

IPR2023-01182 (USP 8,461,719)

Patent Owner's Sur-Reply

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INDUCTEV, INC.

Petitioner,

v.

WITRICITY CORPORATION,

Patent Owner.

Case IPR2023-01182

Patent 8,461,719

PATENT OWNER'S SUR-REPLY

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TABLE OF AUTHORITIES

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<i>Vitronics Corp. v. Conceptronic, Inc.</i> , 90 F.3d 1576, 1583 (Fed. Cir. 1996)	3

EXHIBIT LIST

Ex.	Description
2001	U.S. Patent Application Publication No. 2012/0001492A9 (“Cook-492”)
2002	Non-Final Office Action Issued June 28, 2012 in file history of U.S. Patent No. 8,461,719
2003	U.S. Patent Application Publication No. 2009/0127937A1 (“Widmer”)
2004	U.S. Patent Application Publication No. 2009/0079268A1 (“Cook-268”)
2005	U.S. Patent Application Publication No. 2009/0015075A1 (“Cook-075”)
2006	U.S. Patent Application Publication No. 2009/0033564A1 (“Cook-564”)
2007	U.S. Patent Application Publication No. 2009/0072628A1 (“Cook-628”)
2008	U.S. Patent Application Publication No. 2010/0117454A1 (“Cook-454”)
2009	U.S. Patent Application Publication No. 2010/0210233A1 (“Cook-233”)
2010	U.S. Patent Application Publication No. 2009/0134712A1 (“Cook-712”)
2011	Declaration of Mark Horenstein, Ph.D. (“Horenstein Decl.”)
2012	Curriculum Vitae of Mark Horenstein, Ph.D.
2013	Frederick Emmons Terman, <i>Radio Engineers' Handbook</i> (1st ed. 1943) (“Terman-1943”)
2014	Zoom Deposition of Mark Allen, Ph.D. (“Allen Depo.”)
2015	Wiley Electrical and Electronics Engineering Dictionary, IEEE Press, 2004 (“Wiley”)

I. INTRODUCTION

Petitioner's arguments in its Reply (Paper 30) fail for several primary reasons. First, Ground II fails because the Petition fails to demonstrate that Cook-554 constitutes prior art. Cook-554 does not pre-date the earliest claimed priority date of the '719 patent, i.e., September 27, 2008. Cook-554 was filed on March 4, 2009, and issued on October 7, 2014. The Petition contends that Cook-554 qualifies as prior art pre-AIA 35 U.S.C. § 102(e) because Cook-554 is entitled to the earlier March 5, 2008 date of an earlier-filed provisional application that the Petition refers to as the "Cook Provisional" Ex. 1006 Pet. 10. The Petition cites the Cook Provisional for alleged support of claim 17 of Cook-554, but the Petition fails to demonstrate that the Cook Provisional provides sufficient support for at least one element of the claim. Cook-554 therefore does not constitute prior art.

Second, Grounds II and IV regarding Claim 17 fail because neither Cook-554, nor Lee and Cook-523, teach or suggest "at least one of the resonators includes a coil of a plurality of turns of a conducting material connected to a network of capacitors." The Petition cites to each of Cook-554 and Lee as teaching a switched capacitor bank. But Cook-554 and Lee do not teach or suggest that a resonator includes their switched capacitor bank, or that their switched capacitor bank is a network of capacitors with two or more degrees of freedom as properly construed in the '719 Patent.

In addition, Patent Owner is moving the Board to cancel Claim 16 of the '719 Patent. *See* email from Mr. Lawson to the Board dated October 30, 2024.

Accordingly, the parties' arguments regarding Claim 16 are moot.¹ So the only claim now in issue and challenged by Petitioner is Claim 17 of the '719 Patent.

For at least these reasons, the Board should enter a final decision ruling that Petitioner has not met its burden to show that Claim 17 of the '719 Patent is invalid as being obvious over the cited prior art.

