction-estimating array into an energy-monitoring module that plugs into a wall outlet. Pet. at 63. The Petition identifies no design need in Chan that such an array would answer. *In re Van Os*, 844 F.3d at 1361. Thus, Petitioner has not shown by a preponderance of the evidence that Claim 34 is unpatentable. Ex. 2008, ¶ 142.

I. Grounds 8 and 13 Do Not Show that Claims 35, 36, 39, 40, 42, 43, and 47 Are Unpatentable

Ground 8 challenges Claims 35, 36, 39, 40, 42, 43, and 47 over Chan and Fraden; Ground 13 challenges Claims 35 and 39 over Seo, Chan, and Fraden. Pet. at 64-67, 96-97. Fraden is a catalogue of sensing principles, and the Petition uses it as one: for each claim it locates the recited sensor type in Fraden and concludes that “[i]t would thus have been obvious to try” it “when implementing Chan’s various sensors.” *Id.* at 66. Ex. 2008, ¶ 143.

That reasoning does not address the claims. Each of these claims specifies what “*the first sensor*” of Claim 1 must be, *i.e.*: a thermoelectric sensor of the recited limitations (Claim 35), a nanosensor, crystal, or semiconductor (Claim 36), a bulk or surface acoustic sensor (Claim 39), a gas-ionization radiation sensor (Claim 40), and so on. The “*first sensor*” is the component Element 1[F] requires to be housed in the single enclosure and Element 1[G] requires to transmit digital data to the wireless network in response to the physical phenomenon. Establishing that a sensor type existed does not establish the claimed appliance configured with it, and for the reasons in Section VI.A, the underlying first-sensor limitations are not disclosed at all. Ex. 2008, ¶ 144.

Claim 40 illustrates the point. Claim 40 requires a radiation sensor responsive to “*radioactivity, nuclear radiation, alpha particles, beta particles, or gamma rays,*” “*based on gas ionization.*” Chan discloses no radiation sensor of any kind. The Petition’s showing is that “[r]adiation sensors that operate in the recited manner were well-known” and that “[i]t would thus have been obvious to incorporate it into Chan and/or try it when implementing Chan’s various sensors to enhance Chan’s functionalities.” Pet. at 66. Nothing in Chan calls for a gas-ionization radiation detector in a refrigerator’s power module, and “enhance Chan’s functionalities” is not a not a sufficient reason. *In re Van Os*, 844 F.3d at 1361. Claims 42 and 43 depend from Claim 41, and Claim 47 from Claim 46. Each inherits the defects of its

parent, and the Petition's showing for each is the same catalogue-plus-obvious-to-try formula. Ex. 2008, ¶¶ 145-146.

J. Ground 10 Does Not Show that Claim 59 Is Unpatentable

Ground 10 challenges Claim 59 over Chan and Ozturk. Pet. at 69-70. Claim 59 depends from Claim 53 and requires that “*the actuator consists of, or comprises, a thermoelectric actuator and is a heater or a cooler, operative for affecting the temperature of a solid, a liquid, or a gas object.*” ’590 Patent, Claim 59. Ex. 2008, ¶ 147.

Ozturk discloses no thermoelectric actuator. Ozturk models “[a] common ATX form factor personal computer system” and studies “forced convection air cooling” of a CPU using a heat sink and a fan. EX1014, 650. The word “thermoelectric” appears nowhere in the reference. A fan moves air and a heat sink conducts heat away; neither converts electrical energy into heat, and neither pumps heat electrically. The ’590 Patent describes a thermoelectric actuator as “a heating or cooling heat pump,” “an electric heater, converting electrical energy into heat, using resistance, or a dielectric heater,” “a solid-state active heat pump device based on the Peltier effect,” or “an air cooler, using a compressor-based refrigeration cycle of a heat pump.” ’590 Patent, 41:23-32. A heat sink and fan are none of them. Ex. 2008, ¶¶ 148-150.