II. THE TERM “NETWORK OF CAPACITORS” SHOULD BE CONSTRUED TO MEAN “A CIRCUIT TOPOLOGY OF PASSIVE CIRCUIT COMPONENTS INCLUDING ONE OR MORE CAPACITORS THAT PROVIDES TWO OR MORE DEGREES OF FREEDOM”

Patent Owner and Dr. Horenstein explained in detail why a POSA would construe a “network of capacitors” to mean “a circuit topology of passive circuit components including one or more capacitors that provides two or more degrees of freedom.” Response at 11-14²; Horenstein Decl. ¶¶ 36-60.

Petitioner's argument that the construction of “network of capacitors” should be “any circuit topology including one or more capacitors” is unavailing for several straightforward reasons. Citing the '719 Patent specification at 10:11-14 and 57:34-40, Petitioner asserts that “PO's construction would exclude the capacitor

¹ *See* email from Mr. Lawson to the Board dated October 30, 2024.

² Citing *Phillips v. AWH Corp.*, 415 F.3d 103, 1312-14 (Fed. Cir. 2005 (en banc)).

topologies in Figures 36(a)-(d), which the '719 patent expressly states are “four topologies of networks of fixed and variable capacitors.” PO Response at 3 (emphasis in original). Petitioner simply misses the point of the capacitor circuits in Figs. 36(a) – (d). These capacitor combinations function as two-terminal circuit elements only (one top terminal and one bottom terminal). Petitioner is incorrect in asserting that the diagrams in Fig. 36 are additional preferred embodiments. The figures in Fig. 36 are offered as alternatives to any of the single, variable capacitors in the preferred embodiment networks of Figs. 30-35, e.g., C_1 and C_2 . So instead of a “preferred embodiment” as Petitioner argues, the disclosure in Figs. 36(a) – (d) could potentially be used to replace one of the single, variable capacitors in the complete circuits that are disclosed as preferred embodiments in Figs. 30-35 with the accompanying Smith Charts for Figs. 30-35. So contrary to Petitioner's assertion, Patent Owner's construction of network of capacitors requiring two or more degrees of freedom does *not* exclude a preferred embodiment.³

In addition, the stated purpose of the circuits in Figs. 36(a) – (d) of the '719 Patent is to afford finer resolution in the adjustment of the variable capacitance:

“four examples of a variable capacitance, using networks of one variable capacitor and the rest fixed capacitors. Using these network

³ Accordingly, because Patent Owner's claim construction does not exclude the preferred embodiments shown in Figures 30-35 of the '719 Patent, Petitioner's citation to *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1583 (Fed. Cir. 1996) is inapplicable to the proper claim construction in this case.

topologies, **fine tunability of the total capacitance value may be achieved.**" '719 Patent, 57:34-37 (emphasis added.)

The Patent similarly indicates that Figs. 36(a) – (d) show “networks of fixed and variable capacitors designed to **produce an overall variable capacitance with finer tuning resolution.**” *Id.*, 10:11-13 (emphasis added). The Patent also explains that “the topologies of Figs 36(a), (c), (d) may [also] be used to **reduce the voltage across the variable capacitor.**” *Id.* 57:38-39 (emphasis added.) The stated functions of the capacitor circuits of Figs. 36 are thus to (a) offer finer adjustment resolution when substituted for the variable capacitors in Figs. 30-35, and (b) reduce the voltage across the variable capacitor.

The fact that the word “network” appears in the passages cited by Petitioner is immaterial to the meaning of a “network of capacitors” connected to a resonator, as distinguished in Claim 17 of the '719 Patent. Of note, the circuits of Figs. 36 show no inductors, no resistive loads, and, for that matter, no complete circuits. Additionally, the capacitors shown in Figs. 36 cannot perform any impedance matching, nor are they accompanied by any Smith Chart indicative of the two or more degrees of freedom to function as required by the circuits of Figs. 30-35.

III. PETITIONER FAILS TO DEMONSTRATE COOK-554 CONSTITUTES PRIOR ART

Petitioner continues to assert that Cook Prov. supports claim 17 of Cook-554 but is wrong as noted in PO's Response and as shown below. The elements of Cook-554 claim 17 have the following requirements:

- (a) **receive power** via a resonant circuit...**at a receive power level**;
- (b) **convert the received power** ... with a power converting circuit; and
- (c) vary the impedance of the power converting circuit ... **based on the received power level**. Cook-554 claim 17 (emphasis added.)

As noted by Dr. Horenstein, in attempting to apply claim 17 to Fig. 4-12 of Cook Prov., the received power of element (a) is the power received by the resonant circuit, i.e., the Receive Antenna Unit in Fig. 4-12. Horenstein Decl. at 95. Element (b) further states that this received power is then converted with a power converting circuit. In Cook Prov. Fig. 4-12, the indicated power-converting circuit comprises the components within the central dotted box.

As noted by Dr. Horenstein in his deposition, and as cited by Petitioner, it is well known that power is equal to the product of voltage and current. Pet. Repl. at 5 (citing Horenstein Tr. 32:18-33:7 et al). Both Petitioner and Dr. Allen have correctly noted that the voltage sense V and current sense I (elements E and F) in Fig. 4-12 indeed yield a value of power. This power, however, is the power being delivered to the load: "Voltage and current sense to measure output voltage and

output current into the external load.” Cook Prov. at 31, Exh. 1006 pg. 043. The power delivered to the load is clearly not the power being received by the resonator as would be measured at the antenna feeder cable.

As shown in Cook Prov. Fig. 4-12, the power received by the resonator is first converted by the Receive Power Converter Unit into a DC or AC output via a rectifier and DC/DC or DC/AC converter; this output power is then delivered to the load. The V and I sensors (E and F in Fig. 4-12) thus measure the power *delivered to the load*. As noted in Cook Prov., losses occur in the Receive Power Converter Unit. Cook Prov. at 5.51, Exh. 1006 pg. 060. Thus, the power delivered to the load, as measured by V and I, will be less than the power received by the resonator. For each of the above reasons, Cook-554 Claim 17, which requires the tuning to be based on the power being received by the resonator, is not supported by the Cook Provisional. Accordingly, Petitioner has not met its burden to show that Cook-554 is prior art to Patent Owner's '719 Patent. *Dynamic Drinkware, LLC v. National Graphics, Inc.*, 800 F.3d 1375, 1381-82 (Fed. Cir. 2015) (ruling that Petitioner failed to meet its burden to show that the provisional application supported the claims in the patent relied on by Petitioner as a prior art reference).

IV. INDEPENDENT CLAIM 17 IS PATENTABLE OVER COOK-554 (PETITIONER'S GROUND 2)

Even assuming Cook-554 is prior art, it does not make obvious Claim 17 of the '719 Patent. Cook-554 Fig. 16 does not show a circuit that has “two degrees of

freedom”; rather, Cook’s Fig. 16 has only one degree of freedom. This is because the four elements in Cook’s circuit, the Principal Anti-Reactor⁴, the Tunable Reactance⁵, the Antenna Loop/Coil, and the “Tuning Capacitors,” are connected to the Power-Stage Bridge Inverter by a simple series connection. The four series elements all pass the same current from the Power-Stage Bridge Inverter and allow only adjustment of the resonant frequency in Cook’s circuit without adjusting the load resistance presented to the power stage to a matching value. Horenstein Decl. at 40, 45.

The “Tuning Capacitors” component in series is comprised of multiple capacitors 1604 that can be added to yield a single total capacitance having one top terminal and one bottom terminal. Horenstein Decl. 52. These capacitors are connected, respectively, to the bottom of the Antenna Loop/Coil and ground.⁶ Capacitors are added to these common connections, as needed, via individual “RF Switches”. As a POSA would have understood, all the capacitors in the bank 1604 share the same top and bottom connections when their respective RF switches are closed. Horenstein Decl. at 52-53, 56. This configuration is known as a “capacitor bank”. Horenstein Decl. at 50-53. The entire capacitor bank 1604, however, is still connected in series with the other three elements in the chain and functions as a single, variable series capacitor.