Claim 59 also inherits Claim 53's requirement that the actuator be "*coupled to the wireless transceiver for being activated or controlled in response to digital data received from the wireless network.*" The Petition's showing is a chain of inferences: "the fan and heatsink would be coupled to the wireless transceiver for controlled in response to digital data received from the wireless network, since the CPU operates based on such data and the cooling assembly responds to the resulting increase in processor activity and heat generation." Pet. at 69-70 (citing EX1002, ¶ 458). On the Petition's own description, the fan responds to heat, not to received data. That a processor's workload may originate in network traffic does not make its cooling fan an actuator controlled in response to digital data received from a wireless network. Ex. 2008, ¶¶ 151-152.

K. Ground 14 Does Not Show that Claim 58 Is Unpatentable

Ground 14 challenges Claim 58 over Seo, Chan, and Betts-LaCroix. Pet. at 97. Claim 58 depends from Claim 53 and requires that "*the actuator consists of, or comprises, a chemical or an electrochemical actuator, and is operative for producing, changing, or affecting a matter structure, properties, composition, process, or reactions.*" '590 Patent, Claim 58. Ex. 2008, ¶ 153.

The Petition's theory is that Seo's screen display would be implemented as an OLED, and that an OLED is an electrochemical actuator. Pet. at 97. The premise that an OLED is an electrochemical actuator is drawn from the '590 Patent and from

Kuo (EX1015, 174), *i.e.*, from the challenged patent, which is not prior art, and a reference in no ground. Pet. at 97; Ex. 2008, ¶ 154. Betts-LaCroix itself is cited for one proposition only: that “OLED displays do not require a backlight to function and thus consume far less power than LCDs.” EX1050, [0002]. An OLED is electroluminescent, not electrochemical, however, and no cited source says it is. The Petition relies on four passages, the closest of which nonetheless falls well short. For example, 11:55-57 says: “[a]dding mobile ions to an OLED creates a light-emitting electrochemical cell or LEC, which has a slightly different mode of operation.” To make an OLED electrochemical, however, requires the addition of mobile ions, and the result is a different device—an LEC (sometimes LEEC, “light emitting electrochemical cell.”). None of the cited prior art, however, supports the proposition that an OLED is electrochemical. The patent itself draws a distinction at 39:10-26, stating that the “actuator may be a light source” and goes on to include OLEDs. It then turns and says, “[t]he actuator may be a chemical or electrochemical actuator, and may be operative for producing changing, or affecting a matter structure, properties, composition, process, or reactions, such as producing, changing, or affecting an oxidation/reduction or an electrolysis reaction.” *Id.* Thus OLED are distinguished in the patent from electrochemical actuators. Thus, LECs use oxidation/reduction, whereas OLED do no. Ex. 2008, ¶¶ 154-156.

Claim 58 also depends from Claim 53, which requires an actuator “*in the single enclosure*” “*coupled to the wireless transceiver for being activated or controlled in response to digital data received from the wireless network.*” For the reasons in Section VI.B, Seo’s display is not controlled or activated in response to digital data received from a wireless network; it presents the output of the control device’s own calculations. Thus, Petitioner has not shown by a preponderance of the evidence that Claim 58 is unpatentable. Ex. 2008, ¶ 155.

VII. CONCLUSION

For the foregoing reasons, Petitioner has not shown by a preponderance of the evidence that any of the Challenged Claims of the ’590 Patent is unpatentable. Patent Owner respectfully requests that the Board issue a final written decision confirming the patentability of all Challenged Claims.

Respectfully submitted,

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CERTIFICATE OF WORD COUNT

The undersigned hereby certifies that the portions of the above-captioned PATENT OWNER'S RESPONSE has 12,021 words in compliance with the 14,000 word limit set forth in 37 C.F.R. § 42.24. This word count was prepared using Microsoft Word for Office 365.

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