⁴ Capacitor 1610

⁵ Element 1620. This would be understood to mean either an adjustable capacitor or an adjustable inductor

⁶ The symbol  is universally used in electronics to indicate a common connection to a single reference node called “ground”.

A POSA would have understood that the antenna loop depicted in Cook Fig. 16 includes an equivalent parallel resistor R_{LOAD} (not shown) which represents the power transferred to the load during wireless power transfer. '719 Patent 14:27-30; Horenstein Decl. 48. This understood load resistance is labeled as resistance R alongside inductance L at the right of all the circuit configurations in Figs. 28-35. '719 Patent, Figs. 28-35.

A POSA would also have known that at resonance, by definition, the effects of the inductance and capacitance (i.e., the “reactive components”) in Cook's Fig. 16 circuit cancel out, leaving only the resistance component. Horenstein Decl. 41. No amount of adjustment in Cook's Fig. 16 circuit can change the value of the resistance presented by the resonant circuit to the Power-Stage Bridge Inverter. Thus, in Cook Fig. 16, while resonance can be achieved by adjusting the series-connected Tunable Reactance 1620 and/or the capacitor bank 1604, there is no way to change the remaining *resistance* connected to the Power-Stage Bridge inverter. Horenstein Decl. 120.

As explained in the '719 Patent, and as noted by Dr. Horenstein, maximum power transfer occurs when the load has the same *resistance* (impedance) as that of the power source. '719 Patent 5:41-43, Horenstein Decl. at 44. A POSA would have understood that “impedance” and “resistance” are interchangeable at resonance, because the load has no reactive component at resonance. Horenstein Decl. at 45.

The POSA also would have known that once in resonance, in order to adjust the resistance presented to the power stage so that a maximum-power match can be achieved, a *second* tunable element that is not connected *in series* must be added to the circuit. Horenstein Decl. at 45. This second tunable element (i.e., inductor or capacitor) adds a second degree of freedom to the impedance matching process. As Dr. Horenstein explains, "...impedance matching requires a minimum of two degrees of freedom." Horenstein Decl. at 45, 73. The '719 patent uses the Smith Chart to illustrate the tuning process via two or more degrees of freedom. *Id.* at 47.

As Dr. Horenstein further explains, "If only one capacitor or inductor is present, the resonant frequency can be set to the desired value, but achieving the desired resonance and an impedance match cannot be accomplished with a single reactive element (e.g., capacitor) only." Horenstein Suppl. Decl. ¶ 73. The family of circuits in the '719 Patent Figs. 30 show networks having two or more degrees of freedom. Horenstein Decl. at 47. Figure 30c, for example, has an additional fixed capacitor C_3 and a variable capacitor C_1 connected in parallel with the coil and load (R, L). As explained by Dr. Horenstein, the purpose of C_1 is to change the value of resistance presented to the power source so that it matches the source resistance of the power stage. Horenstein Decl. at 44-49. Doing so, however, tunes the circuit comprising C_1 , C_3 , R , and L to off-resonance. Although it will present the correct value of load resistance, the detuned circuit will have an equivalent inductance left over. This

inductance can be canceled out by adjusting C_2 . This tuning process is illustrated via the Smith Chart example in the Horenstein Declaration. *Id.* at 49. The various trajectories, which represent adjustments of capacitors C_1 and C_2 , arrive at the center of the Smith chart, indicating a matched resistive load resulting in maximum power transfer at resonance. *Id.*

The need for two degrees of freedom is illustrated for the various networks in the '719 Patent. The equations at '719 52:45-50, for example, indicate the tuning equations for the circuits of Fig. 30(a)-(f). '719 Patent 52:43-44:

45

$$\omega C_1 = \frac{X - \sqrt{X^2 R_n - R^2(1 - R_n)}}{X^2 + R^2},$$

50

$$\omega C_2 = \frac{R_n \omega C_1}{1 - X \omega C_1 - R_n},$$

[MH1]

('719 Patent 52:43-44)

The first equation shows the adjusted value of C_1 needed for matching the resistance component, while the second equation shows the value to which C_2 must be adjusted to cancel out any remaining reactive (inductor) component. These adjustments of the two capacitors exemplifies two degrees of freedom in the tuning of the circuit. Horenstein Decl. ¶¶ 45-49.

Similar sets of equations are shown in the '719 patent at 53:20-25 and 54:1-8.

These equation sets show that for each circuit, first C_1 is adjusted to achieve resistance matching, then C_2 is adjusted to cancel out any remaining inductance component. *Id.*

The Smith charts of Fig. 30(g), 31(d), 32(d), 33(g), 34(d), and 35(d)-(f) of the '719 Patent illustrate this tuning process. Horenstein Decl. ¶¶ 41-57. Both Petitioner and its technical expert failed to recognize the role of the two-degrees-of-freedom process explained in the '719 Patent, and both have simply ignored or bypassed Dr. Horenstein's detailed explanation of the process in paragraphs 41-57 of Dr. Horenstein's Declaration, as well as his Smith Chart example and the Smith charts specifically disclosed in the '719 Patent. Indeed – and tellingly – Petitioner in its Reply and its technical expert *fail to address at all* Dr. Horenstein's detailed explanation of how the Smith Chart associated with the charts in Figs. 30 - 35 operate to provide the two (or more) degrees of freedom required by Claim 17 of the '719 Patent.

In addition, like Petitioner and its technical expert, the prior-art references relied on by Petitioner, including Cook-554, Lee, and Cook-523, also fail to mention, much less explain, the Smith Chart and how it is used to illustrate the two or more degrees of freedom for each resonant circuit.

Petitioner and its technical expert also discard Dr. Horenstein's explanation about how a set of parallel-connected capacitors functions as one single capacitor, and how the capacitor in Cook Fig. 16 functions as a single, variable capacitor Horenstein

Decl. at 52-53, 56-57. As explained by Dr. Horenstein, when capacitors are connected in parallel, the net result is a single equivalent capacitor equal to the sum of the parallel-connected capacitors. *Id.* at 52-53. There is no circuit advantage or feature that can be gained by using a capacitor bank in place of a single capacitor, other than the ability to adjust its value by opening and closing (e.g.) the RF switches in Cook-554 Fig. 16. *Id.* at 58.

**V. INDEPENDENT CLAIM 17 IS PATENTABLE OVER LEE AND COOK-523
(PETITIONER'S GROUND 4)**

Petitioner continues to argue that the switched-capacitor bank disclosed in Lee at Fig. 13 meets the “network of capacitors” limitation in Claim 17 of the ‘719 Patent. But as explained in PO’s Response (62-64), Lee only discloses one degree of freedom, because Lee discloses only a single capacitor bank functioning as one variable capacitor. (Horenstein Decl. at 88-89). The capacitor bank disclosed in Lee is, for relevant purposes, functionally the same as the one shown in Cook-554 Fig. 16. *Id.* at 91.

Petitioner’s argument that the box labeled “impedance matching network” in Lee Figure 13 discloses a second degree of freedom, as required by PO’s claim construction, is also unavailing. The critical flaw is that nothing in Lee discloses what electrical elements are inside the box labeled 37a in Figure 13, nor does Lee disclose the purpose or use of the box labeled 37a. Lee ¶ 75. The entire paragraphs in Lee discussing Figures 12 and 13 simply disclose adjusting the capacitance of the circuit

using capacitor bank 32b (Lee ¶ 4, 23, 75, 78) in order to adjust the resonant frequency. As noted in Lee, the switched capacitor bank 32b performs the function of an electronically controlled capacitor..." *Id.* ¶ 86. Thus in Lee, a **single**, variable capacitor maintains the resonant frequency: "the feedback controller 34 . . . takes the difference in voltage . . . which is used as an error signal to control **the** variable capacitor. The capacitance adjustment causes the resonant circuit of the secondary unit 30 to tune in to the RF driving frequency of the primary unit 20 until the voltage reaches the reference voltage value." *Id.* ¶ 75. This single, variable capacitor used to maintain the resonant frequency is similar to the single, variable capacitor disclosed in Cook-554.

Lee further clarifies the purpose of the single variable capacitance of the capacitor bank in paragraph 78: "Furthermore, the nature of the coupling between the secondary 30 and the primary unit 20 is such that it tends to slightly raise the resonance frequency, which means that there needs to be additional parallel capacitance in order to restore the resonance to its original value so that it can stay matched with the RF driving frequency. This capacitance correction is provided by a bank of switched capacitors 32b shown in FIG. 13." Lee ¶ 78.

Again, Lee's disclosure in Figures 12 and 13 of the single variable capacitance to maintain the resonant frequency of the circuit is similar to the disclosure in Cook-554. *But* Lee clearly does *not* disclose or teach a second degree of freedom in order to match the resistance of the source of the wireless power transfer circuit to the

resistance of the load, as disclosed and explained in detail in the '719 Patent and as required by Claim 17. As highlighted above, the Lee reference, including Figures 12 and 13 and the description in the specification relied on by Petitioner, fail to mention, much less explain, the Smith Chart and its requirement for two degrees of freedom in order to tune the two variable elements to ensure resistance matching for a particular resonant circuit. Horenstein Decl. ¶¶ 45 – 49. As previously explained, Petitioner and its technical expert likewise failed to address the use of the Smith chart in illustrating the two-degrees-of-freedom tuning procedure disclosed in the '719 patent. Horenstein Decl. ¶¶ 44-57. Similarly, the Lee reference also never mentions the Smith Chart or the required two or more degrees of freedom.

Petitioner further states that Patent Owner does not dispute the construction of “network of capacitors.” Reply at 30. Of course, Patent Owner argues in its Response and in this Sur-Reply that the proper construction of the term “network of capacitors” as used in Claim 17 of the '719 Patent is “a circuit topology of passive components including one or more capacitors that provides two or more degrees of freedom.” PO Response at 12-14; Horenstein Decl. ¶¶ 36 – 60.

Petitioner also misrepresents Dr. Horenstein's Deposition testimony by implying in a conclusory sentence in the Reply that Dr. Horenstein confirmed that Lee discloses a network of capacitors with two degrees of freedom as required by Claim 17. Reply at 30, citing Horenstein Tr. at 49: 19-24. Dr. Horenstein did not testify that

Lee disclosed a network of capacitors with two or more degrees of freedom. Indeed, the portion of Dr. Horenstein's testimony cited by Petitioner is not discussing Lee at all; instead, in response to a question by counsel for Petitioner, Dr. Horenstein simply stated that impedance matching, *as disclosed in the '719 Patent*, requires two degrees of freedom. Horenstein Tr. 49:19-24 (emphasis added). As discussed above, Lee does not disclose a network of capacitors that has a circuit topology with two or more degrees of freedom.

VI. CONCLUSION

For the foregoing reasons, Petitioner fails to meet its burden of establishing that the challenged Claim 17 is unpatentable as being obvious over the prior art.

Respectfully submitted,

Dated: October 31, 2024

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CERTIFICATE OF COMPLIANCE UNDER 37 C.F.R. § 42.24(d)

Pursuant to 37 C.F.R. § 42.24(d), the undersigned hereby certifies that the foregoing paper complies with the type-volume limits of C.F.R. § 42.24(c)(4). The foregoing paper contains about 3,582 words, as calculated by Microsoft Word, excluding the parts of the paper exempted by 37 C.F.R. § 42.24(c).

Dated: October 31, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6, I hereby certify that a copy of the foregoing document was served by electronic mail upon the following:

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